PH

# Philippine Specialty Rice

## Understanding Production, Culture, Quality, and Market


Editors

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Flordeliza H. Bordey
Piedad F. Moya
Rhemilyn Z. Relado-Sevilla
Marissa V. Romero



DEPARTMENT OF AGRICULTURE 1898
PHILRICE
IRRI
INTERNATIONAL RICE RESEARCH INSTITUTE
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The Philippine Rice Research Institute (PhilRice) is a chartered government corporate entity under the Department of Agriculture. It was created through Executive Order 1061 on Nov. 5, 1985 (as amended) to help develop high-yielding, cost-reducing, and environment-friendly technologies so farmers can produce enough rice for all Filipinos.

It accomplishes this mission through research, development, and extension work in its central and seven branch stations, coordinating with a network that includes 57 agencies and 70 seed centers strategically located nationwide.

PhilRice has the following certifications: ISO 9001 (Quality Management), ISO 14001:2004 (Environmental Management), and OHAS 18001:2007 (Occupational Health and Safety Assessment Series).

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The International Rice Research Institute (IRRI) is the world's premier research organization dedicated to reducing poverty and hunger through rice science; improving the health and welfare of rice farmers and consumers; and protecting the rice-growing environment for future generations. IRRI is an independent, nonprofit, research and educational institute, founded in 1960 by the Ford and Rockefeller foundations with support from the Philippine government. The institute, headquartered in Los Baños, Philippines, has offices in 17 rice-growing countries in Asia and Africa, and more than 1,000 staff members.

Working with in-country partners, IRRI develops advanced rice varieties that yield more grain and better withstand pests and disease as well as flooding, drought, and other harmful effects of climate change. More than half of the rice area in Asia is planted to IRRI-bred varieties or their progenies. The institute develops new and improved methods and technologies that enable farmers to manage their farms profitably and sustainably, and recommends rice varieties and agricultural practices suitable to particular farm conditions as well as consumer preferences. IRRI assists national agricultural research and extension system in formulating and implementing country rice sector strategies.

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# ACRONYMS

| | |
|---|---|
| 2AP | 2-acetyl-1-pyrroline |
| AC | amylose content |
| ASEAN | Association of Southeast Asian Nations |
| ASV | alkali spreading value |
| ATI | Agricultural Training Institute |
| BR | brown rice |
| CAR | Cordillera Administrative Region |
| CALABARZON | Cavite, Laguna, Batangas, Rizal, Quezon |
| CIS | communal irrigation system |
| CLs | cultural laws |
| CSB | community seed banking |
| DA | Department of Agriculture |
| DA-AMAS | Department of Agriculture - Agribusiness and Marketing Assistance Service |
| DA-BAR | Department of Agriculture - Bureau of Agricultural Research |
| DA-BAFS | Department of Agriculture - Bureau of Agricultural and Fisheries Standards |
| DA-BPI | Department of Agriculture - Bureau of Plant Industry |
| DAR | Department of Agrarian Reform |
| DA-RFOs | Department of Agriculture Regional Field Offices |
| DBMC | Don Bosco Multipurpose Cooperative |
| DENR | Department of Environment and Natural Resources |
| DOT | Department of Tourism |
| DOST | Department of Science and Technology |
| DTI | Department of Trade and Industry |
| FBS | Farm Business School |
| FFS | Farmers' Field School |
| FGD | focus group discussion |
| FMR | farm-to-market road |
| FPIC | free prior informed consent |
| GI | geographical indication |
| GMS | Greater Mekong Sub-region |
| GR | green revolution |

| | |
|---|---|
| GQ | grain quality |
| GT | gelatinization temperature |
| HR | head rice |
| KDML | Khao Dawk Mali |
| KII | key informant interview |
| IKSPs | indigenous knowledge systems and practices |
| ICC | indigenous cultural communities |
| ICT | information communication technology |
| IP | indigenous people |
| IPM | Integrated Pest Management |
| IPRA | Indigenous Peoples Rights Act |
| IQCS | internal quality control system |
| IRRI | International Rice Research Institute |
| LGUs | local government units |
| MAO | Municipal Agriculture Office |
| MC | moisture content |
| MIMAROPA | Mindoro, Marinduque, Romblon, Palawan |
| NCIP | National Commission on Indigenous Peoples |
| NCT | National Cooperative Test |
| NE | northeast |
| NFA | National Food Authority |
| NIA | National Irrigation Administration |
| NICERT | Negros Island Certification Services |
| NIOPA | Negros Island Organic Producers Association |
| NIS | national irrigation system |
| NRP | National Rice Program |
| NSIC | National Seed Industry Council |
| OCCP | Organic Certification Center of the Philippines |
| OFE | operator, family, and exchange |
| PAO | Provincial Agriculture Office |
| PhilRice | Philippine Rice Research Institute |
| PNS | Philippine National Standards |
| PO | participant observation |
| PRA | participatory rural appraisal |
| PSA | Philippine Statistical Authority |

| | |
|---|---|
| QR | quantitative restriction |
| RAA | Rice Achievers Awards |
| RCEF | Rice Competitiveness Enhancement Fund |
| RCFSD | Rice Chemistry and Food Science Division |
| RVIG | Rice Varietal Improvement Group |
| RTL | Rice Trade Liberalization Law |
| SEA | Southeast Asia |
| SR | specialty rice |
| SSIS | small-scale irrigation system |
| TAA | total antioxidant activity |
| TAC | total anthocyanin content |
| TMR | total milling recovery |
| TPC | total phenolic content |
| TRV | traditional rice variety |
| UAE | United Arab Emirates |
| UPRDP | Upland Rice Development Program |
| WFP | work and financial plan |

# ABBREVIATIONS

| | | | |
|---|---|---|---|
| ai | active ingredient | kg | kilogram |
| B | billion | km | kilometer |
| DAS | days after sowing | M | million |
| DAT | days after transplanting | md | mandays |
| DBSe | days before seeding | P | Philippine Peso |
| DS | dry season | t | tons |
| g | gram | WS | wet season |
| ha | hectare | Y | year |

# FOREWORD

The Rice Tariffication Law (Republic Act No. 11203) has engendered profound changes in the Philippine rice industry. It has allowed the country to more freely engage in international rice trade by replacing the quantitative restrictions with tariff. Aside from generating tariff revenue from rice imports, which is used to finance rice competitiveness-enhancing programs, the law has presented opportunity for the industry stakeholders to participate in the export market and expand their reach.

But, liberalizing rice trade has also created an enormous challenge to Filipino farmers whose production is not competitive compared to their exporting neighbors in Asia. Thus, the government now puts heavy emphasis on strengthening the competitiveness of the ordinary white rice and looks at exploring export promotion espoused by the Department of Agriculture (DA). One area where this can be done is the intensified production and marketing of specialty rice (SR) such as aromatic, glutinous, and pigmented rice.

SR is steadily attracting the limelight not only locally but also internationally owing to its premium qualities and high price. As one of the countries that produce SR, the Philippines must craft policies to hasten the development of its own SR industry and take advantage of the growing global demand. However, data on the current status and market potential of local SR is scanty and scattered. Thus, the DA-Philippine Rice Research Institute (PhilRice) and International Rice Research Institute (IRRI), with funding from the Bureau of Agricultural Research of the DA, teamed up to study the local SR and understand its production, culture, quality, and market. This book is the major output of that research.

This book cuts across multidisciplinary approaches to fully understand the local SR industry. It analyzes the economic performance of each SR type and their cultivation practices across sites in many provinces in the country. It characterizes the grain quality attributes and health-promoting properties of local SR and documents the local culture governing their cultivation. The book also assesses the competitiveness of our local SR compared to Thailand and Cambodia in terms of yields, costs, profitability, input uses, management practices, grain quality, and marketing. The lessons learned from our neighbors could be applied to further improve local SR production and marketing.

Understanding SR production and marketing from different angles presents opportunities to be tapped and gaps to be filled. These are used as basis in identifying appropriate interventions and next steps to further develop the local SR industry. The book also synthesizes the findings into recommended action plans that encompass recommendations from input provision to marketing, and provides directions for research and development, and policy-making.

A collaborative work among economists, sociologists, anthropologists, and food scientists, this book offers a holistic view of our SR industry and hopes to serve as a credible reference for policymakers, planners, academic professionals, scholars of the field, and rice stakeholders. We hope that the insights and lessons compiled in this book can help propel the growth of the Philippine specialty rice industry.

John C. De Leon
Executive Director, PhilRice

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AUTHORS

# I

# OVERVIEW






GILAS






1

# INTRODUCTION TO SPECIALTY RICE

Jesusa C. Beltran, Rhemilyn Z. Relado-Sevilla, Marissa V. Romero,
Flordeliza H. Bordey, and Piedad F. Moya

Specialty rice (SR) are unique varieties of *Oryza sativa* with characteristic aroma, kernel color, and chemical composition. Rice is considered aromatic if it exhibits *pandan*-like scent. Pigmented rice, on the other hand, contains anthocyanin, which gives either red or black color in its grain. Lastly, rice with sticky characteristics due to low amylose content is categorized as glutinous. These features make them easily distinguishable from ordinary white table rice (Chaudhary, 2001).

Historically, SR are cultivated by the indigenous people in the upland areas inasmuch as most types only thrive well under climatic conditions in the highlands. Also, these varieties grow delicately in specific environments where they would express their unique characteristics. In addition, most of the traditional SR varieties are low-yielding (40-50 bags of harvest per hectare) and are cultivated in one cropping per year (DA, 2015).

For this reason, indigenous people made sure that they would pass on specific varieties that historically thrive in their area to succeeding generations, lessening problems related to staple availability. Consequent with this practice, SR production has been embedded into the culture, tradition, and knowledge of the indigenous local farmers (Pham et al., 2017). From generation to generation, SR production has not been limited to just being an agricultural venture; it is a way of life for the tribes cultivating it. They use SR in their cultural festivities, in the production of traditional delicacies and beverages, in fostering cultural aesthetics, and even in the practice of traditional medicine (MSSRF, 2005).

Over the years, adoption of modern varieties has become widespread due to their high yield, lower input cost, higher pest resistance, and shorter maturity period (Pham et al., 2017). The Green Revolution (GR) that promoted the use of these modern high-yielding varieties to ensure food security became a threat to the continuous cultivation of traditional SR varieties. Consequently, the number of traditional varieties grown, including some SR varieties, dwindled. Nonetheless, the germplasm of traditional SR varieties has been preserved as part of our cultural heritage and conserved as genetic resources for breeding activities. Realizing the importance of the unique traits of SR varieties, breeding efforts also pursued the development of glutinous, aromatic, and pigmented rice, which are valued by consumers, the industry, and market.

SR, known for their good eating qualities, health benefits, industrial uses, and high market value, are considered among the world's superior goods (Chaudhary, 2001; Tuaño et al., 2015). The aromatic rice of Asia, specifically, Basmati of the Himalayas and Jasmine of Thailand, have gained popularity all over the world for their enticing fragrance and good eating qualities (Chaudhary, 2001).

Pigmented rice is becoming a dietary aid due to its high antioxidant content and health-promoting properties (Harun et al., 2018). Traditional Chinese medicine uses pigmented rice to strengthen kidney function, promote blood circulation, remove blood stasis, treat anemia, and control sugar level (Deng et al., 2013; Limtrakul et al., 2019). Moreover, modern laboratory tests have proven that pigmented rice is rich not only in antioxidants but in phytonutrients as well (PhilRice, 2017).

Meanwhile, glutinous rice is being utilized in producing many well-known delicacies of the world- *tteokbokki* of Korea, *buchi* and *tikoy* of China, *mochi* of Japan, and rice cakes in several Asian countries. Glutinous rice is a suitable raw material for these dishes because of its low amylose content, which results in sticky texture when cooked. Glutinous rice production is concentrated in the area near the Mekong River in Southeast Asia as Laotians include glutinous rice in their everyday meal (Pham et al., 2017).

These characteristics of SR are highly valued in the market, especially among consumers with increasing purchasing power. The growing popularity of SR has been reported in Malaysia, Vietnam, India, Pakistan, the Middle East, European Union, America, Singapore, Hong Kong, Japan, Philippines, and elsewhere (Chaudhary, 2001; Harun et al., 2018; Pham et al., 2017; Tuaño et al., 2015; PhilRice, 2013 and PDI, 2017).

In the Philippines, production of different types of SR is rather scattered in provinces with a significant production of traditional varieties. Majority of the sites are described as mountainous and have large portions of highland areas, making them conducive to SR production. Traits responsible for aroma and pigments are more expressed in these areas than in the lowland.

Local production of SR varieties is common in various provinces. In 2014, the key provinces in Central Luzon that grow aromatic and pigmented rice are Nueva Ecija, Tarlac, and Aurora. Further, Cagayan Valley also has areas devoted to these SR types, more notably Isabela and Quirino. Traditional aromatic and pigmented rice varieties are cultivated in the Cordillera Administrative Region (CAR) with greater concentration in Ifugao and Mountain Province (DA, 2015). There are also SR production sites identified in Abra and Apayao. In Southern Luzon, there is aromatic rice production in Oriental Mindoro and glutinous rice production in Camarines Sur. A wide variety of SR types is cultivated in the Visayas provinces such as Iloilo, Negros Occidental, and Samar. Lastly, areas in Mindanao with SR production include Bukidnon and North Cotabato.

Some local stakeholders are now slowly penetrating the world market. Farmers from the Don Bosco Foundation for Sustainable Development, Inc. in North Cotabato exported organic black rice to Dubai, United Arab Emirates (UAE) and the United States (PhilRice, 2013; PDI, 2017). Aside from the growing export industry of black rice, local varieties of aromatic rice and glutinous rice are deliberately being introduced in the global market. SL Agritech's aromatic long-grained Jasponica rice, cultivated by farmers from Talavera, Nueva Ecija, have been shipped to Dubai (PhilRice, 2013). There were also small-scale exports of glutinous rice (Commodity Fact Sheet). These volumes were distributed to Singapore and Hong Kong. Other export destinations of aromatic and glutinous rice varieties are Kazakhstan, Canada, Vietnam, USA, Saudi Arabia, Qatar, and UAE.

Even with small ventures in local production and export of SR, the Philippines still cannot meet the growing demand from the local and international markets. The country has been consistently importing aromatic and glutinous rice from countries with more sustainable production volume and consistent quality. Glutinous rice flour processed by neighboring countries has also penetrated the Philippine market. Rice flour is popular in the local market, especially among institutional consumers for its quality and convenient use in processing rice cakes.

## Why this study?

The implementation of the rice tariffication law in the Philippines removes quantitative restrictions (QR) (maximum quota of volume of commodity being imported for a specific duration), allowing free entry of goods from neighboring countries. The lifting of QR in importing goods and the exposure of the Philippines to trade liberalization resulted in adverse repercussions to local farmers. To gauge the position of the country in the world trade market, a study titled "Benchmarking the Philippine Rice Economy Relative to Major Rice Producing Countries in Asia" was conducted by PhilRice and IRRI as funded by the DA-BAR. Results showed that, with the current situation in the local rice industry, the Philippines cannot compete with other neighboring countries due to high costs of production. This resulted in a higher price of rice relative to the produce of other Southeast Asian countries. Farmers will be at a disadvantage since market players and consumers will naturally patronize cheaper but good-quality rice. To address this problem simultaneous with the free entry of cheaper rice imports, farmers must reduce their cost of producing paddy.

Opening of trade is double-edged. It opens imports but it also encourages opportunities for exports albeit small and niche markets. The government intends to empower the local farmers through export promotion as part of the eight new paradigms espoused by DA. The country can harness the opportunity to develop the local SR industry to take advantage of the growing local and global demand for SR. In spite of previous initiatives to profile the SR being planted in the country, there is still limited knowledge on its production dynamics, marketing, and full potential. Thus, DA-BAR initiated and funded the project "Assessing the Production and Marketing of Philippine Specialty Rice" for implementation by PhilRice, in collaboration with IRRI, to produce a baseline and gain a comprehensive understanding of the production, grain quality, marketing, sociocultural uses, and potentials of SR.

Figure 1.1 presents the overview of the project. The four components of the project are: (1) understanding the demand and supply of SR; (2) matching Philippine SR quality attributes with specific product requirements; (3) ethnoryza profiling: a study of culture and SR; and (4) benchmarking the Philippine SR relative to other producing countries. Insights drawn from this project will be used to produce a recommended action plan to DA for harnessing the commercial value and preserving the cultural significance of Philippine SR.

To have a better understanding of the SR value chain, the first study investigates the cost and profitability of producing SR at the farm level and its marketing at selected market chains. It projects the locally available supply of SR and estimates the size of its existing and emerging demand. Finally, it generates insights on the flow of SR in various markets.

Study 2 evaluates grain quality attributes of local and international SR as well as the quality requirements of specific products. It also matches the available SR and specific products in terms of quality attributes.

Ethnoryza profiling (Study 3) documents the local culture governing the cultivation of Philippine SR. In so doing, it examines the local sociocultural uses of SR and determines potential areas for improving cultivation techniques that will not run counter to the local beliefs of producers. Based on these results, it recommends ways of improving the productivity and profitability of SR cultivation while still maintaining the cultural heritage of producers.

Lastly, Study 4 tackles the potential expansion of a niche market for the Philippine SR internationally. This encompasses comparison of local and international SR in different aspects such as production and marketing practices, and grain quality attributes. From these comparisons, best practices on SR production and marketing in exporting countries that can be adopted in the country are identified.

## Organization of the book

This book is divided into six parts. Part 1 introduces the rationale and objectives of the project. It also discusses the general data collection and methods of analysis. Part 2 comprises six chapters. For each type of SR, Chapters 3 to 6 profile the socio-demographics of SR producers and farm characteristics in various sites in the Philippines, describe the farming practices and input use in SR production, and analyze its productivity, cost, and profitability. Chapter 7 describes the grain quality preferences and demand requirements of household consumers and institutional buyers. Chapter 8 traces the market flow of SR from producers to consumers and presents the marketing practices and associated costs.

Part 3 consists of Chapters 9 and 10. This presents the grain quality and health-promoting profile of local SR. It also compares the quality of farmers' produce and household consumers' preference in terms of physical,

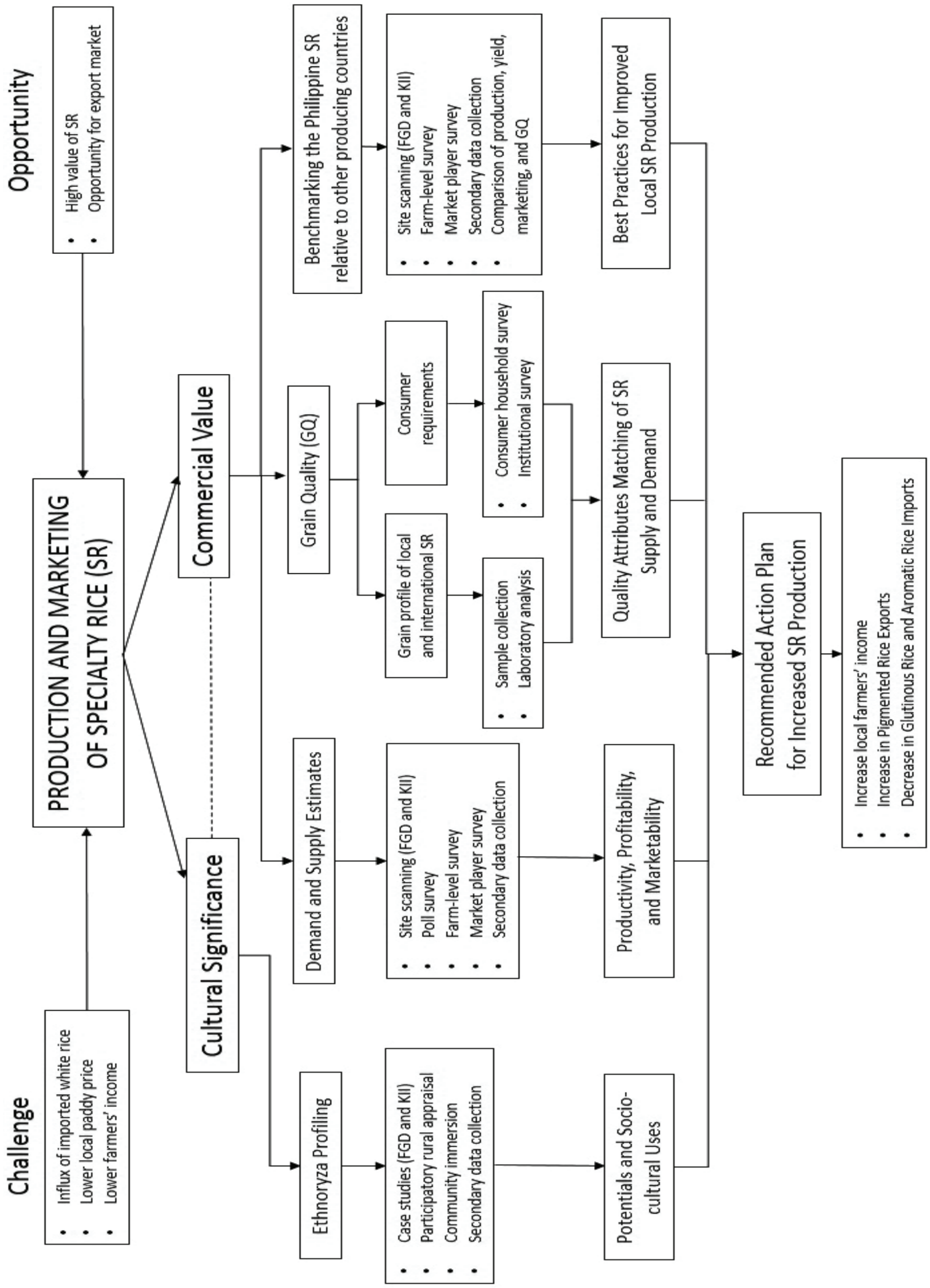


**Figure 1.1.** Overview of the project.

physicochemical, cooking, and sensory properties.

Part 4 contains the ethnoprofile of SR producers. Chapter 11 presents the socio-cultural characteristics of SR producers, while Chapter 12 showcases unique characteristics of SR producers in four case studies: (a) indigenous people (IP); (b) subsistence producer; (c) market-oriented producer; and (d) organic SR producer.

Part 5 describes the SR industry in selected Southeast Asian countries. Chapter 13 evaluates the competitiveness of Philippine SR in the international market and compares the socio-demographic profile of SR producers, productivity, and profitability with those in neighboring countries. Chapter 14 compares the grain quality of local SR with that of international SR varieties.

Part 6 synthesizes the results of the project. Chapter 15 presents the recommended action plans to improve the Philippine SR industry. This includes specialized recommendations to harness production of each SR type, develop markets, and preserve the cultural significance of SR in the Philippines.

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2

# THE SPECIALTY RICE DATA: SOURCES, CONCEPTS, AND METHODS

Jesusa C. Beltran, Marissa V. Romero, Rhemilyn Z. Relado-Sevilla, Flordeliza H. Bordey, and Piedad F. Moya

This chapter presents the general methods of data collection adopted in the project. It also describes the analytical tools employed for each component. For transparency, the limitations of this project are mentioned. A comprehensive explanation of the methodology is given for each component in the succeeding sections.

## Site selection

Due to limited information on specialty rice (SR), the initial selection of sites was based on the magnitude of area harvested to traditional rice varieties per province using Philippine Statistics Authority (PSA) data. To validate further the presence of SR production, the initial areas were scanned through site visits, key informant interviews (KIIs), and focus group discussions (FGDs). After consolidating the results of preliminary scanning, the provinces of Oriental Mindoro, Negros Occidental, North Cotabato, Bukidnon, and Apayao were selected as local sites. Additional sites were recommended after a series of consultations with DA-Regional Field Offices (DA-RFO) and local government units (LGUs). Consequently, Iloilo, Samar, Camarines Sur, and Abra were validated and selected. From these provinces, representative municipalities were further selected on the basis of area planted to SR.

Figure 2.1 shows the location of the project sites. Except for Oriental Mindoro and Camarines Sur, which have distinct concentrations of specific SR types, the other sites were identified to cultivate different types of SR. Representative

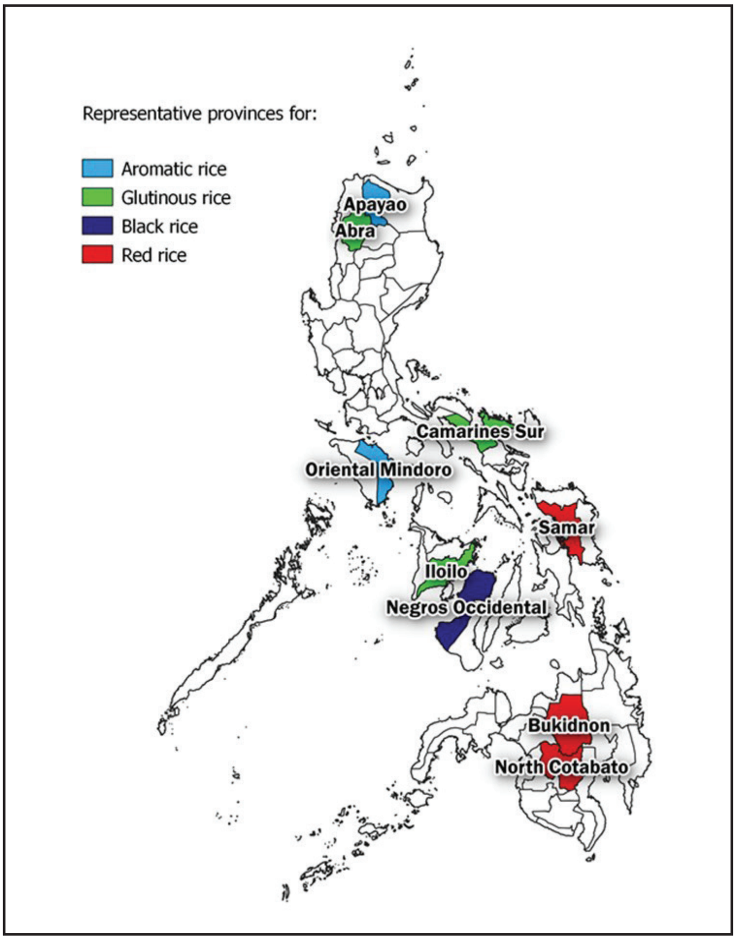


**Figure 2.1.** Location of project sites.

provinces were chosen based on what SR types are more concentrated in the area. Another consideration was consistency in cropping period. Oriental Mindoro and Apayao were selected as sites to study aromatic rice varieties. Specifically, the municipalities of Calapan and Naujan were selected from Oriental Mindoro, while Kabugao, Conner, and Pudtol were chosen from Apayao. For glutinous rice, Camarines Sur, Iloilo, and Abra were identified as representative provinces. The municipality of Ocampo was chosen in Camarines Sur; Zarraga in Iloilo; and Luba and Manabo in Abra. Negros Occidental was chosen for the black rice study and the municipalities covered were Bago City, Kabancalan, Don Salvador Benedicto, and Murcia. Lastly, North Cotabato, Bukidnon, and Samar were selected for red rice. Alamada and Banisilan were the representative municipalities for North

Cotabato; Kalilangan for Bukidnon; and Paranas and San Jose de Buan for Samar.

Generally, these are the selected sites to study the production and consumption of SR. To trace where the bulk of SR is sold and to track where the institutional buyers are, other sites were identified (Table 2.1). Majority of these sites are urbanized.

## Ethical considerations for indigenous peoples' (IP) rights

Out of all the project sites, Abra and Apayao cover indigenous cultural communities/indigenous peoples (ICC/IP). To protect the rights of IP, free, prior, and informed consent (FPIC) was obtained through the National Commission on Indigenous Peoples (NCIP) in conformity with the Indigenous Peoples Rights Act of 1997 (Republic Act No. 8371). FPIC, as defined by the Official Gazette (1997), is "the consensus of all members of the ICCs/IPs to be determined in accordance with their respective customary laws and practices, free from any external manipulation, interference and coercion, and obtained after fully disclosing the intent and scope of the activity, in a language and process understandable to the community." In relation to Section 32 (Community Intellectual Rights), FPIC refers to permission to enter the community while protecting the intellectual rights of IPs. This is to facilitate the collection of paddy and rice samples and information through surveys in these areas.

The FPIC application was submitted to the NCIP Central Office and forwarded to the offices of NCIP-Cordillera Administrative Region (NCIP-CAR). A field-based investigation was conducted as the next step to review the purpose and the scope of the project and the extent of the project's effect on the ICC/IP. Afterward, a pre-FPIC conference took place in order to finalize the work and financial plan (WFP) and the work order. A series of community assemblies was administered to officially meet and converse with community leaders and the local people. Based on these meetings, a memorandum of agreement for each site was produced and signed by both parties.

**Table 2.1.** Project sites of institutional survey.

| Luzon | | Visayas | | Mindanao | |
|---|---|---|---|---|---|
| **Province** | **Municipalities/ Cities** | **Province** | **Municipalities/ Cities** | **Province** | **Municipalities/ Cities** |
| Ilocos Sur | Candon City | Iloilo | Iloilo City | Misamis Oriental | Cagayan de Oro City |
| | Bantay<br>Sto. Domingo | | Pototan<br>Santa Barbara | | Clarin |
| | | | | Davao del Sur | Digos City |
| Pangasinan | Calasiao | Aklan | Kalibo | | |
| | | | Malay | Davao City | |
| Isabela | Cabatuan | | | | |
| | | Negros Occidental | Bacolod City | General Santos City | |
| Benguet | Baguio City | | | | |
| | | Bohol | Tagbilaran City | Surigao del Norte | Surigao City |
| Tarlac | Tarlac City | | Jagna | | |
| | | | | Zamboanga del Sur | Zamboanga City |
| Nueva Ecija | San Jose City | Cebu | Cebu City | | |
| | Rizal | | Mandaue City | | |
| | | | Loloan | | |
| Pampanga | Angeles City | | | | |
| | | Leyte | Tacloban City | | |
| Bulacan | Malolos | | | | |
| Laguna | Nagcarlan | | | | |
| Cavite | Tagaytay City | | | | |
| Albay | Daraga | | | | |
| | Legazpi City | | | | |
| Palawan | Puerto Princesa City | | | | |

## Data and collection method

Different qualitative and quantitative methods of data collection were employed, depending on the objectives of each component. In summary, the following were used: 1) participatory rural appraisal (PRA), 2) FGD, 3) case study, 4) household surveys, and 5) collection of rice samples.

***Study 1***

A series of surveys followed the site scanning: poll survey, farm-level survey, and market player survey. The market participation of farmers in each site was determined through a one-page poll survey questionnaire. From the respondents of the poll survey, farmers who participated in the market were randomly sampled again to get the initial target of 45 respondents for each province for farm-level survey through the fishbowl method. Farmer-respondent must be an SR farm operator, must either be an owner, lessee, tenant, or mortgagee, and must be selling a percentage of his/her produce be it in small portions or in large volumes. Reference period covered harvests from 2016 to 2018. Data collected included quantity of output, input use, costs, prices, and crop management practices.

For the market player survey, the snowball method was applied to interview paddy traders, millers, and rice retailers as key informants. However, whenever the tracing of a market player is no longer feasible, purposive selection of respondents was applied. For each market level, commodity flow and market channels were traced aside from collecting data on marketing costs.

***Study 2***

In Study 2, SR varieties were collected and their grain quality and health-promoting properties were evaluated using laboratory analysis. Consumer surveys for households and institutional buyers were also conducted to determine quality preferences for SR varieties and match them with quality attributes of locally available SR varieties.

<u>Collection of samples</u>

SR in paddy form (3-5 kg) were collected from farmers who were the respondents in the farm-level survey in nine project sites in the Philippines (i.e., Apayao, Abra, Camarines Sur, Oriental Mindoro, Iloilo, Negros Occidental, Samar, Bukidnon, and North Cotabato). The samples were cleaned, processed, and evaluated for grain quality and health-promoting properties in the Rice Chemistry and Food Science Division (RCFSD) laboratory of PhilRice.

Grain quality evaluation

Grain quality characteristics include milling recoveries, physical attributes, physicochemical properties, cooking parameters, and sensory characteristics. Each category was assessed using different parameters: milling recoveries (% brown rice, total milled rice, and head rice), physical attributes (grain length and shape), physicochemical properties (amylose content, gelatinization temperature, and crude protein), cooking parameters (optimum cooking water, weight increase, height increase, cooking time, Instron cooked rice hardness), and sensory characteristics (descriptors for both raw and cooked rice). These various parameters were determined and classified using standard protocols described in the National Cooperative Test (NCT) Manual for Rice (1997).

Evaluation of health-promoting properties

The antioxidants present in black and red rice were determined by evaluating total anthocyanin content (TAC), total phenolic content (TPC), and total anti-oxidant activity (TAA). These were determined spectrophotometrically based on different reference methods, with slight modifications: TPC (Abdel-Aal and Hucl, 1999); TPC (Folin-Ciocalteu method by Singleton et al., 1999); and TAA (DPPH radical-scavenging assay by Brand-Williams et al., 1995).

Consumer survey

To determine consumer preferences for grain quality of SR varieties for subsequent matching with quality characteristics of local SR varieties, surveys were conducted among both household consumers and institutional buyers.

*Household consumers*

A household consumer survey was conducted at the same time with the farm-level survey in the identified areas. Respondents were selected based on two criteria: (1) must neither be a farmer nor a farm operator, and (2) must be purchasing any of the four types of SR varieties from the market or farmers and consuming them either as table rice and snacks at least twice a month.

Scouting for potential respondents started by coordinating with the

Provincial Agriculture Office (PAO) and/or Municipal Agriculture Office (MAO). Forward tracing (i.e., snowball sampling) was used to locate potential respondents. Some were referred by different rice retailers within the areas. The qualified respondents were either gathered in one place (e.g., provincial/municipal/barangay hall, gymnasium, etc.) or visited and surveyed in their respective houses and offices.

The questionnaire included socio-demographic profiles, most commonly used SR type and form, quantity requirement, quality requirement, and problems encountered in consuming SR. Actual grain samples with different quality characteristics based on standards were used as reference to aid respondents in describing their actual and preferred grain quality characteristics. All the information gathered were consolidated and processed by descriptive analysis.

*Institutional buyers*

To qualify for the institutional buyer survey, respondents must be food processors and/or owners/managers/operators of hotels, restaurants, and similar establishments in the Philippines that continuously procure SR in paddy or milled form, prepare/process, and sell them as special table rice, cakes, snacks, and other rice-based food products.

In scouting for potential respondents, coordination with the Department of Trade and Industry (DTI) and Department of Tourism (DOT) was done to obtain the lists of accredited food processing companies and hotels/restaurants, respectively. The internet and different social media platforms were utilized, after which, communication with the potential respondents was made through phone calls and emails. Official letters of request were sent to the identified respondents and schedules were arranged.

Actual interviews were then conducted using guide questions covering information related to socio-demographic profile of the company/establishment, most common SR types used, quantity requirement, prices, quality preference, and problems encountered in using SR. The data gathered were consolidated and processed into output tables by descriptive analysis.

### *Study 3*

The third study employed several data-gathering methods to capture and elucidate the sociocultural aspects of SR farming. These were surveys, formal and informal interviews, KIIs, FGDs, and community immersion through participant observation (PO). To complement these primary data-gathering approaches, secondary data such as agricultural and economic profiles and comprehensive land use programs were also collected from public sources and through related literature review.

A two-page questionnaire supplemented the farm-level survey. This included questions on rituals, traditions, beliefs, taboos, and sociocultural changes in SR farming. Guide questions for KIIs and FGDs were then constructed based on a preliminary review of related literature and interviews with key stakeholders in the area. Purposive site identification and selection were then done to ensure that study locations would best represent SR production in the chosen municipalities. These activities were imperative precursors to PO, which was necessary to witness and document indigenous knowledge systems and practices (IKSPs) and customary laws (CLs) related to rice production. Four case studies were conducted: (1) non-IP producing SR for home consumption only (Bukidnon in Mindanao); (2) IP producing SR for home consumption only (Apayao in Luzon); (3) IP producing SR for market participation (Abra in Luzon); and (4) organic production of SR also for marketing (Negros Occidental in Visayas).

### *Study 4*

Study 4 employed the same survey data collection approach as that of Study 1. Farmers from international sites were interviewed personally using a structured cost and return survey questionnaire. The marketing system was also explored through KIIs with different types of market players.

Unpolished and polished rice samples from Thailand and Cambodia were obtained either from farmer-respondents of FGD and KII or from supermarkets/stores. These were then evaluated for grain quality and health-promoting properties following the procedure described in Study 2 and subsequently compared with samples from corresponding identified sites in the Philippines.

## Analytical methods

All the results from the different components were integrated to provide a holistic picture to understand the production and marketing of SR in the Philippines. Overall, descriptive and inferential statistics were undertaken for central tendency measures and test of means. Thematic analysis was used to describe the IKSPs and CLs. To correlate the relationship between social systems and their rice farm ecosystems, human ecology analysis was employed.

A farm budget structure was also constructed for the production of SR per type in the area using actual and imputed prices. The cost structure was disaggregated by SR type. Relevant costs included seed, fertilizer, pesticide, irrigation, machine rental, fuel and oil, transportation, labor (land preparation, crop establishment, crop care and maintenance, harvesting and threshing, and postharvest), rental value of land, and interest cost of capital. All costs were expressed on a per-hectare basis. Gross revenue was calculated by multiplying rice yield (after threshing) with the price of wet paddy. Net returns above production cost per hectare were computed using this equation:

$$\pi = \left(y \times p\right) - \left(\sum_j x_j\right) \qquad \left(j \in \left\{seed, fertilizer, pesticide, labor, irrigation, land, others\right\}\right) \quad (1)$$

where $\pi$ is net returns, $y$ is rice yield, $p$ is price of paddy, and $x$'s are the cost items. Using the farm budget structure, the costs of rice production and profitability of SR farming were estimated across provinces.

## Scope and limitations

There are several limitations that should be considered in this study. Identification and selection of respondents for the surveys were very challenging. For the farm-level survey, respondents were originally planned to be drawn from the poll survey respondents. However, there were cases where the target of 45 samples was not reached, even if the respondent list had been exhausted already. In this case, other farmers were selected purposively to reach the target, prorated per municipality, regardless of SR type. Thus, a province is selected to represent a particular SR type, depending on the greater concentration of producers even if various SR types are also planted in that province.

There were also difficulties in arranging interviews with institutional survey respondents. Majority of the samples were small and medium enterprises as big companies were hesitant to be interviewed. In addition, the respondents who were interviewed were not able to provide detailed quality preferences due to time constraints. This has restricted the matching of grain quality to the preferences of institutional buyers.

In identifying exporters and importers for the international component, the project only focused on Southeast Asian (SEA) countries due to limited funds and time constraints. This has limited our view on international market outside SEA such as US, Europe, and the Middle East.

There are also limitations when it comes to data collection. Reference period depended on the recent cropping season during the time of survey. One factor was the delay of some surveys due to the long process of obtaining FPIC before proceeding with data gathering. Cropping period also varied across project sites due to water availability, climate, and other environmental factors. Thus, there were differences in cropping period. The information collected was based on farmer interviews and the accuracy of information was thus affected by the farmers' ability to estimate input use or recall total expenditure in SR rice farming for each cropping season. A language barrier also restrained the quality and accuracy of information collected as some of the enumerators are not fluent in the dominant language used in the project sites.

For sample collection, those coming from international sites were collected in milled rice form, whereas samples from local sites were in paddy form. This may have implications in comparing the grain quality attributes of SR from local and international sites. In addition, there were cases where harvested paddy was not available during the survey period. This limited the grain quality assessment of SR.

On ethnoprofiling, the site selection from immersion in Apayao was affected by Typhoon Ompong. This limited the research sites to those areas where SR survived and could be harvested. Another limitation was the peace and order situation in the area. Hence, immersion took place in areas that may not necessarily conform to the suggestion of respondents during the FGDs. However, the study's objectives of witnessing and documenting the indigenous practices of the SR farmers were still achieved.

The ethnographic nature of the study was also non-conventional by its time frame, since an ethnographic fieldwork was usually done for at least 6 months.

In fact, the ideal duration of stay in the field is 1 year so that all seasons are covered and observed. Nonetheless, rapid ethnography is now already gaining ground, along with the applied practice of the discipline.

Information was only gathered from the project coverage areas; therefore, results may have not captured conditions in other SR farms in other provinces that may also have large amount of production or unique farming systems of SR. For example, the province of Ifugao was not included as a project site despite the presence of heirloom rice. The DA-RFO of CAR strongly suggested to focus on other CAR provinces not covered in their studies on heirloom rice.

Furthermore, aggregate supply and demand of SR were only estimated based on available secondary data and supplemented by primary data collected from the project sites. Ideally, accurate estimates could have been done if time-series data on national production and consumption were available. In the absence of these, we used certain assumptions on the area planted and per capita consumption.

Despite these drawbacks, this baseline project is a stepping stone to fill in the insufficiency on data and research regarding SR in the country. This dataset remains the most useful and updated source of information for revisiting SR production. Overall, results from this project will be beneficial to researchers, policymakers, and the farmers themselves.

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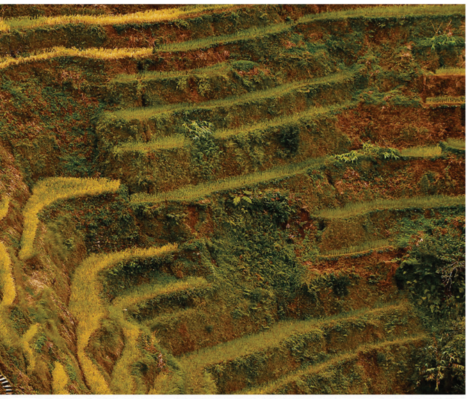
# II

# PRODUCTION AND MARKETING OF SPECIALTY RICE




unpolished
NSIC Rc160
(white rice)
polished
NSIC Rc160
(white rice)
BLACK RICE
BUTWA BLACK
BRILLIANTE
HINUMAY
KATORSA

3

# AROMATIC RICE

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Aromatic rice is a specialty rice (SR) type that contains the main aroma compound 2-acetyl-1-pyrroline (2AP) that is responsible for the *pandan*-like scent (Buttery and Ling, 1982). The major categories are Jasmine type with subtle floral aroma and Basmati type with distinctive spicy fragrance. Jasmine-type rice, originally grown in Thailand as *Khao Hom Mali* (Vanavichit et al., 2018), is also cultivated in Cambodia and Vietnam. Basmati-type rice, on the other hand, is grown in the foothills of the Himalayas (Ashfaq, 2015) in India and Pakistan and in other South Asian countries. There are other types of aromatic rice exhibiting 2AP that do not belong to these two major categories; examples are those found in the Philippines.

The provinces of Oriental Mindoro, Apayao, Negros Occidental, Iloilo, Samar, and Bukidnon in the Philippines were identified as major aromatic rice-producing areas. Oriental Mindoro and Apayao were selected as representative sites for the aromatic rice study as there was a higher concentration of aromatic rice farmers in these provinces. In particular, the study focused on the municipalities of Calapan and Naujan in Oriental Mindoro (Figure 3.1) and the towns of Conner, Kabugao, and Pudtol in Apayao (Figure 3.2). Eighty-two farmers were interviewed: 42 from Oriental Mindoro and 40 from Apayao. The common aromatic rice produced in Oriental Mindoro are NSIC Rc 218 and *Dinorado*, while *Gobyerno* and Palawan are grown in Apayao. Also cultivated are other aromatic varieties such as NSIC Rc 238 in Negros Occidental, *Kinarabao* in Samar, and *Loksamama* in Bukidnon, but these were not included in the study due to sample limitations.

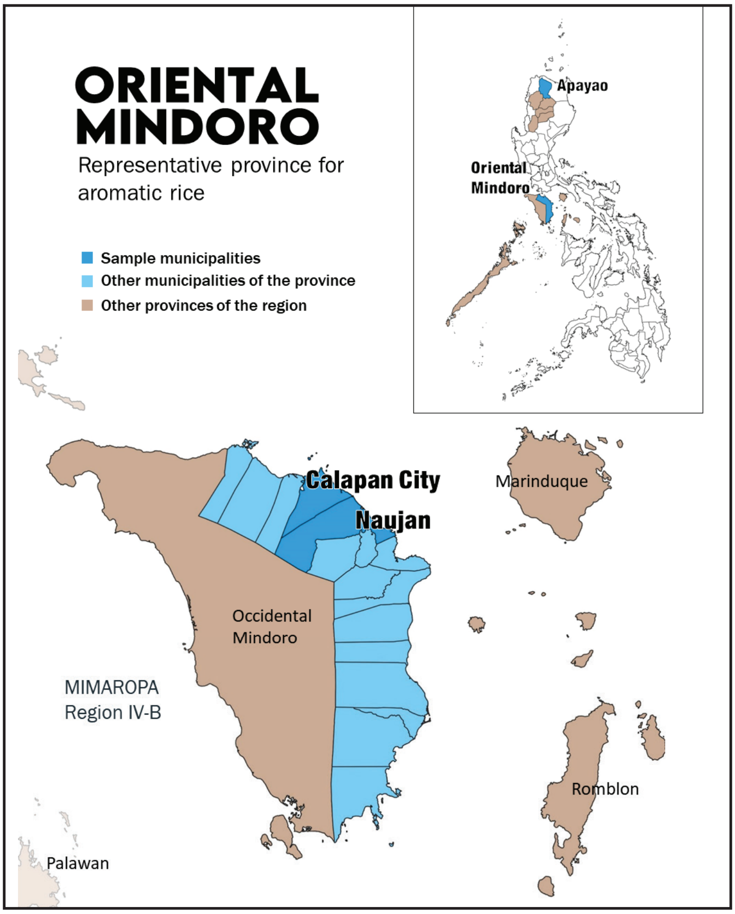


**Figure 3.1**. Location of selected municipalities in Oriental Mindoro.

This chapter aims to (1) describe the current aromatic rice production system and farming practices of farmers in the areas covered; (2) profile aromatic rice farmers and describe the physical profiles of aromatic rice farms; (3) examine the cost and profitability of aromatic rice production; and (4) provide recommendations for harnessing the production of aromatic rice.

## Farm profile

The average rice area of respondents in Oriental Mindoro was 2.58 ha, of which 2.43 ha was planted to aromatic rice (Table 3.1). The majority of the farms were irrigated (90%) with water supply from irrigation systems (83%).

**Table 3.1.** Profile of aromatic rice farms in Oriental Mindoro and Apayao, 2017.

| Farm characteristic | Oriental Mindoro | Apayao |
|---|---|---|
| | n=42 | n=40 |
| Average total rice area (ha) | 2.58 | 1.40 |
| Average total aromatic rice area (ha) | 2.43 | 1.30 |
| Percentage of total aromatic rice area to total rice area | 96 | 92 |
| Source of water (%) | | |
| NIS/CIS | 38 | 3 |
| SSIS (STW, open/dug well, deepwell, SWIP, SFR) | 45 | 3 |
| Rain | 10 | 85 |
| Natural (rivers, streams, free-flowing) | 7 | 10 |
| Ecosystem (%)) | | |
| Upland | - | 78 |
| Rainfed | 10 | 8 |
| Irrigated | 90 | 15 |
| Position (%) | | |
| Upper | 2 | 18 |
| Middle | 5 | 65 |
| Lower | 93 | 18 |
| Distance to road (km) | 0.30 | 2.00 |
| Distance to market (km) | 8.00 | 10.00 |
| Soil type (%) | | |
| Clayey | 40 | 60 |
| Loamy | 21 | 13 |
| Silty | 7 | 3 |
| Sandy | 26 | 20 |
| Others* | 5 | 5 |
| Cropping pattern (%) | | |
| rice-rice | 95 | 3 |
| rice-rice-rice | 2 | - |
| rice-vegetable | - | 3 |
| rice-fallow | 2 | 78 |
| rice-corn | - | 15 |

*Others include sandy loam and silty clay.

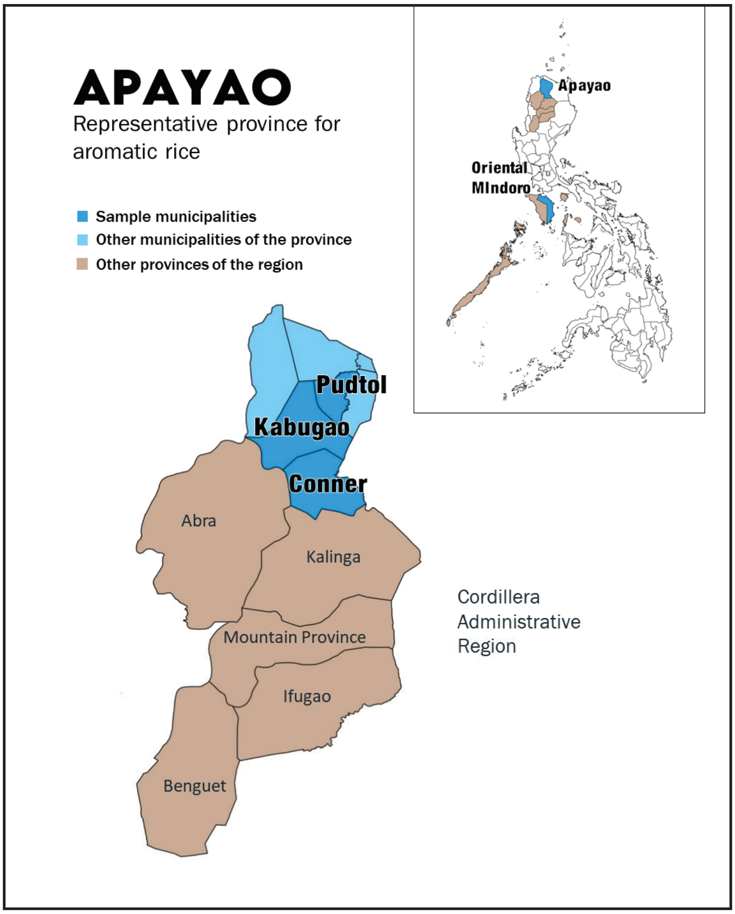


**Figure 3.2.** Location of selected municipalities in Apayao.

These conditions enable aromatic rice farmers to plant rice for two seasons (95%). Distance from the aromatic rice farms to the nearest main road was 0.30 km. The distance to the nearest market averaged 8.00 km. Most of the aromatic rice farms have clayey soil type (40%).

Though farm sizes in Apayao are smaller at 1.40 ha, a trend similar to that of Oriental Mindoro was seen where majority of the area (1.30 ha) was planted to aromatic rice. Aromatic rice farms here are mainly in the upland, depending only on rainwater (85%). More than three-fourths of these farms are situated in middle-to-upper elevations. Many aromatic rice farms are potentially along the slopes of forests and are reached only by hiking. The aromatic rice farmers of Apayao only plant for one season, with a subsequent fallow period (78%) or corn production (15%). The average distance of aromatic rice farms was 2 km

**Table 3.2.** Profile of aromatic rice farmers in Oriental Mindoro and Apayao, 2017.

| Farmer characteristic | Oriental Mindoro | Apayao |
|---|---|---|
| | n=42 | n=40 |
| Sex (%) | | |
| Male | 69 | 35 |
| Female | 31 | 65 |
| Age (years) | 50 | 48 |
| Civil status (%) | | |
| Single | - | 3 |
| Married | 93 | 93 |
| Widower | 5 | 3 |
| Separated | 2 | 3 |
| Education (years) | 9 | 9 |
| Farming experience (years) | 24 | 24 |
| Household size | 4 | 6 |
| IP membership (%) | | |
| Isnag | - | 73 |
| Ilocano/Isnag | - | 10 |
| Others | - | 9 |
| None | 100 | 10 |
| Tenurial status (%) | | |
| Owner/CLT | 36 | 35 |
| Amortizing/CLT (partially paid) | 2 | - |
| Lessee | 14 | 3 |
| Tenant | 36 | 8 |
| Ancestral domain | 5 | 53 |
| Mortgagee | 7 | - |
| Others | - | 3 |
| Organization (% member) | | |
| Cooperatives | 2 | 7 |
| Irrigators' association | 14 | 2 |
| Farmers' association | 76 | 49 |
| None | 12 | 41 |
| Training (% trained) | | |
| Inbred rice production | 12 | 19 |
| Nutrient management | 21 | 12 |
| Pest management | 33 | 8 |
| Farmer field school/Palaycheck | 12 | 13 |
| Others | 21 | 4 |
| None | 26 | 44 |
| Capital source (% borrower) | 17 | 75 |
| Income from rice (%) | 72 | 58 |

from the main road and 10 km from the market. Most of the farms are found to have clay soil (60%).

## Farmer profile

Aromatic rice farmers in Oriental Mindoro were mostly male, 50 years old, married, and with an average of 9 years of formal education (Table 3.2). They have been cultivating rice for 24 years and were generally financially capable, with only 17% of them borrowing capital. Their households have an average size of four members. One-third of them were land owners, the other third were tenants, while the rest were into other forms of tenurial arrangement. Eighty-eight percent were members of at least one organization and majority have attended at least one training or seminar since 2014. On average, rice farming provided 72% of the household income.

Aromatic rice farmers in Apayao were mostly female, 48 years old, married, have 9 years of formal education, and have grown rice for 24 years (Table 3.2). Average size of households was six. They predominantly belong to the *Isnag/ Isneg* ethnic group, the indigenous inhabitants of the province (see Chapter 12). Participation of women can be traced back to the traditional practice of shifting cultivation, where men traditionally performed the clearing of swiddens, while the women were tasked with planting, management, and harvest of the rice crop. Apayao farmers have unique tenurial arrangement by virtue of their ancestral domain title, a privilege made exclusive through Republic Act 8371, otherwise known as the Indigenous Peoples' Rights Act (IPRA).

Although 59% of aromatic rice farmers in Apayao belonged to at least one organization, a considerable 41% had none. Majority of the farmers have attended at least one training or seminar since 2014, but there was a substantial number with no training at all. Seventy-five percent of Apayao farmers relied on borrowings for their farm capital. Being subsistence farmers, 70% of what they produce was generally for home consumption and only 20% was sold (see Figure 7.2 in Chapter 7). More than half of household income was derived from rice farming.

## Productivity of aromatic rice

On average, aromatic rice yield in Oriental Mindoro was estimated at 4.80 t $ha^{-1}$ with a dry equivalent of 4.40 t $ha^{-1}$ at 14% moisture content (MC) (Figure

3.3). Yield was at par with the 2019 national average of about 4.04 t $ha^{-1}$ (PSA, 2020). This can be attributed mainly to the use of modern varieties and irrigation. However, yields varied from 2.40 t $ha^{-1}$ to 6.70 t $ha^{-1}$ due to problems encountered by farmers such as high incidence of insects (e.g., brown planthoppers and stem borers), diseases, and weeds.

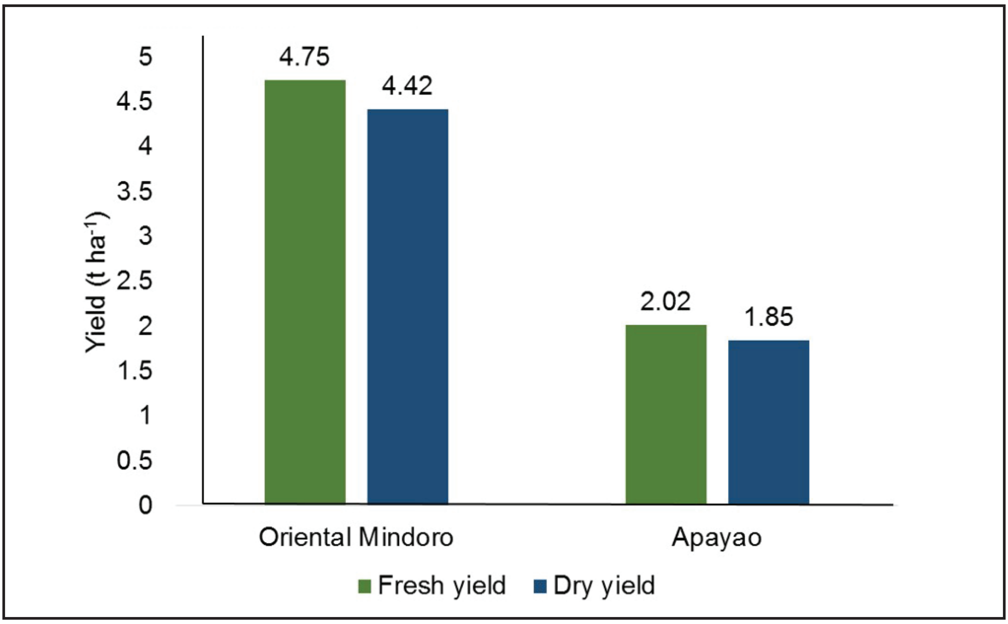


**Figure 3.3.** Farm yields of aromatic rice in Oriental Mindoro and Apayao, 2017.

Apayao producers, who are mostly into subsistence farming, had an average yield of 2.02 t $ha^{-1}$ with 1.85 t $ha^{-1}$ dry equivalent. The lower yield reported was probably due to the upland ecosystem, common use of traditional varieties, pest problems, and low fertilizer use. Farm yield levels within the area also varied widely, with minimum yield at 0.30 t $ha^{-1}$ and maximum yield at 6 t $ha^{-1}$.

## Material input use and management practices

### *Variety, seed class, and crop establishment*

Two aromatic rice varieties were mainly cultivated in Oriental Mindoro – NSIC Rc 218 and *Dinorado* (Table 3.3 ). Average maturity periods for these varieties were 108 and 105 days, respectively. NSIC Rc 218 was commonly grown in Region 4B, along with ordinary rice varieties such as PSB Rc 18, NSIC Rc 354, and NSIC Rc 394 (PhilRice, 2018). This variety is also planted by a small number of farmers in Iloilo. However, it is susceptible to pests and diseases such as blight, tungro, bacterial leaf blight, brown planthopper, green

**Table 3.3.** Main varieties planted by farmers of aromatic rice in Oriental Mindoro and Apayao, 2017.

| Province | Varieties | Maturity (days) | Percent user |
|---|---|---|---|
| Oriental Mindoro | NSIC Rc 218 | 108 | 57 |
| | *Dinorado* | 105 | 43 |
| Apayao | *Gobyerno* | 146 | 50 |
| | Palawan | 137 | 38 |
| | *Binagingan* | 150 | 2 |
| | *Digmi* | 150 | 2 |
| | *Moros* (White) | 150 | 2 |

leafhopper, and white stem borer. Despite this, most farmers still plant NSIC Rc 218 because of its premium price and high demand in the market. This variety has high milling recovery (67%), long grain, and good eating quality. It is important to note, however, that many farmers call their rice *Dinorado* when it actually is NSIC Rc 218. Thus, in reality, it is possible that farmers who indicated *Dinorado* (or at least a percentage of them) planted NSIC Rc 218.

In Apayao, where most rice varieties planted are traditional, two major aromatic rice varieties were cultivated. The first is *Gobyerno*, also known as Bayu. It matures at an average of 146 days (Table 3.3). The other is locally known as Palawan with an average maturity of 137 days. As mentioned, aromatic rice cultivated in the province are traditional varieties with typical long maturity periods. There were other aromatic rice varieties not included in this study but were nonetheless collected as samples for grain quality analysis (see Chapter 9).

More than half of the farmers in Oriental Mindoro (55%) used certified seeds (Table 3.4), mostly sourcing these out from nearby seed growers and seed centers. Some farmers (33%) used farmers' saved seeds. They either set aside a portion of their harvest for seeds or bought planting material from their co-farmers.

Direct seeding was widely adopted (79%) through manual broadcasting in wet fields, while manual transplanting was practiced in the rest (21%) of the area. These farmers commonly used the straight-row planting method, averaging three seeds per hole. Seeding rate was 112 kg $ha^{-1}$, much higher than the recommended rates of 20-40 kg $ha^{-1}$ for transplanted and 60-80 kg $ha^{-1}$ for direct-seeded rice. The higher seeding rate was practiced to compensate for seedling damage brought about by birds, rodents, and other pests.

Most of the farmers in Apayao used their own seeds. Average seeding rate was 57 kg $ha^{-1}$ (Table 3.4). The relatively lower seeding rate is attributed to the crop establishment practice of dibbling: a wooden stick is used to create holes 26 cm apart. Five to six seeds are placed per hole. Transplanting and direct seeding methods are not suitable because of steep slopes that render the area prone to erosion.

***Fertilizer use and management***

Table 3.4 shows the average NPK rates applied by farmers in cultivating aromatic rice in Oriental Mindoro and Apayao. On average, farmers in Oriental Mindoro applied an average of 92 kg N $ha^{-1}$, 10 kg P $ha^{-1}$, and 32 kg K $ha^{-1}$. Majority of the farmers (52%) applied fertilizers in three splits per cropping season. The first application was usually done 18 days after seeding (DAS) for direct-seeded rice and 8 days after transplanting (DAT) for transplanted rice. The second application was done 33 DAS and 25 DAT for direct-seeded and transplanted rice, respectively.

The last application was usually completed 48 DAS for direct-seeded rice and 41 DAT for transplanted rice. The most common inorganic fertilizer grades used by farmers were complete (14-14-14) with 93% of farmers reporting; 45% mentioned urea (46-0-0); 45% reported ammonium chloride (25-0-0); and 26% mentioned potassium nitrate (17-0-17).

In Apayao, average application rates were 21 kg N $ha^{-1}$, 1 kg P $ha^{-1}$, and 1 kg K $ha^{-1}$ (Table 3.4). These levels were relatively low as fertilizer application was not commonly practiced and given the fact that 43% of the farmers did not apply fertilizers. Topographically, farm areas are steep, which might cause fertilizers to be wasted once they are applied. Farmers also believed that upland areas have more fertile soil so there is no need to apply fertilizer. Twenty-eight percent of the farmers applied fertilizer once, whereas 8% applied twice. The first application was at 30 DAS and the second was at 45 DAS. The top three commonly used fertilizers were urea, complete, and ammonium phosphate.

**Table 3.4.** Material input use in aromatic rice production in Oriental Mindoro and Apayao, 2017.

| Item | Oriental Mindoro | Apayao |
|---|---|---|
| | n=42 | n=40 |
| Seed (kg $ha^{-1}$) | 112 | 57 |
| Fertilizer (kg $ha^{-1}$) | | |
| N | 92 | 21 |
| P | 10 | 1 |
| K | 32 | 1 |
| Pesticide (kg ai $ha^{-1}$) | | |
| Herbicide | 0.40 | 0.05 |
| Insecticide | 1.41 | 0.03 |
| Fungicide | 0.13 | |
| Molluscicide | 0.65 | |
| Rodenticide | 0.08 | 0.004 |

***Pesticide use and management***

In Oriental Mindoro, majority of the farmers have long been using different kinds of pesticide in their farms to control pests and diseases every season. Table 3.4 shows the pesticide application of farmers in terms of active ingredient (ai).

Herbicide is one of the most common types of pesticides applied by farmers. Ninety-eight percent of farmers applied herbicides to control weeds in their fields because these are cheap and easy to use. This heavy reliance on herbicides was primarily due to the method of crop establishment practiced (direct seeding). On average, herbicide application rate was 0.40 kg ai $ha^{-1}$, mostly for two applications. These were commonly applied at 6 and 21 DAS.

Insecticide was the second commonly used pesticide by farmers (95%) with an average of 1 kg ai $ha^{-1}$. Despite having the same frequency of application as that of herbicides, higher insecticide rates were observed due to heavy insect infestations. The more common insects reported were rice bugs and stem borers. The first and second applications were done at 29 DAS and 49 DAS, respectively.

Molluscicide is another type of pesticide commonly used by farmers (95%) with a mean application rate of 0.65 kg ai $ha^{-1}$ split into two applications. The first application was usually done at 3 DAS, while the second was at 6 DAS. Rodenticides and fungicides were the least used types of pesticide. About 60% of farmers applied rodenticides, while 48% used fungicides. Mean application rates were 0.08 and 0.13 kg ai $ha^{-1}$ for rodenticide and fungicides, respectively.

Farmers in Apayao are minimal users of pesticides. More than half (68%) applied herbicides to control weeds in their fields (Table 3.4). Mean application rate was 0.05 kg ai $ha^{-1}$ and usually applied either 12 days before seeding (DBSe) or 27 DASe. Other types of pesticides were infrequently used. Most of the farmers in this province did not use mitigation techniques against pests and diseases. Farmers said that pests were not prevalent, although occurrences of pest infestation have been recorded.

## Labor use and mechanization

Rice cultivation involves major activities such as land preparation, crop establishment, crop care and maintenance, harvesting and threshing, and post-harvest. These activities can be done by an operator, family and exchange (OFE) and hired labor. Hired laborers are workers paid on a daily or contractual basis. Contract agreements may vary from cash, in-kind, to per-hectare basis payments. OFE labor, on the other hand, is rendered by the farmer himself, family members, or other unpaid workers. This type of labor has no actual payment and is imputed using prevailing wage rates.

Table 3.5 shows the total labor use in aromatic rice production in the two provinces. In Oriental Mindoro, farmers incurred a total of 35 mandays (md) to finish work on a 1-ha farm of aromatic rice. The relatively lower md, as compared with the national level of 64 md $ha^{-1}$ (PhilRice, 2012), is mainly attributed to the popularity of direct seeding as a method of crop establishment and the use of combine for harvesting and threshing. OFE contributed more than half (52%) of the total labor use. Daily activities were paid using the prevailing wage rate of P300 $day^{-1}$.

Among all farm activities, crop care and maintenance was the most laborious, requiring an average of 13 md $ha^{-1}$. Predominantly done by family labor, crop care and maintenance activities included fertilizer and pest management practices. The next was land preparation with an average of 10 md $ha^{-1}$ requirement. Since

**Table 3.5.** Labor requirements of aromatic rice production in Oriental Mindoro and Apayao, 2017.

| Item | Oriental Mindoro | Apayao |
|---|---|---|
| | n=42 | n=40 |
| Hired labor (md $ha^{-1}$) | | |
| Land preparation | 4.38 | 3.75 |
| Crop establishment | 6.17 | 7.9 |
| Crop care and maintenance | 3.17 | 1.37 |
| Harvesting and threshing | 1.29 | 11.68 |
| Postharvest | 1.63 | 1.09 |
| OFE labor (md $ha^{-1}$) | | |
| Land preparation | 5.48 | 7.89 |
| Crop establishment | 2.54 | 5.58 |
| Crop care and maintenance | 9.79 | 4.43 |
| Harvesting and threshing | - | 8.22 |
| Postharvest | 0.33 | 3.03 |
| Total labor | 34.78 | 54.93 |

these areas were lowland, land preparation activities were labor-intensive with existent practices of plowing, harrowing, leveling, and even rototilling in some places. Hand tractor was the most popular machine used with 95% of farmers reporting. Draft animals (88%) were the next most common source of power. Some farmers used four-wheel tractors (64%). The operators of these machinery were paid either through a daily wage rate or contract on a per-hectare basis. The least strenuous activities were harvesting and threshing, and postharvest. Harvesting and threshing were fully mechanized, requiring an average of 2 md $ha^{-1}$ because of the use of combine harvesters from service providers. On the other hand, postharvest only involved hauling of paddy from the harvesting area to the first point of destination; cost was P15 $sack^{-1}$.

In Apayao, aromatic rice production was more labor-intensive. Farmers incurred an average of 55 md $ha^{-1}$ even without seedling care and maintenance activities (Table 3.5). The higher labor use was probably because majority of the activities were manually done and mostly performed by family labor (53%). The bulk of the work came from harvesting and threshing, which required an average of 20 md $ha^{-1}$. Harvesting was manually done by the majority of the farmers as combine harvesters cannot be used in upland and sloping areas.

Farmers used *rakem* in harvesting rice. Fifty-seven percent of the labor came from OFE. Daily wage rate for farm activities ranged from P200 to P300.

Land preparation was also laborious, requiring an average of 12 md $ha^{-1.}$ Farmers practiced the *kaingin* system instead of conventional land preparation activities. It usually takes 1 to 3 months, depending on the dryness of the area. Typically done during April, *kaingin* commences with the clearing of woods and grasses surrounding the chosen area bordered with a fire line. This line marks a 3-meter distance from the burning area to the remaining parts of the forest to avoid wildfire. Once clearing is done, farmers wait for at least a week without rainfall before they start burning. They use bamboo for setting the flame and follow the wind direction. After putting out the fire, they ensure that the area is cleaned before planting.

Minimal labor was incurred on crop care and maintenance since fertilizer and pesticide applications were not commonly practiced in the province (Table 3.5). Twenty percent of the farmers reported no pest occurrence during the cropping period. Weed incidence was the most common problem, thus the herbicide application in the area. As supplementary pest management technique, some farmers set up scarecrows that prevented birds from disturbing the field. Lastly, postharvest was the least laborious activity as it only involved hauling of paddy (usually paid at P50 $sack^{-1}$).

## Production cost and input cost share

Figure 3.4 shows the cost share distribution in aromatic rice production. In Oriental Mindoro, farmers spent a seasonal average of P63,000 $ha^{-1}$ or about P13 $kg^{-1}$ to produce aromatic rice (Table 3.6). Among cost components, land rent captured the largest share (30%) to total cost. The high cost of land is probably due to rapid urbanization and land conversion in the area. As mentioned earlier, half of the farmers rented their land either as lessee or tenant. Next to land rent was hired labor cost with 24% share of the total cost. This could be attributed to high contract payment for land preparation, crop establishment, harvesting, and threshing, which ranged from P2,500 to P5,000 $ha^{-1}$. Fertilizer inputs contributed 13% of total production cost. Respondents also spent a considerable amount on pesticides with 7% share.

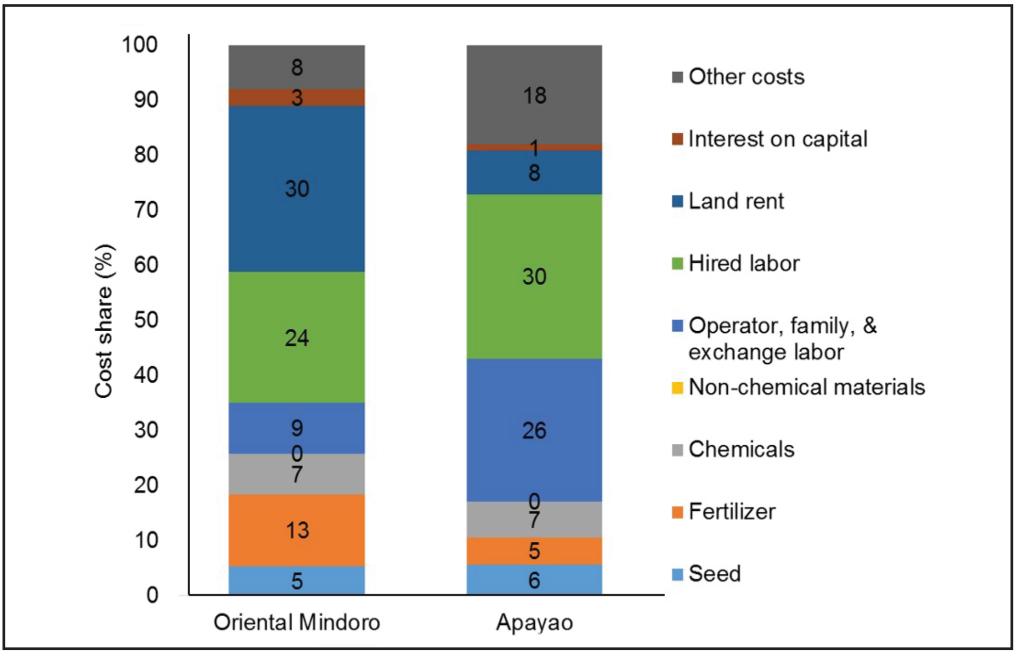


**Figure 3.4** Cost shares (%) in aromatic rice production in Oriental Mindoro and Apayao, 2017.

Note: Other costs include power, irrigation, transportation, food, and other input costs.

In Apayao, the average cost of aromatic rice production was P25,211 ha$^{-1}$ (Table 3.6). On a per-kilogram equivalent, farmer spent an average of P13. Decomposing the cost shares of farm production resulted in hired and OFE labor costs constituting the biggest percentage shares of 30% and 26%, respectively (Figure 3.4). The main reason for this was the lower level of mechanization in the area. Respondents spent considerable amounts on pesticides and fertilizers with cost shares of 7% and 5%, respectively, despite infrequent use of these chemicals in the field.

## Profitability of aromatic rice farming

Table 3.6 summarizes the costs and returns of aromatic rice production in Oriental Mindoro and Apayao. In Oriental Mindoro, farm gate price of aromatic rice ranged from P16 to P22 kg$^{-1}$ with an average of P19 kg$^{-1}$. With high yield and relatively better paddy prices, farmers were able to generate a gross revenue that ranged from P45,600 to P133,980 ha$^{-1}$ with an average of P92,397

**Table 3.6** Costs and returns of aromatic rice production in Oriental Mindoro and Apayao, 2017.

| Item | Oriental Mindoro n=42 | Apayao n=40 |
|---|---|---|
| **Returns** | | |
| Yield (kg $ha^{-1}$) | 4,754 | 2,016 |
| Paddy price (peso $kg^{-1}$) | 19 | 18 |
| Gross revenue (peso $ha^{-1}$) | 92,397 | 36,145 |
| **Costs (peso $ha^{-1}$)** | | |
| Seed | 3,340 | 1,403 |
| Fertilizer | 8,199 | 1,260 |
| Chemicals | 4,693 | 1,639 |
| Non-chemical materials | 15 | 2 |
| Hired labor | 14,931 | 7,541 |
| Operator, family, & exchange labor | 5,810 | 6,556 |
| Land rent | 19,039 | 1,983 |
| Interest on capital | 1,918 | 290 |
| Other costs* | 4,957 | 4,536 |
| **Total paid-out cost (peso $ha^{-1}$)** | 44,173 | 16,580 |
| **Total cost (peso $ha^{-1}$)** | 62,901 | 25,211 |
| **Cost per unit (peso $kg^{-1}$)** | 13 | 13 |
| **Net income from rice farming (peso $ha^{-1}$)** | 29,495 | 10,934 |
| **Net returns over paid-out costs (peso $ha^{-1}$)** | 48,224 | 19,566 |

*Other costs include power, irrigation, transportation, food, and other input costs.

$ha^{-1}$. Considering all farm production costs, farmers attained an average net income of P29,495 $ha^{-1}$. Returning the value of imputed costs (i.e., OFE labor, interest on capital and land rent), farmers' net returns increased at an average of P48,224 $ha^{-1}$.

Average paddy price of aromatic rice in Apayao was almost the same as that of ordinary white rice varieties planted in the area (P18 $kg^{-1}$), this in spite of the aroma advantage. Price is so variable that it can go as low as P14 $kg^{-1}$ and as high as P20 $kg^{-1}$. Cultivation of traditional rice varieties in Apayao occurs in a low input-output situation with low production cost requirements and low yield. The relatively low yield pulled down the average gross revenue at P37,243 $ha^{-1}$. Extremely low values of yield and paddy price could lower gross revenue at

P5,700 $ha^{-1}$, but with proper farm management and better prices, this can increase to as high as P90,000 $ha^{-1}$. Deducting expenses from gross returns, a farmer can get a net income of P10,934 $ha^{-1}$. Farmers who own land and capital and render no OFE labor services may receive P19,566 $ha^{-1}$.

## Summary and implications

Aromatic rice farmers in both sites were similar in age, educational attainment, and farming experience, except in organizational membership where a significant percentage of Apayao farmers were non-members. This may have dire implications on access to training, seminars, cooperative activities, and related government programs such as provision of credit and machinery. Also notable was the gender differentiation observed in farming activities for aromatic rice production: Apayao women farmers were more involved than men. This fact should be considered in planning extension interventions, especially with respect to training designs intended for aromatic rice farmers.

When it comes to production, yields in Oriental Mindoro were reported to be at par with the national average. However, there is still room to enhance yield and reduce cost. First, farmers should further increase their adoption of high-quality seeds in the case of NSIC Rc 218. Additionally, newly released aromatic varieties with features comparable with those of NSIC Rc 218 should be introduced and made available in the area. In the absence of these varieties, rice research and breeding should include this in their thrusts. In the case of *Dinorado*, a traditional variety, the government should have programs for community seed banking (CSB) to ensure availability of and access to pure seeds. Community seed banks are repository of local seeds that facilitates exchange among community members (Vernooy et al., 2017). It should also be emphasized that a system for truthful labeling be strictly observed among farmers and traders, given that NSIC Rc 218 is marketed as *Dinorado.* Second, the adoption of integrated pest management should be intensified in the province, given their heavy use of pesticides as primary response to pest and disease infestations. Lastly, the high cost of land rent in the province was a drawback, the consequence of urbanization and land conversion. The market value of land is expected to increase over time and the value of aromatic rice needs to match this to ensure sustainability. Land conversion policies should be strictly implemented to lessen the cost of land rent.

Aromatic rice production in Apayao is a typical system for upland rice farming where adoption of traditional varieties and low input use of fertilizers and pesticides are observed. This results in a much lower yield compared with lowland rice areas, making this more of subsistence farming. However, there is still room to enhance yield and reduce cost. This study reinforces the recommendations for upland rice farming given by the Heirloom Project. First, training on seed purification as well as development of CSB infrastructure must be initiated to produce quality and pure seeds. Farming techniques espoused by the *PalayCheck* for Highland Rice Production System and Diversified Farming Technologies, which aims to raise productivity and profitability, must also be introduced. This must include recommendations for all farming activities. For varietal selection, smaller bundles of panicles are recommended to achieve uniform drying of grains. Proper storage must also be done to prolong shelf-life and ensure good germination. For land preparation, microtillers are recommended for soil tillage for flat to slightly rolling fields in order to reduce manual labor cost. Further details of technology recommendations for upland rice farming are discussed in *PalayCheck* for Highland Rice Production System and Diversified Farming Technologies (Miranda, 2017).

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4

# GLUTINOUS RICE

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Glutinous rice is commonly cultivated in South, East, and Southeast Asia (Sattaka, 2016). It is characterized by its stickiness, brought by its low to almost nil amylose content (Setyaningsih and Saputro, 2015), making it suitable as raw material for rice-based products such as *kakanin*. Around 73% of the Filipinos like this rice-based product (Ballesteros and Abilgos-Ramos, 2019). This consumption behavior explains why glutinous rice farming is scattered across the country. There is small-scale production (less than 0.5 ha) of glutinous rice as it is intended only for home consumption. Crops planted in more than half a hectare can only be found in a significant number of farms in limited areas of the country.

Participants in focus group discussions and key informant interviews reveal that glutinous rice is popularly produced in semi-large scale in the provinces of Camarines Sur, Iloilo, Abra, and Negros Occidental. From these provinces, the following were selected as representative sites as there was high concentration of glutinous rice farmers in these locations: Ocampo and Bato in Camarines Sur (Figure 4.1) with 44 respondents, Zarraga in Iloilo (Figure 4.2) with 28 respondents, and Manabo and Luba in Abra (Figure 4.3) with 21 respondents. The common glutinous rice varieties grown were *Pulutan* and *Gurung-gurong* in Camarines Sur, *Pilit* in Iloilo, and *Waray* in Abra. Other glutinous rice varieties such as Magnolia, *Dalagang bukid*, and *Señorita* were cultivated in Negros Occidental but were not included in the analysis.

This chapter aims to (1) describe the current glutinous rice production system and farming practices of farmers in the covered areas; (2) profile glutinous rice farmers and describe the physical profiles of glutinous rice farms; (3)

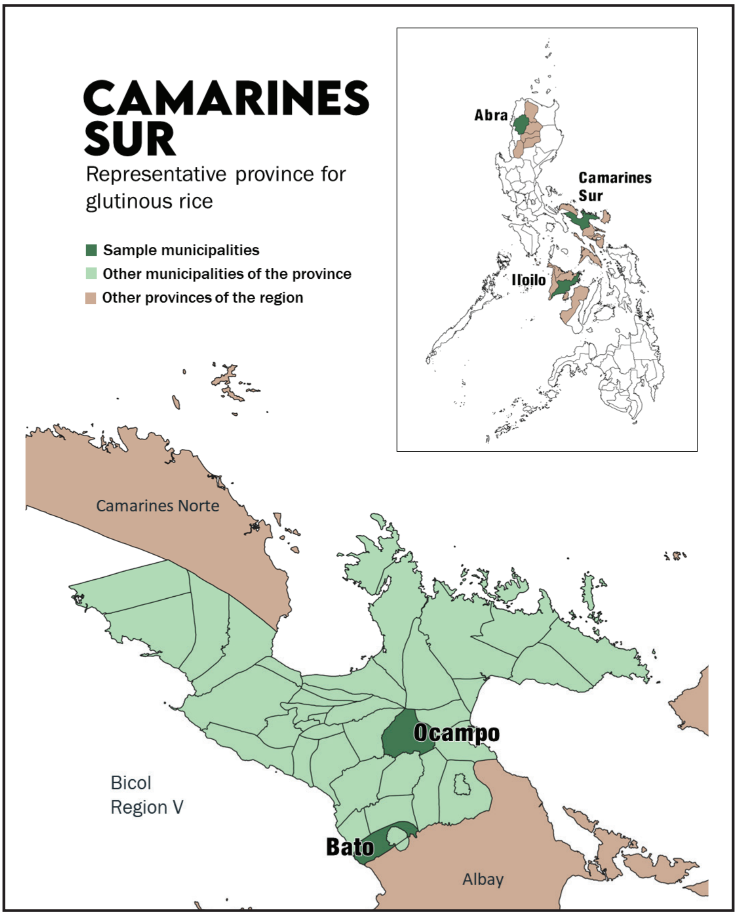


**Figure 4.1.** Location of selected municipalities in Camarines Sur.

examine the cost and profitability of glutinous rice production; and (4) recommend strategies to enhance the production of glutinous rice.

## Farm profile

Table 4.1 presents the physical characteristics of glutinous rice farms in the three representative sites. Farmers in Camarines Sur have large rice landholdings, averaging 2.38 ha. They allocate almost their entire rice area for glutinous rice production, 95% on average. Glutinous rice farms have clay soil (84%) and are mainly lowland irrigated (82-100%) by national and small-scale irrigation systems. These farms have two rice cropping seasons a year.

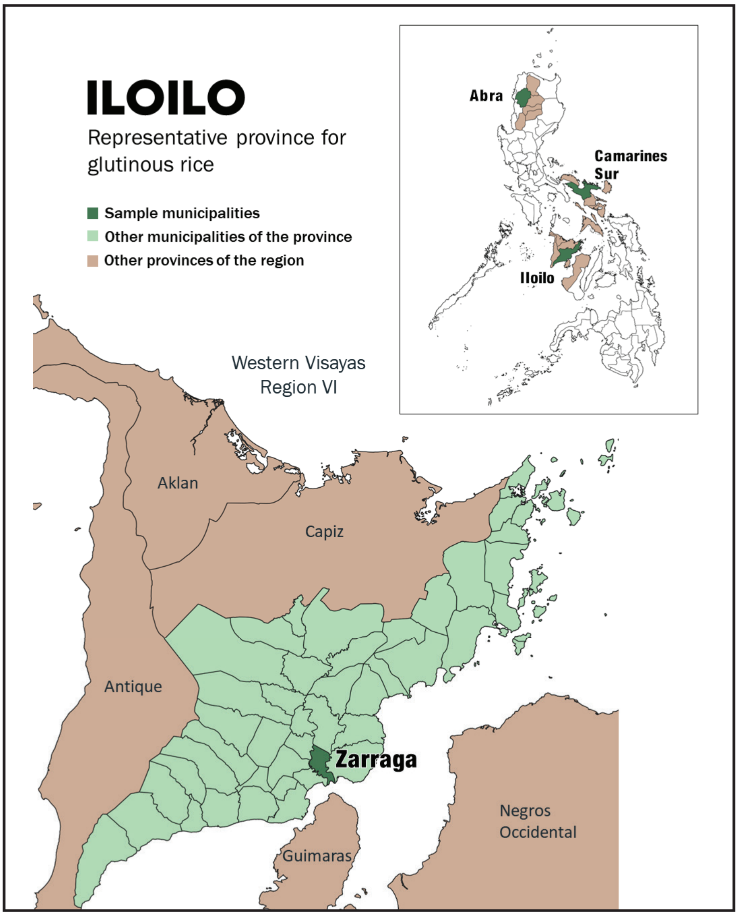


**Figure 4.2.** Location of selected municipalities in Iloilo.

In Iloilo, rice farm areas averaged 1.98 ha. However, farmers allocated only 27% of their total rice area to glutinous rice production. It is, in fact, the only province across all SR types with below two-thirds allocation of total rice area to SR production. Glutinous rice farms either have loamy soil (46%) or clay soil (21%). Majority (61%) of the farmers practiced the rice-rice-mungbean cropping pattern (Table 4.1).

Rice farms in Abra have an average size of 1.30 ha and have 68% allocation for glutinous rice production (Table 4.1). The representative municipalities differed in irrigation dynamics. In Luba, water is usually sourced through makeshift diversion canals made by the farmers themselves, whereas in Manabo, there is an extensive communal irrigation system that irrigates almost the entire valley. However, during the period of this study, the Manabo irrigation system

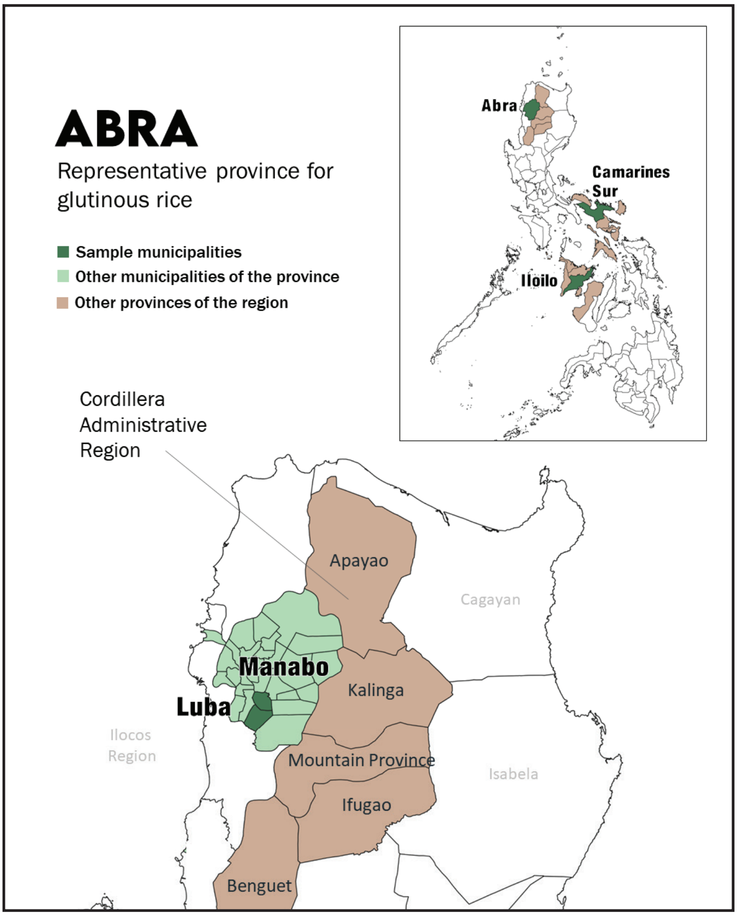


**Figure 4.3.** Location of selected municipalities in Abra.

was badly damaged, resulting in a considerable number of farmers being unable to receive water from the system. Only about 49% of them were able to plant two crops of rice. Some farmers cultivated vegetable or tobacco after rice (both at 14% each) to maximize land use in the dry season. The dominant soil type is clay.

## Farmer profile

Table 4.2 shows the sociodemographic profile of glutinous rice farmers in the provinces covered. Glutinous rice farmers in Camarines Sur are almost equally distributed between male and female, are 53 years old, married, have at least attended 9 years of formal education, and have been cultivating rice for 28 years. Household size averages five members. Majority of them own the land they cultivate

**Table 4.1.** Profile of glutinous rice farms in Camarines Sur, Iloilo, and Abra, 2017.

| Farm characteristic | Camarines Sur | Iloilo | Abra |
|---|---|---|---|
| | n=44 | n=28 | n=21 |
| Average total rice area (ha) | 2.38 | 1.98 | 1.30 |
| Average total glutinous rice area (ha) | 2.21 | 0.26 | 0.88 |
| Percentage of total glutinous rice area to total rice area | 95 | 27 | 77 |
| Source of water (%) | | | |
| NIS/CIS | 48 | 25 | 29 |
| SSIS (STW, open/dug well, deepwell, SWIP, SFR) | 32 | 39 | 5 |
| Rain | 2 | 18 | - |
| Natural (rivers, streams, free-flowing) | 18 | 18 | 67 |
| Ecosystem (%) | | | |
| Rainfed | 2 | 18 | - |
| Irrigated | 98 | 82 | 100 |
| Position (%) | | | |
| Upper | - | - | 10 |
| Middle | 2 | 18 | 14 |
| Lower | 98 | 82 | 76 |
| Distance to road (km) | 0.60 | 0.60 | 0.20 |
| Distance to market (km) | 8.00 | 4.00 | 24.00 |
| Soil type (%) | | | |
| Clayey | 84 | 21 | 86 |
| Loamy | 5 | 46 | - |
| Silty | 2 | 4 | 5 |
| Sandy | 2 | 4 | - |
| Others* | 7 | 25 | 10 |
| Cropping pattern (%) | | | |
| rice-rice | 84 | 29 | 48 |
| rice-rice-rice | 14 | - | - |
| rice-vegetable | - | - | 14 |
| rice-fallow | 2 | 7 | 19 |
| rice-rice-mungbean | - | 61 | - |
| rice-tobacco | - | - | 14 |
| others | - | 4 | 5 |

*Others include sandy loam, sandy clay, silty loam, and clay loam.

and are members of at least one organization. Yet, there remains a substantial percentage that does not belong to any organization (41%). A sizeable portion has not been able to attend any training or seminar. Farmers are financially self-reliant with only 30% of them borrowing money for capital. In terms of income source, majority of the farmers primarily derive their revenue from rice farming.

In Iloilo, glutinous rice farmers are mostly female, 55 years old, married, have 11 years of formal education, and have 20 years of rice farming experience (Table 4.2). Households are commonly composed of five members. Majority of them are landowners. Moreover, almost all farmer respondents are members of at least one rice organization and have attended at least one training or seminar since 2014. Almost half of the farmers borrow capital.

Glutinous rice farmers in Abra have slightly more male than female, are 58 years old, married, have 10 years of formal education, and have extensive rice farming experience of 32 years (Table 4.2). A farm household usually has five members. Farmers are predominantly of *Tingguian* (or alternatively, *Itneg*) ethnicity – the original inhabitants of the province prior to the influx of Ilocano migrants. In addition, the ethnic group comprises several more subgroups, of which the *Maeng* and the *Moyadan* are the primary inhabitants of the municipalities covered in the study. More is discussed about them in the ethnographic case studies in Chapter 12, particularly in the section on indigenous peoples' cultivation of SR. Majority of the farmers own the land they cultivate and belong to at least one organization, although a significant number do not have any membership (33%). Forty-three percent of the farmers have not attended any training or seminar since 2014. Glutinous rice farmers from Abra are the least financially independent as 71% of them borrow capital for rice farming.

## Productivity of glutinous rice

Figure 4.4 presents yield data across the three provinces. The estimated yield in Camarines Sur was 3.70 t ha$^{-1}$ with a dry equivalent at 14% MC of 3.40 t ha$^{-1}$. It ranged from 2.30 to 6.40 t ha$^{-1}$. Yields could be higher were if not for the occurrence of Typhoon Haikui; 48% of the farmers experienced this tropical storm.

Average yield in Iloilo was 4.00 t ha$^{-1}$ with a dry equivalent (14% MC) of 3.60 t ha$^{-1}$. Yields ranged from 0.90 to 10.00 t ha$^{-1}$. Glutinous rice farmers did not experience production loss due to typhoons, but 82% of them mentioned pests and diseases as a major problem.

**Table 4.2.** Profile of glutinous rice farmers in Camarines Sur, Iloilo, and Abra, 2017.

| Farmer characteristic | Camarines Sur | Iloilo | Abra |
|---|---|---|---|
| | n=44 | n=28 | n=21 |
| Sex (%) | | | |
| Male | 48 | 21 | 57 |
| Female | 52 | 79 | 43 |
| Age (years) | 53 | 55 | 58 |
| Civil status (%) | | | |
| Single | 2 | 11 | - |
| Married | 95 | 79 | 100 |
| Widower | 2 | 11 | - |
| Education (years) | 9 | 11 | 10 |
| Farming experience (years) | 28 | 20 | 32 |
| Household size | 5 | 5 | 5 |
| IP membership (%) | | | |
| Tingguian | - | - | 76 |
| None | 100 | 100 | 24 |
| Tenurial status (%) | | | |
| Owner/CLT | 55 | 71 | 71 |
| Amortizing (partially paid) | 7 | 4 | 0 |
| Lessee | 5 | 7 | 14 |
| Tenant | 30 | 18 | 14 |
| Mortgagee | 5 | - | - |
| Organization (% member) | | | |
| Cooperatives | 34 | 21 | 10 |
| Irrigators' association | 27 | - | 29 |
| Farmers' association | 9 | 96 | 33 |
| None | 41 | 4 | 33 |
| Training (% trained) | | | |
| Inbred rice production | 29 | 11 | 29 |
| Nutrient management | 46 | 20 | 19 |
| Pest management | 68 | 18 | 14 |
| FFS/Palaycheck | 7 | 7 | - |
| Hybrid | 4 | 2 | 19 |
| Organic farming | 7 | 7 | 5 |
| Others | - | 4 | - |
| None | 11 | 48 | 43 |
| Capital source (% borrower) | 46 | 30 | 71 |
| Income from rice (%) | 58 | 70 | 68 |

In Abra, glutinous rice yield was 2.40 t ha $^{-1}$ with a dry equivalent (14% MC) of 2.20 t ha$^{-1}$. Yields ranged from 0.80 to 4.60 t ha $^{-1}$. The low yield was also attributed to Tropical Storm Haikui with 10% of the farmers reporting it as their main problem during the crop reference period.

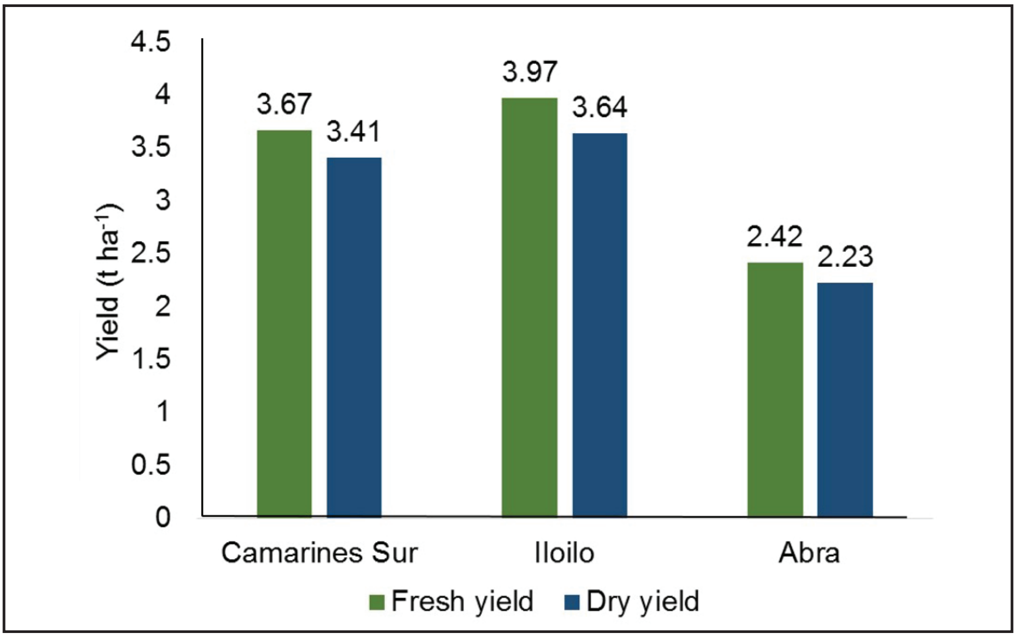


**Figure 4.4.** Farm yields of glutinous rice in Camarines Sur, Iloilo, and Abra, 2017.

## Material input use and management practices

***Variety, seed class, and crop establishment***

Table 4.3 shows the varieties of glutinous rice planted in the study provinces. In Camarines Sur, the most popular variety of glutinous rice cultivated was *Pulutan*. Favored by farmers because of its high yield and resistance to pests and diseases, this variety was planted by 66% of the respondents from the province. *Gurong-gurong* was also commonly planted as reported by 23% of farmer-respondents. Both varieties mature at an average of 121 days. *Burdagul*, *Laguna*, and R5 were the other glutinous varieties planted in the province.

In Iloilo, almost all of the glutinous rice farmers cultivated the *Pilit* variety on their largest parcels. Common reasons mentioned by farmers for cultivating it included tenderness, delicious taste, and high market demand. Notably, varieties from Iloilo are early-maturing, unlike those cultivated in Camarines Sur and Abra, which more or less take around more than 4 months to harvest.

**Table 4.3.** Main glutinous rice varieties planted by farmers in Camarines Sur Iloilo, and Abra, 2017.

| Province | Varieties | Maturity (days) | Percent user |
|---|---|---|---|
| Camarines Sur | *Pulutan* | 121 | 66 |
| | *Gurong-gurong* | 121 | 23 |
| | *Burdagul* | 113 | 7 |
| | Laguna | 120 | 2 |
| | R5 | 120 | 2 |
| Iloilo | *Pilit* | 93 | 93 |
| | *Pilit* Red | 90 | 4 |
| | *Tapol* | 95 | 4 |
| Abra | *Waray* | 140 | 91 |
| | C4 | 150 | 4 |
| | *Dikit* | 120 | 4 |

Almost all glutinous rice farmer-respondents in Abra cultivated the heirloom variety *Waray* (Table 4.3). According to the farmers, it is long maturing, 140 days on average. Farmers in the province take pride in the variety, saying that it is unrivalled in terms of its cohesiveness and satisfying eating quality. It is regarded as a sturdy and resistant rice plant, being able to withstand strong winds, rains, and pests. However, this makes it more difficult to thresh because the grains attach strongly to the panicles. Maintaining the purity of the *Waray* was also a particular concern to some *Tingguian* farmers. As such, some still use the *rakom* (a cylindrically shaped piece of wood with an impaled crescent-shaped blade) to handpick the best panicles as seeds for their next planting season. Note that there are other glutinous rice varieties not included in this study but are found in the sample collection (see Chapter 9).

Table 4.4 shows the seed use for glutinous rice production in all three representative provinces. Almost all of the farmers in Camarines Sur (93%) set aside a portion of their harvests to be used as seeds for the next cropping season. Manual wet direct seeding was the major practice in Camarines Sur. In Iloilo, procurement of seeds from co-farmers was more commonly practiced and the major crop establishment method was manual wet direct seeding.

Glutinous rice farmers in Abra reported using farmer's seeds for planting. Transplanting was the major method of crop establishment in Abra. Farmers sowed seeds in seedbeds (approximately 259 $m^2$) from a 1-ha land. Twenty-DAS, seedlings were transplanted in the main field in random manner.

***Fertilizer use and management***

Table 4.4 shows the fertilizer application levels in the three provinces. In Camarines Sur, glutinous rice farmers applied N at 74 kg $ha^{-1}$. They used low levels of P at 11 kg $ha^{-1}$ relative to the recommended fertilizer rate of 25-30 kg $ha^{-1}$ in the Philippines. This recommendation is for areas with wide variations of rainfall (Concepcion, 2006). An average of three applications was observed for each cropping season. The common fertilizers used were complete (14-14-14), urea (60-0-0), and ammonium phosphate (60-20-0).

Iloilo has high N fertilizer application rate (87 kg $ha^{-1}$). This is probably one of the factors that contributed to the province's high yield. The findings of Srisompun et al. (2013) show that fertilizers and seed significantly increased the yield of glutinous rice. On the average, fertilizers were applied thrice per cropping season. Commonly used fertilizers were complete, urea, and ammonium phosphate. The use of organic fertilizers such as animal manure, vermicompost, and decomposed leaves was also reported (Table 4.4).

Farmers in Abra applied high levels of N (77 kg $ha^{-1}$) and low levels of P and K (20 and 33 kg $ha^{-1}$, respectively). They also had an average of three applications per cropping season and commonly applied complete, urea, and ammonium phosphate. Other farmers used organic fertilizers (Table 4.4).

***Pesticide use and management***

The amounts of pesticide application are also summarized in Table 4.4. Herbicide was the most commonly used pesticide in Camarines Sur with an application rate of 0.40 kg ai $ha^{-1}$. This was applied either once or twice per cropping season. Fungicide was another common pesticide in the province, given at 0.30 kg ai $ha^{-1}$. Insecticide, molluscicide, and rodenticide applications are also reported.

**Table 4.4.** Material input use in glutinous rice production in Camarines Sur, Iloilo, and Abra, 2017.

| Item | Camarines Sur | Iloilo | Abra |
|---|---|---|---|
| | n=44 | n=28 | n=21 |
| Seed (kg $ha^{-1}$) | 109 | 68 | 71 |
| Inorganic fertilizer (kg $ha^{-1}$) | | | |
| N | 74 | 87 | 77 |
| P | 11 | 11 | 20 |
| K | 22 | 21 | 33 |
| Organic fertilizer (kg $ha^{-1}$) | - | 42 | - |
| Animal manure | - | 7 | - |
| Decomposed leaves | - | - | 4 |
| Vermicompost | - | 4 | - |
| Concoction | - | - | 4 |
| Pesticide (kg ai $ha^{-1}$) | | | |
| Herbicide | 0.36 | 0.65 | 0.34 |
| Insecticide | 0.23 | 0.37 | 0.08 |
| Fungicide | 0.28 | 0.03 | 0.06 |
| Molluscicide | 0.11 | 0.13 | 0.15 |
| Rodenticide | 0.02 | 0.02 | 0.08 |

Herbicides in Iloilo were used at 0.60 kg ai $ha^{-1}$ and were applied once or twice. Insecticides, on the other hand, are applied at 0.40 kg ai $ha^{-1}$. High application rates of herbicides and insecticides use were observed due to higher incidence of pests and diseases. About 82% of farmers encountered problems on pests and diseases such as stem borers, brown and green leafhoppers, rice bug, among others. Fungicide, molluscicide, and rodenticide were also applied in minimal amount.

Glutinous rice farmers in Abra applied herbicide at 0.30 kg $ha^{-1}$ and molluscicide at 0.20 kg ai $ha^{-1}$. Insecticides were also applied at 0.10 kg ai $ha^{-1}$ as 28% of the farmers reported infestations of stem borers, brown and green leafhoppers, and rice bugs.

## Labor use and mechanization

Generally, rice farming in the country is labor-intensive from crop establishment to postharvest activities. Table 4.5 shows the labor use across the three provinces. Total labor use in Camarines Sur was 55 md $ha^{-1}$. More than 50% was done by hired labor. Among the major activities, harvesting and threshing incurred the largest share in total labor use. This implies that manual harvesting is still predominantly practiced in the country, especially for glutinous rice farming. The adoption of combine harvesters was still low in Camarines Sur. Another large component was land preparation, which required an approximate of 16 md $ha^{-1}$.

Total labor use in Iloilo was 40 md $ha^{-1}$ with land preparation comprising the largest share (Table 4.5). This activity used both hired and OFE labor. Crop care and maintenance was another big component, which required around 12 md $ha^{-1}$. Manual harvesting and threshing also contributed largely to total labor use with an average requirement of 9 md $ha^{-1}$.

**Table 4.5.** Labor requirements of glutinous rice production in Camarines Sur, Iloilo, and Abra, 2017.

| Item | Camarines Sur | Iloilo | Abra |
|---|---|---|---|
| | n=44 | n=28 | Wn=21 |
| Hired labor (md $ha^{-1}$) | | | |
| Land preparation | 13.15 | 8.36 | 7.37 |
| Crop establishment | 3.54 | 1.77 | 15.37 |
| Crop care and maintenance | 3.95 | 4.82 | 2.13 |
| Harvesting and threshing | 18.05 | 8.84 | 14.16 |
| Postharvest | 6.2 | 2.62 | 2.51 |
| OFE labor (md $ha^{-1}$) | | | |
| Land preparation | 2.38 | 4.04 | 6.62 |
| Crop establishment | 0.94 | 1.29 | 7.3 |
| Crop care and maintenance | 6.61 | 6.69 | 7.3 |
| Harvesting and threshing | 0.07 | 0.29 | 2.37 |
| Postharvest | - | 1.21 | 0.49 |
| Total labor | 54.88 | 39.92 | 65.63 |

Labor use in Abra was high at 66 md $ha^{-1}$. With the prevalent practice of transplanting, crop establishment has the largest share to total use. This activity required both hired and OFE labor. Harvesting and threshing labor requirements were also high since mechanization level in the area was low (Table 4.5).

## Production cost and input cost share

Table 4.6 shows the estimated cost of glutinous rice production across provinces while Figure 4.5 presents the distribution of percent input cost share to total production cost. In Camarines Sur, around P44,000 ha$^{-1}$ was spent for glutinous rice production. In terms of cost per kilogram, farmers in the province incurred the lowest cost at P12 kg$^{-1}$. Hired labor costs constituted the biggest cost share at 35%, followed by fertilizer costs (16%) and land rent (15%).

In Iloilo, P51,000 ha$^{-1}$ was incurred for glutinous rice per cropping. Cost per kilogram of paddy was P13. Forty-five percent of total production cost was attributed to hired labor cost, 19% to land rent, and 12% to fertilizer cost (Figure 4.5).

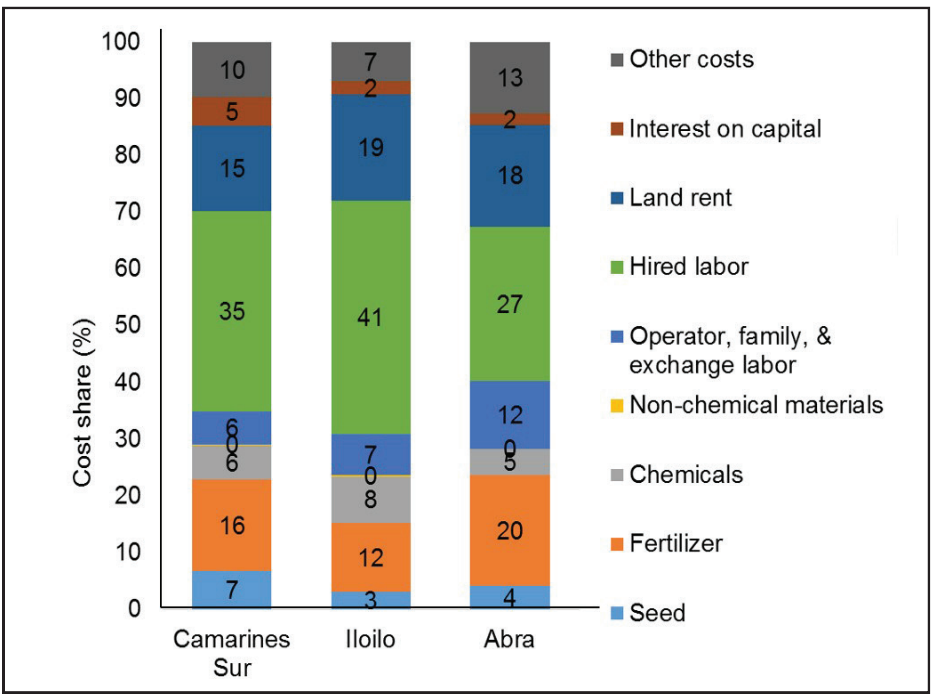


**Figure 4.5.** Cost shares (%) in glutinous rice production in Camarines Sur.
Note: Other costs include power, irrigation, transportation, food, and other input costs.

Farmers engaged in glutinous rice production in Abra spent P42,000 for a 1-ha land with a cost per unit of P17 $kg^{-1}$ (Table 4.6). The biggest proportions of total production cost came from hired labor cost (27%), fertilizer cost (20%), and land rent (18%). The high percentage share of labor cost was attributed to high labor requirements as well as to high prevailing wage and contract rates, which also varied across provinces. Other production costs included chemical and non-chemical (5-8%), seeds (3-7%), and imputed value for OFE labor (6-12%), among others (Figure 4.5).

**Table 4.6.** Cost and returns of glutinous rice production in Camarines Sur, Iloilo, and Abra, 2017.

| Item | Camarines Sur | Iloilo | Abra |
|---|---|---|---|
| | n=44 | n=28 | n=21 |
| **Returns** | | | |
| Yield (kg $ha^{-1}$) | 3,671 | 3,967 | 2,422 |
| Paddy price (peso $kg^{-1}$) | 15 | 15 | 22 |
| Gross revenue (peso $kg^{-1}$) | 56,264 | 58,761 | 52,425 |
| **Costs (peso $ha^{-1}$)** | | | |
| Seed | 2,973 | 1,572 | 1,734 |
| Fertilizer | 7,018 | 6,240 | 8,262 |
| Chemicals | 2,674 | 4,126 | 1,960 |
| Non-chemical materials | 49 | 177 | 11 |
| Hired labor | 15,486 | 21,092 | 11,532 |
| Operator, family, & exchange labor | 2,514 | 3,645 | 5,068 |
| Land rent | 6,581 | 9,563 | 7,591 |
| Interest on capital | 2,189 | 1,113 | 827 |
| Other costs* | 4,242 | 3,564 | 5,345 |
| **Total paid out cost (peso $ha^{-1}$)** | 33,675 | 39,496 | 30,300 |
| **Total cost (peso $ha^{-1}$)** | 43,725 | 51,091 | 42,332 |
| **Cost per unit (peso $kg^{-1}$)** | 12 | 13 | 17 |
| **Net income from rice farming (peso $ha^{-1}$)** | 12,539 | 7,670 | 10,093 |
| **Net returns over paid-out costs (peso $ha^{-1}$)** | 22,589 | 19,265 | 22,124 |

*Other costs include power, irrigation, transportation, food, and other input costs.

## Profitability of glutinous rice farming

Returns to glutinous rice production across provinces are presented in Table 4.6. With its current yield and a paddy price of P15 $kg^{-1}$, farmers in Camarines Sur received a gross revenue of P56,000 $ha^{-1}$. Considering both paid-out and imputed costs, average net returns were around P13,000 $ha^{-1}$. Returning the value of imputed costs (i.e., the farmer owns the land and capital use in rice farming, and he did not pay for OFE labor), net income from glutinous rice production increased by more than 80% per cropping season (Table 4.6).

In Iloilo, average gross revenue was P59,000 $ha^{-1}$ with a paddy price of P15 $kg^{-1}$. Farmers were able to generate a net income of around P8,000 $ha^{-1}$. Net income has increased more than double per cropping season when imputed costs were not accounted for in the total production cost.

Abra farmers, on the other hand, had a gross revenue of P52,000 $ha^{-1}$. Note that even with low yield, Abra's estimated gross revenue was still at par with the other two provinces. This was due to the higher price of fresh paddy in Abra, which was pegged at P22 $kg^{-1}$. The premium price is due to its cohesiveness and good eating quality. Considering all costs, the net income generated was P10,000 $ha^{-1}$. Net income has increased by more than 100% per cropping season when imputed costs were not included in the total cost (Table 4.6).

## Summary and implications

In general, glutinous rice farmers are around middle-age, have at least attended high school, and have extensive rice farming experience. Notable differences were observed when it comes to organizational membership since Camarines Sur and Abra have large percentages of non-members. Farmers also differed in terms of training as there was a significant number of farmers from Iloilo and Abra who did not attend training courses. These factors have implications on the facilitation and provision of government rice-related services and programs to farmers. It can be also be noted that farmers in Abra are dependent on borrowed capital, thus, credit assistance is crucial to them.

With the reported yield levels from the representative provinces, there is room for improvement in terms of increasing yields and reducing costs. For Camarines Sur, a seed production system for glutinous rice must be established involving modern varieties. Promotion of already released modern glutinous rice varieties must be intensified in the area. The local government units may lead in the promotion of glutinous rice production in partnership with DA-RFO and PhilRice. Mechanization is also recommended to reduce cost, especially in Camarines Sur, which is a significant glutinous rice production area. Labor cost, specifically on land preparation and harvesting and threshing activities, can be reduced through the introduction of four-wheel tractors and combine harvesters. This can be efficiently achieved by motivating farmers to join organizations. Cooperatives and similar organizations will be helpful, especially in giving shared facility services to farmers. Organized farmers also benefit from group marketing as there is stronger bargaining power when it comes to price negotiations. Training courses and modules for glutinous rice production must also be devised and organized. Available information on management of glutinous rice must be developed, consolidated, packaged, and promoted. These aforementioned recommendations would also benefit glutinous rice farmers in Iloilo.

As traditional glutinous rice varieties are planted in Abra, community seed banking is recommended. This is to maintain the purity of the seeds and make these varieties available to local farmers. PhilRice can assist the community in training farmers to ensure proper seed purification protocol.

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5

# BLACK RICE

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Pigmented rice is unique because it has pigments known as anthocyanins, which are potent antioxidants. Known to give health and nutritional benefits (see Chapter 9), pigmented rice falls into two major categories: black and red rice. The higher the anthocyanin content, the darker the color. Thus, black rice has more anthocyanin than red rice. This section focuses on black rice.

China has the largest production of black rice in the world. Other leading countries are Sri Lanka, Indonesia, India, Philippines, and Thailand (Pengkumsri et al., 2015). Under this type of pigmented rice are four varieties differentiated by taste, texture, or aroma. Black *Japonica* rice has an earthy but slightly sweet flavor. Black glutinous rice is the sticky type with sweet taste. Italian black rice has rich, buttery flavor. Lastly, Thai black Jasmine rice is known for its subtle floral aroma (Saha, 2016).

To identify the major sites or provinces that will be covered in the study, site scanning was conducted through key informant interviews with DA-LGUs and focus group discussions among farmers who plant specialty rice. Negros Occidental, Iloilo, Abra, and Bukidnon were identified as top producers of black rice. Of these provinces, Negros Occidental has a high number of black rice farmers and was considered a major site. Black rice planted in Negros Occidental is one of the more common black rice varieties. Other varieties not included in the study are *Bingawan*, BR 261, and *Calatrava* for Iloilo, *Balatinaw* for Abra, and black rice for Bukidnon. For the selected site, a total of 28 black rice farmers were interviewed, distributed across towns and municipalities of Bago City, Don Salvador Benedicto, Murcia, and Kabankalan (Figure 5.1).

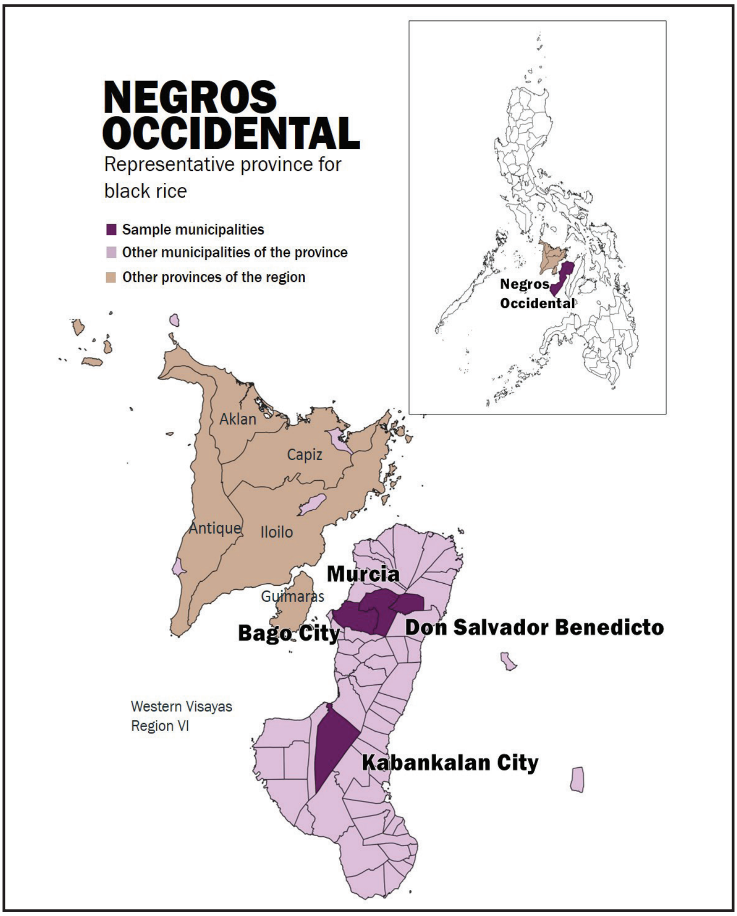


**Figure 5.1.** Location of selected municipalities in Negros Occidental.

This chapter aims to (1) describe the current black rice production system and farming practices of farmers in the areas covered; (2) profile black rice farmers and describe the physical profiles of black rice farms; (3) examine the cost and profitability of black rice production; and (4) recommend practices to boost production of black rice.

## Farm profile

As shown in Table 5.1, the average total area planted to rice in Negros Occidental was 1.91 ha. On average, farmers allocated 69% of the land to black rice production. Majority of the farms were in the low-elevation areas (50%), were irrigated (93%), and sourced water from the NIS /CIS (61%). These farms

**Table 5.1.** Profile of black rice farms in Negros Occidental, 2017.

| Farm characteristic | Negros Occidental n=28 |
|---|---|
| Average total rice area (ha) | 1.91 |
| Average total black rice area (ha) | 0.99 |
| Percentage of black rice area to total rice area | 69 |
| Source of water (%) | |
| NIS/CIS | 61 |
| SSIS (STW, Open/dug well, deepwell, SWIP, SFR) | - |
| Rain | 7 |
| Natural (rivers, streams, free-flowing) | 32 |
| Ecosystem (%) | |
| Rainfed | 7 |
| Irrigated | 93 |
| Elevation (%) | |
| Upper | 14 |
| Middle | 33 |
| Lower | 50 |
| Combination | 4 |
| Distance to road (km) | 0.30 |
| Distance to market (km) | 11.00 |
| Soil type (%) | |
| Clayey | 39 |
| Loamy | 32 |
| Silty | 4 |
| Sandy | 7 |
| Others* | 18 |
| Cropping pattern (%) | |
| rice-rice | 68 |
| rice-rice-rice | 11 |
| others | 21 |

*Others include sandy clay and clay loam.

have either clay (39%) or loamy (32%) soil. Further, these are 0.30 km away from the road and 11 km away from the market. The rice-rice cropping pattern was the most commonly practiced, although some were able to plant three rice crops (11%). The remaining 21% was planted to other crops after one rice cropping.

## Farmer profile

Farmer interviews in Negros Occidental were equally participated in by male and female farmers. They were 50 years old, married, have attended 10 years of formal education, and have 21 years of farming experience (Table 5.2). Farm households usually have five members. Almost all of them were non-IP with only a small representation (7%) of the *Bukidnon Ati* ethnic group. They also generally own the land they cultivate. Furthermore, almost all were members of at least one rice organization and have attended at least one training or seminar since 2014. In terms of capital source, the farmers were roughly split in half between those who borrow money and those who have their own capital. Moreover, rice farming was the primary source of household income, averaging 54% of overall income.

## Productivity of black rice

Figure 5.2 shows farm-level yields of fresh and dried forms of black rice in Negros Occidental. Unlike ordinary white rice, black rice has lower yields since they are traditional varieties. The average fresh yield in Negros Occidental was 3.27 t $ha^{-1}$, and at 14% MC, dry yield equivalent was 3.01 t $ha^{-1}$. The lowest yield attained was 0.90 t $ha^{-1}$, while the maximum yield was 8.30 t $ha^{-1}$.

## Material input use and management practices

### *Variety, seed class, and crop establishment*

The main variety cultivated, simply referred to as *Black Rice*, has an average maturity period of 114 days (Table 5.3). Farmers preferred this variety for its tenderness and health benefits. The locals report that it is occasionally sought by diabetic individuals as recommended by their doctors. Cordova, Mindoro, and Mindoro 5 were the other black rice varieties planted by farmer-respondents from the province. Other black rice varieties not mentioned in this chapter were collected as samples for the grain quality analysis (see Chapter 9).

**Table 5.2.** Profile of black rice farmers in Negros Occidental, 2017.

| Farmer characteristic | Negros Occidental |
|---|---|
| | n=28 |
| Sex (%) | |
| Male | 54 |
| Female | 46 |
| Age (years) | 50 |
| Civil status (%) | |
| Single | 14 |
| Married | 79 |
| Widower | 4 |
| Separated | 4 |
| Education (years) | 10 |
| Farming experience (years) | 21 |
| Household size | 5 |
| IP membership (%) | |
| None | 93 |
| Bukidnon Ati | 7 |
| Tenurial status (%) | |
| Owner/CLT | 79 |
| Lessee | 11 |
| Tenant | 4 |
| Mortgagee | 7 |
| Others | - |
| Organization (% member) | |
| Cooperatives | 11 |
| Irrigators' association | 17 |
| Farmers' association | 66 |
| None | 6 |
| Training (% trained) | |
| Inbred rice production | 27 |
| Nutrient management | 19 |
| Pest management | 19 |
| FFS/Palaycheck | 4 |
| Organic farming | 23 |
| Others | 2 |
| Capital source (% borrower) | 54 |
| Income from rice (%) | 54 |

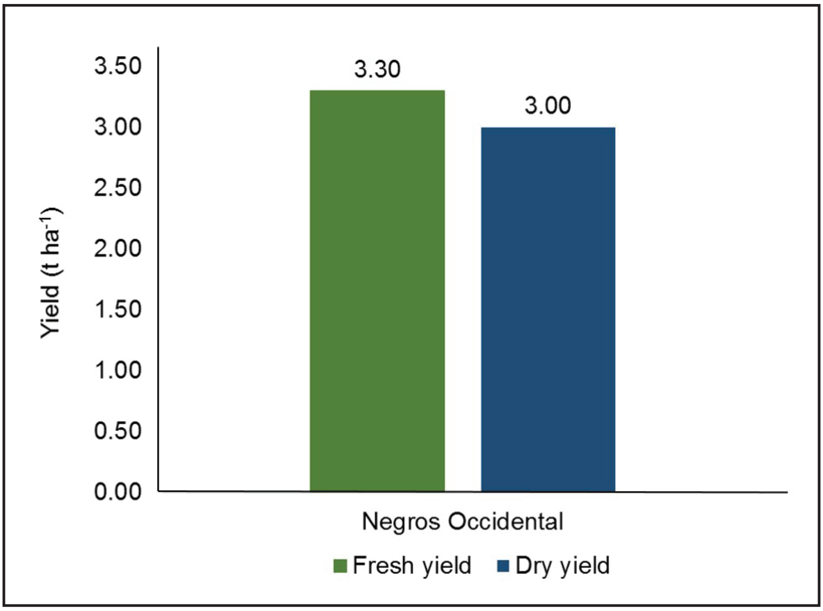


**Figure 5.2.** Farm yields of black rice in Negros Occidental, 2017.

**Table 5.3.** Main varieties of black rice planted by farmers in Negros Occidental, 2017.

| Variety | Maturity (days) | Percent user |
|---|---|---|
| Black Rice | 114 | 89 |
| Black rice (Cordova) | 90 | 4 |
| Mindoro | 120 | 4 |
| Mindoro 5 | 120 | 4 |

Table 5.4 shows the inputs used in black rice production. Farmers sowed seeds at 59 kg ha$^{-1}$ on the average. Low seeding rate was used as 86% of the farmers practiced transplanting, which requires lesser amount of seeds. Most of the seeds used mostly came from co-farmers; others used their own produce from the previous season. A few farmers (10%) used good seeds obtained from seed growers, cooperatives, and the DA-LGU. Black rice in Negros Occidental matures in 96 days on the average.

### *Fertilizer use and management*

Around 43% of the farmers did not apply inorganic fertilizers; the rest did so, but only once per cropping. This resulted in less amount of inorganic fertilizer used. Application rates of N, P, and K were only 30-7-16 kg $ha^{-1}$, respectively. The use of organic fertilizers was more evident as revealed by its higher frequency of application (68%). Farmers applied organic fertilizers four times on the average, at 321 kg $ha^{-1}$ of solid organic inputs and 11 li $ha^{-1}$ of liquid organic inputs (Table 5.4). The solid organic fertilizers included vermicompost, animal manure, snails, amino acids, humus, indigenous microorganisms, trichoderma, and own-produced vermicast, among others. Liquid organic inputs included concoctions such as fermented plant juice, fermented fruit juice, fish amino acids, calcium phosphate, and some commercial foliar organic fertilizers.

**Table 5.4.** Material input use in black rice production in Negros Occidental, 2017.

| Item | Negros Occidental n=28 |
|---|---|
| Seed (kg $ha^{-1}$) | 59 |
| Fertilizer (kg $ha^{-1}$) | |
| N | 31 |
| P | 7 |
| K | 16 |
| Pesticide (kg ai $ha^{-1}$) | |
| Herbicide | 0.10 |
| Insecticide | 0.06 |
| Fungicide | 0.06 |
| Molluscicide | 0.01 |
| Rodenticide | 0.02 |

### *Pesticide use and management*

Since most farmers practiced organic farming, the use of pesticides in black rice cultivation was not popular (Table 5.4). Majority did not use any type of pesticide in their crop. Biological control such as use of trichoderma and trichogramma obtained from the Sugar Regulatory Administration was a common preventive measure against stem borers. They also had concoctions to control green and brown planthoppers, while vermitea was used as poison for rats. Farmers did spot manual weeding, good water management, and weed control through use of wooden rakes with nails. Among users of pesticides, a minimal amount (almost nil) was applied (0.01 to 0.10 kg ai $ha^{-1}$) with pre-emergence herbicides having the highest usage.

## Labor use and mechanization

Labor utilization, which consisted mainly of hired labor (43 md $ha^{-1}$), was 56 md $ha^{-1}$ (Table 5.5). The biggest amount of labor was spent on crop care and maintenance at 15 md $ha^{-1}$. Both hired and family labor performed the said farm activity. Though inorganic fertilizers and pesticides were sparingly used, farmers applied more organic fertilizers, which required more labor.

**Table 5.5.** Labor requirements in black rice production in Negros Occidental, 2017.

| Item | Negros Occidental |
|---|---|
| | n=28 |
| Hired labor (md $ha^{-1}$) | |
| Land preparation | 12.01 |
| Crop establishment | 10.79 |
| Crop care and maintenance | 7.67 |
| Harvesting and threshing | 11.23 |
| Postharvest | 1.56 |
| OFE labor (md $ha^{-1}$) | |
| Land preparation | 1.80 |
| Crop establishment | 3.18 |
| Crop care and maintenance | 6.63 |
| Harvesting and threshing | 0.47 |
| Postharvest | 0.22 |
| Total labor | 55.57 |

Farmers prepared their land mostly through the use of hand tractors and floating tillers. Some farmers still used animals such as carabaos from plowing to leveling, in the process spending 14 md $ha^{-1}$ for land preparation. They usually transplanted rice, consuming more man-days than direct-seeded rice. Harvesting was manually done. Small threshers were used by the majority of the farmers (72%), while a few (28%) still did it manually. The use of combine harvesters was still not popular in Negros Occidental.

## Production cost and input cost share

Table 5.6 shows costs of production and Figure 5.3 shows the share of each input to total cost of producing black rice in Negros Occidental. Seed cost was P1,752 $ha^{-1}$, which was only 3% of total cost of production at P49, 873 $ha^{-1}$. A sizeable proportion (89%) of farmers used home-saved seed, usually valued at current paddy prices, making it cheaper than high-quality seed.

Fertilizer cost comprised 6% (P3,268 $ha^{-1}$) of total production cost. Organic fertilizers were more commonly used with 8% share to total cost (P3,832 $ha^{-1}$). As use of pesticides was almost nil, cost was only P755 $ha^{-1}$, equivalent to only 1% of total cost of production.

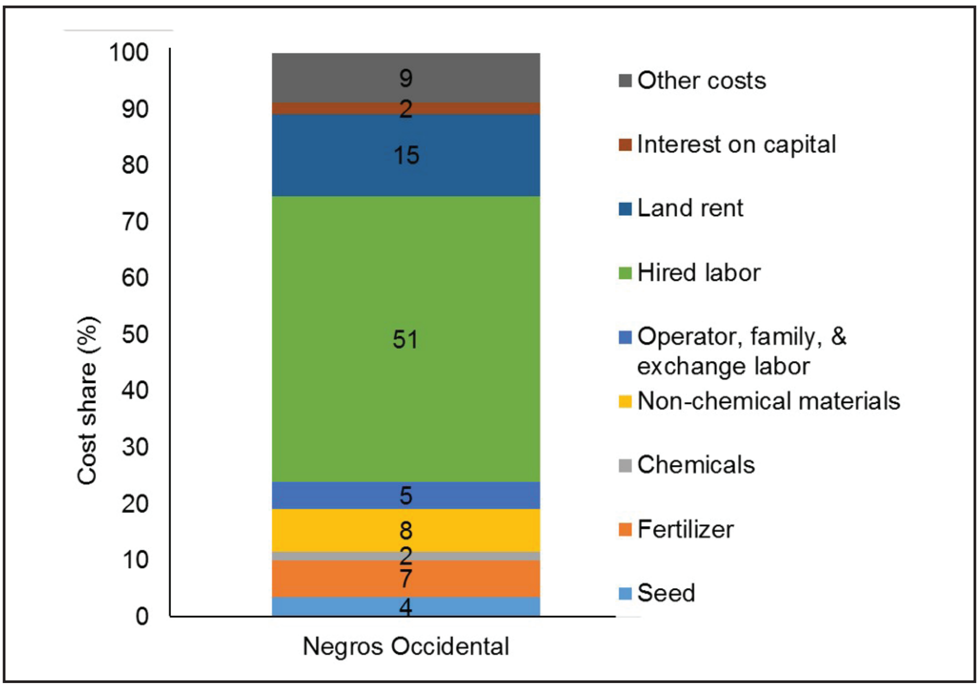


**Figure 5.3.** Cost shares (%) in black rice production, Negros Occidental, 2017.

**Table 5.6.** Cost and returns of black rice production in Negros Occidental, 2017.

| Item | Negros Occidental<br>n=28 |
|---|---|
| **Returns** | |
| Yield (kg $ha^{-1}$) | 3,272 |
| Paddy price (peso $kg^{-1}$) | 19 |
| Gross revenue (peso $ha^{-1}$) | 62,781 |
| **Cost (peso $ha^{-1}$)** | |
| Seed | 1,752 |
| Fertilizer | 3,268 |
| Chemicals | 755 |
| Non-chemical materials | 3,832 |
| Hired labor | 25,232 |
| Operator, family, & exchange labor | 2,352 |
| Land rent | 7,315 |
| Interest on capital | 997 |
| Other costs* | 4,369 |
| **Total paid-out cost (peso $ha^{-1}$)** | 40,541 |
| **Total cost (peso $ha^{-1}$)** | 49,873 |
| **Cost per unit (peso $kg^{-1}$)** | 15 |
| **Net income from rice farming (peso $ha^{-1}$)** | 12,908 |
| **Net returns over paid-out costs (peso $ha^{-1}$)** | 22,240 |

*Other costs include power, irrigation, transportation, food, and other input costs.

Similar to ordinary rice production, labor cost, specifically hired labor, still comprised the bulk (58%) of the total cost in growing black rice. On average, farmers incurred P25,232 $ha^{-1}$ for hired labor (53% of the total production cost). This is attributed to labor-intensive management practices done by a bigger proportion of farmers such as transplanting and manual harvesting and threshing. Labor done by OFE, on the other hand, had only 5% share in total production cost. Land rent was also one factor with the highest share. The imputed cost of land was P7,315 $ha^{-1}$ (12%) on the average and paid-out land rent was P1,332 $ha^{-1}$ with 3% share to total cost. Power cost, which is the cost of renting animals and machinery (fuel and oil included) had a small share in total production cost, only 2%. This reveals the low level of mechanization in black rice production in the site.

The total cost of producing black rice in Negros Occidental was P49,873 $ha^{-1}$. Total paid-out cost was P40,541 $ha^{-1}$ when imputed costs of OFE labor, land rent, and interest on capital were excluded. It will cost a farmer P15 to produce one kg of black rice, given a yield of 3,272 kg $ha^{-1}$.

## Profitability of black rice farming

Paddy yield, prices, and profitability in black rice production are reflected in Table 5.6. The average paddy price of black rice in Negros Occidental during the survey period was P19 $kg^{-1}$. With an average yield of 3.27 t $ha^{-1}$, farmers realized a gross return of P62,781 $ha^{-1}$. Net returns from black rice farming in Negros Occidental was P12,908 $ha^{-1}$ and would further increase to P22,240 $ha^{-1}$ if imputed costs were not included.

## Summary and implications

Black rice farmers in Negros Occidental are generally middle-aged and have at least attended high school. Majority are members of organizations and have attended training. These factors are advantageous to farmers, giving them greater access to government support and programs. Since more than half of the black rice farmers are borrowers of capital, credit support must be extended to them through farmer organizations and cooperatives. Organized farmers can also take advantage of benefits from group marketing such as value addition to their produce.

With the use of traditional rice varieties, yields are quite lower compared with other specialty rice types. Even then, black rice production has the potential for commercial-scale production, thus, farmers must achieve yield improvement and reduction in cost per unit. One of the causes of low production is the lack of access of farmers to high-quality pigmented rice seeds. Farmers generally use seeds from their own harvest or from co-farmers and this practice continues from one cropping season to the next. The quality of the seeds usually deteriorates over time due to variety mixtures or cross-pollinations. Poor storage likewise contributes to losses and infestations. The availability of seeds from suppliers could also affect the area devoted to black rice production. Thus, an informal seed system must be established through community seed banking to ensure the purity of seeds. Training on seed purification must also be conducted in order to sustain the informal seed system. Moreover, breeding for improvement of existing varieties must be continued.

Black rice in Negros Occidental is commonly grown using organic inputs. Given these existing practices, black rice can be positioned as an organically grown product to increase its value in the market. In general, the yield of black rice is low because of low fertilizer usage and improper timing of application. With abundance of agricultural waste and biomass, farmers can produce their own organic fertilizers as supplementary source of nutrients to increase yield and reduce costs. Farmers can be trained in the production of organic fertilizers. If possible, mechanizing the production of organic inputs is encouraged to lessen labor requirements. With regard to postharvest, it is important to use a separate machine for milling black rice to avoid mixing and to maintain grain purity and quality.

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6

# RED RICE

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Red rice is another category of pigmented rice that contains anthocyanin. Although it has lower anthocyanin content than black rice (Pengkumsri et al., 2015), it generally has higher antioxidant level (Anggraini et al., 2015). Aside from the pigment, some red rice varieties are known to possess aromatic traits (Saikia, 2012). Different types of red rice are cultivated across Asia. Japonica type was grown in Japan while *Indica* type was cultivated in China. These types were also found in Korea (Ahuja et al., 2007).

Red rice is also cultivated in the Philippines. Among the provinces that produce red rice, North Cotabato was identified as the market-oriented representative province. Red rice has been grown for almost two decades in North Cotabato. Alamada and Banisilan were the municipalities selected for the study (Figure 6.1). The other red-rice producing provinces were Samar and Bukidnon. The municipalities of Paranas and San Jose de Buan were selected in Samar (Figure 6.2); Kalilangan town and Valencia City were chosen in Bukidnon (Figure 6.3). In contrast to North Cotabato, these provinces generally grow red rice for their own consumption with minimum surplus traded within the locality. These sites were selected in this study due to the high concentration of red rice farmers; 110 respondents from these three provinces were identified. To be exact, 44 red rice farmers were interviewed from North Cotabato, 47 from Samar, and 19 from Bukidnon. The survey was also conducted in Abra, Apayao, Negros Occidental, and Iloilo, but only a few farmers planted red rice in these areas.

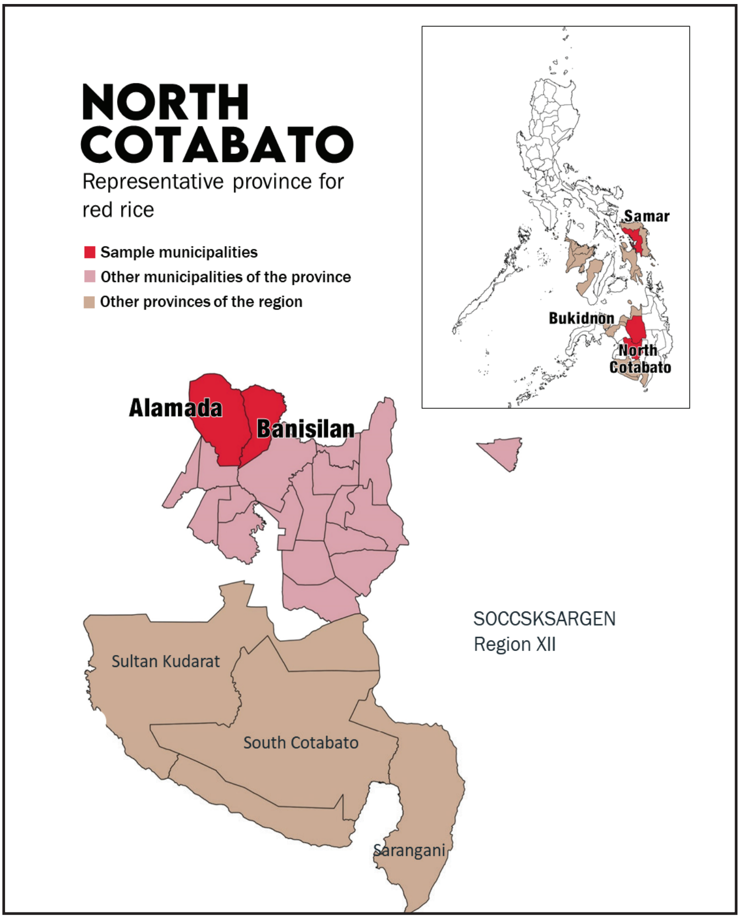


**Figure 6.1.** Location of selected municipalities in North Cotabato.

This chapter aims to (1) describe the current red rice production system and farming practices of farmers in covered areas, (2) profile red rice farmers and describe the physical profiles of red rice farms, (3) examine the cost and profitability of red rice production, and (4) recommend measures to intensify production of red rice.

## Farm profile

The average total rice farm area in North Cotabato was 2.63 ha (Table 6.1) with farmers devoting their entire rice areas to red rice. Red rice farms are under an upland ecosystem that is rain-dependent. Most have clay soil type (77%). In terms of distance, farms were 1.60 km away from the main road. Intercropping

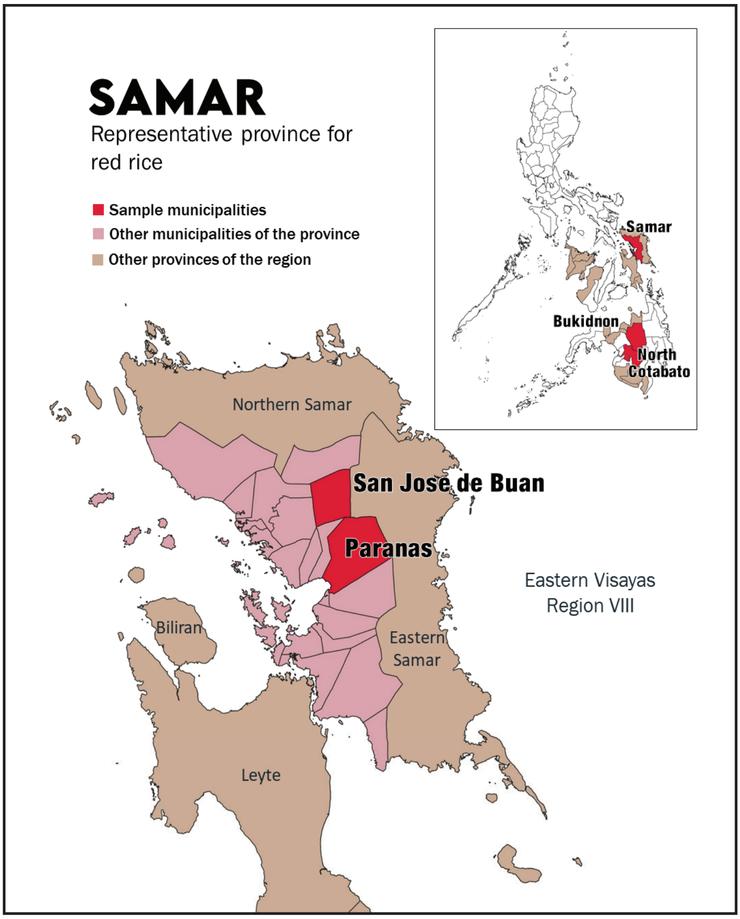


**Figure 6.2.** Location of selected municipalities in Samar.

red rice primarily with corn (82%) was practiced, although there were farmers who also cultivate peanut or mungbean.

Rice farms in Samar averaged 0.81 ha, with 84% allocated to red rice (Table 6.1). Red rice farms are upland, rain-dependent, and predominantly loamy or sandy. These farms were 2.10 km away from the main road. It is also a common practice to plant other crops after one rice cropping to replenish soil nutrients.

Bukidnon rice farms averaging 1.11 ha were devoted entirely to red rice (Table 6.1). Red rice areas have varying ecosystems: upland (26%), rainfed (37%), and irrigated (37%). The latter sourced water from NIS/CIS and natural water systems (21% and 16%, respectively). Soil type ranged from clayey to loamy to silty. Cropping practices in the province included rice-fallow (42%), rice-rice (32%), rice-corn (21%), and rice-vegetables (5%).

**Table 6.1.** Profile of red rice farms in North Cotabato, Samar, and Bukidnon, 2017.

| Farm characteristic | North Cotabato | Samar | Bukidnon |
|---|---|---|---|
| | n=44 | n=47 | n=19 |
| Average total rice area (ha) | 2.63 | 0.81 | 1.11 |
| Average total red rice area (ha) | 2.60 | 0.58 | 1.11 |
| Percentage of red rice area to total rice area | 100 | 84 | 100 |
| Source of water (%) | | | |
| NIS/CIS | - | - | 21 |
| SSIS (STW, open/dug well, deepwell, SWIP, SFR) | - | - | - |
| Rain | 100 | 100 | 63 |
| Natural (rivers, streams, free-flowing) | - | - | 16 |
| Ecosystem (%) | | | |
| Upland | 100 | 96 | 26 |
| Rainfed | - | 4 | 37 |
| Irrigated | - | - | 37 |
| Position (%) | | | |
| Upper | 20 | 23 | - |
| Middle | 21 | 40 | 33 |
| Lower | 39 | 36 | 68 |
| Combination | 20 | - | - |
| Distance to road (km) | 1.60 | 2.10 | 6.90 |
| Distance to market (km) | 10.00 | 4.00 | 6.00 |
| Soil type (%) | | | |
| Clayey | 77 | 15 | 37 |
| Loamy | 2 | 47 | 26 |
| Silty | - | 4 | 21 |
| Sandy | - | 34 | - |
| Others* | 20 | - | 16 |
| Cropping pattern (%) | | | |
| rice-rice | - | - | 32 |
| rice-rice-rice | - | - | - |
| rice-vegetable | - | 28 | 5 |
| rice-fallow | - | 30 | 42 |
| rice-corn | 82 | 26 | 21 |
| rice-rice-mungbean | - | - | - |
| rice-tobacco | - | - | - |
| others | 18 | 17 | - |

*Others include sandy clay, sandy loam, clay loam, and silty clay.

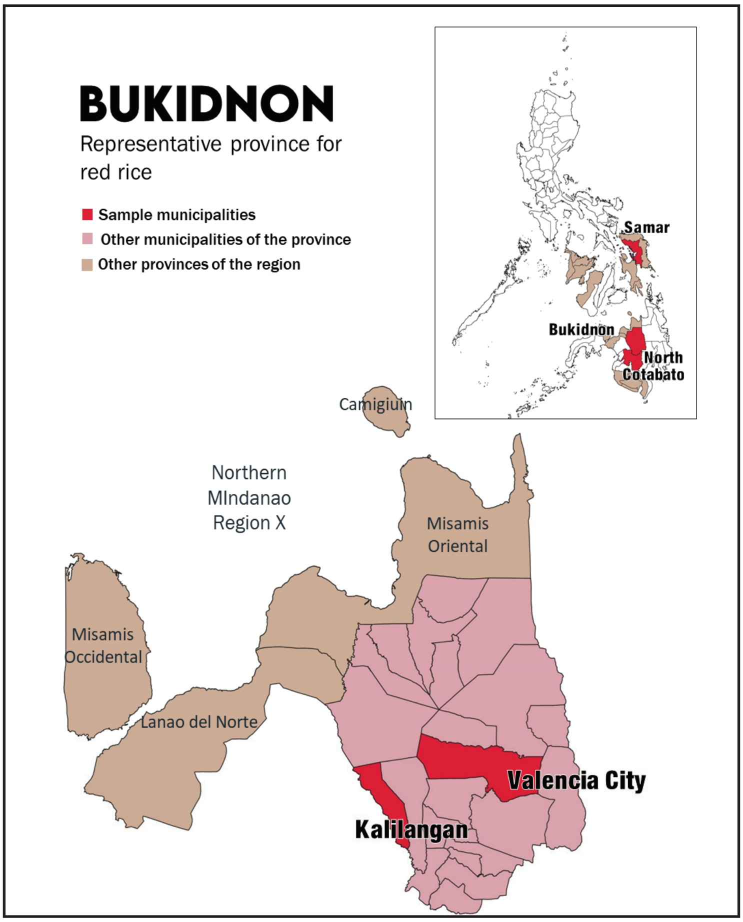


**Figure 6.3.** Location of selected municipalities in Bukidnon.

## Farmer profile

Red rice farmers in North Cotabato were almost equally distributed between male and female, 41 years old, married, have 9 years of formal education and 19 years of rice farming experience (Table 6.2). Farm households have an average number of five family members. Majority were owners of the land they cultivate. Sixty percent were members of farmer organizations and 7% were members of cooperatives. In terms of training, a substantial 48% reported no participation in any training. Farmers in the province were also dependent on creditors. North Cotabato farmers got 64% of their household income from rice farming.

In Samar, 72% of the farmer respondents were female, 49 years old, married, elementary graduates, and have extensive farming experience (26 years). Average

**Table 6.2.** Profile of red rice farmers in North Cotabato, Samar, and Bukidnon, 2017.

| Farmer characteristic | North Cotabato | Samar | Bukidnon |
|---|---|---|---|
| | n=44 | n=47 | n=19 |
| Sex (%) | | | |
| Male | 57 | 28 | 68 |
| Female | 43 | 72 | 32 |
| Age (years) | 41 | 49 | 52 |
| Civil status (%) | | | |
| Single | 11 | - | 5 |
| Married | 86 | 89 | 95 |
| Widower | 2 | 11 | - |
| Separated | - | - | - |
| Education (years) | 9 | 6 | 10 |
| Farming experience (years) | 19 | 26 | 26 |
| Household size | 5 | 5 | 6 |
| IP membership (%) | | | |
| Ivatan | - | - | 11 |
| Igorot | - | - | 5 |
| Tingguian | - | - | 5 |
| None | 100 | 100 | 79 |
| Tenurial status (%) | | | |
| Owner/CLT | 89 | 68 | 89 |
| Amortizing/CLT (partially paid) | - | 4 | - |
| Lessee | 2 | 6 | 11 |
| Tenant | 2 | 15 | - |
| Ancestral domain | - | 4 | - |
| Mortgagee | 7 | 2 | - |
| Organization (% member) | | | |
| Cooperatives | 7 | 2 | - |
| Irrigators' association | - | - | 11 |
| Farmers' association | 66 | 45 | 5 |
| None | 27 | 55 | 84 |
| Training (% trained) | | | |
| Inbred rice production | 18 | - | - |
| Nutrient management | 39 | 19 | 11 |
| Pest management | 41 | 6 | 16 |
| Upland rice training | - | 11 | - |
| Others | 6 | 2 | 10 |
| None | 48 | 64 | 63 |
| Capital source (% borrower) | 70 | 21 | 79 |
| Income from rice (%) | 64 | 33 | 45 |

household size was five. Majority were landowners. There were notably high percentages of non-membership in organizations and non-participation in any training. In terms of financial capacity, 79% had their own source of capital. Thirty-three percent of the farmers' income came from rice farming (Table 6.2).

Bukidnon red rice farmers were mostly male, 52 years old, married, have 10 years of formal education, and have cultivated rice for 26 years (Table 6.2). Most own the land they farm. A household averaged six members. Majority were non-IP members. Only a few belonged to the Ivatan, Igorot, and *Tingguian* tribes. Large percentages of non-membership in organizations (84%) and non-participation in training (66%) were observed among the farmers. Most (79%) of them were highly dependent on credit for capital in rice farming. Forty-five percent of the total household income was derived from rice farming.

## Productivity of red rice

Yields of red rice across the representative provinces are presented in Figure 6.4. In North Cotabato, red rice farmers produced an average yield of 1.85 t $ha^{-1}$ (1.70 t $ha^{-1}$ at 14% MC). Yields ranged from 0.40 to 4.50 t $ha^{-1}$. Low yields were observed because of insufficient water supply and rampant pest infestations. Farmers were solely dependent on rainfall as their source of water, although some farms have access to natural sources such as rivers and streams. Due to unavailability of water, red rice was planted only once a year.

Just like North Cotabato farmers, those in Samar obtained low yields averaging 1.81 t $ha^{-1}$ (1.67 t $ha^{-1}$ at 14% MC) as shown in Figure 6.4. The lowest reported yield was 0.4 t $ha^{-1}$ while the highest was 7 t $ha^{-1}$. The low production was attributed to the upland rice farming system existing in Samar. Red rice production in Samar was heavily subsistence as production was just enough for home consumption. A few farmers sold a small portion of their harvest; others sold only as an additional source of income if there were surplus from home consumption (see Chapter 7).

Red rice cultivation in Bukidnon attained yield levels from 1.38 to 5.17 t $ha^{-1}$ at fresh weight (Figure 6.4). Average yield was 3.57 t $ha^{-1}$ (3.28 t $ha^{-1}$ at 14% MC). Minimum yield in the area was 1.50 t $ha^{-1}$ and the maximum was 5.60 t $ha^{-1}$.

## Material input use and management practices

### *Variety, seed class, and crop establishment*

*Dinorado* Red was the major variety cultivated in North Cotabato (86%) with an average maturity period of 130 days (Table 6.3). Besides its pigment, it is favored by farmers because of its tenderness and aroma. In Samar, the main variety grown was *Calinayan*, planted by 91% of the farmers. It matures in 136 days. Farmers preferred this variety as it has good eating quality; for them it is tasty, tender, and aromatic.

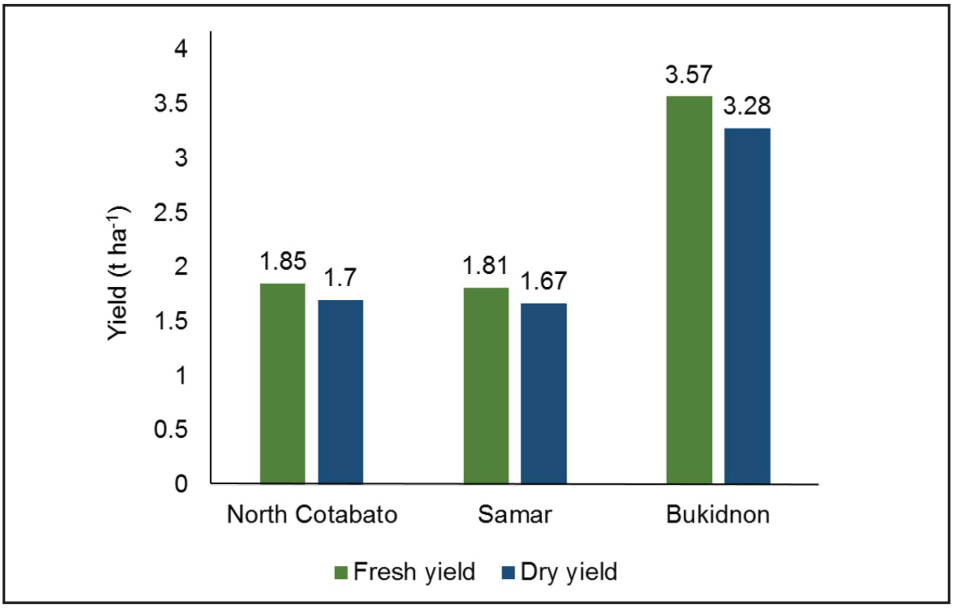


**Figure 6.4.** Farm yields of red rice in North Cotabato, Samar, and Bukidnon, 2017.

The most favored variety in Bukidnon was *Dikit* (alternatively called *Margakit* by the locals), planted by 37% of farmer-respondents. An upland rice, *Dikit* has a long maturity period, 147 days. Furthermore, the main reason for this preference was its good eating quality, its aroma in particular. The other red rice varieties–*Dinorado* Red, *Kapukaw*, Red 18, Red Rice, and Red V10–were each cultivated by 11-16% of the respondents. The former two are upland rice while the latter three are cultivated in lowland irrigated fields.

There were other red rice varieties not included in this study but were collected as samples for grain quality analysis (see Chapter 9).

Table 6.4 shows the seed use and sourcing of seeds of farmers planting red rice. High seeding rates (79 kg $ha^{-1}$) were used in North Cotabato as direct seeding was practiced by all the farmers, which requires higher amounts of seed. Farmers in Samar used only 43 kg $ha^{-1}$. Majority (77%) practiced dibbling and 21% practiced direct seeding. Some farmers borrowed seeds from their seed community bank and returned the same amount of seeds after harvest. A few (6%) used certified seeds bought from seed growers and DA-LGUs. In Bukidnon, farmers engaged in direct seeding at the rate of 70 kg $ha^{-1}$.

**Table 6.3.** Main varieties planted by red rice farmers in North Cotabato, Samar, and Bukidnon, 2017.

| Province | Varieties | Maturity (days) | Percent user |
|---|---|---|---|
| North Cotabato | *Dinorado* Red | 132 | 86 |
| | *Awot* | 133 | 11 |
| | *Hinumay* | 135 | 2 |
| Samar | *Calinayan* | 120 | 68 |
| | *Kalinayan* | 137 | 23 |
| | *Macab A* | 140 | 4 |
| | *Gibarapon* | 120 | 2 |
| | *Cahucot* | 120 | 2 |
| Bukidnon | *Dikit* | 147 | 37 |
| | Red 18 | 119 | 16 |
| | Red V10 | 118 | 16 |
| | *Dinorado* Red | 130 | 11 |
| | *Kapukaw* | 158 | 11 |
| | Red rice | 123 | 11 |

***Fertilizer use and management***

Table 6.4 shows the fertilizer and nutrient management practices of farmers across the three provinces. Majority of the farmers in North Cotabato applied inorganic fertilizers. On the average, fertilizers were commonly applied twice at 19 DASe and 60 DASe. While N was applied at an average of 66 kg

$ha^{-1}$, P and K usage was minimal, at 9 and 6 kg $ha^{-1}$, respectively. The more popular fertilizers used were urea, ammonium phosphate, and complete. Since red rice is planted only once a year, farmers grew other crops such as corn and peanut to maintain soil fertility.

Most of the farmers (66%) in Samar did not use inorganic fertilizers because they believe that their soil is still rich in nutrients needed by the rice crop (Table 6.4). A few farmers used urea and complete (14-14-14) fertilizers, with an average of only 6 kg N $ha^{-1}$ and less than 1 kg $ha^{-1}$ (0.35 kg $ha^{-1}$ and 0.67 kg $ha^{-1}$) for P and K, respectively. The lesser amount of inorganic fertilizers used in Samar could be attributed to their practice of planting traditional varieties, which are believed to be less responsive to fertilizers. A few farmers in Samar used animal manure, decomposed leaves, and concoctions averaging 21 kg $ha^{-1}$.

Bukidnon has almost the same practice as that in North Cotabato, except in the use of K, where farmers applied a bigger amount. Potassium was applied at 19 kg $ha^{-1}$ (Table 6.4).

**Table 6.4.** Material input use in red rice production in North Cotabato, Samar, and Bukidnon, 2017.

| Item | North Cotabato | Samar | Bukidnon |
|---|---|---|---|
| | n=44 | n=47 | n=19 |
| Seed (kg $ha^{-1}$) | 79 | 43 | 70 |
| Fertilizer (kg $ha^{-1}$) | | | |
| N | 66 | 6 | 66 |
| P | 9 | 0 | 11 |
| K | 6 | 1 | 19 |
| Pesticide (kg ai $ha^{-1}$) | | | |
| Herbicide | 0.96 | 0.54 | 0.07 |
| Insecticide | 0.07 | 0.00 | 0.26 |
| Fungicide | | | 0.02 |
| Molluscicide | | | 0.05 |
| Rodenticide | 0.74 | 0.01 | 0.12 |

***Pesticide use and management***

Table 6.4 summarizes the amount of pesticides applied across provinces. In North Cotabato, farmers relied mostly on herbicides to control weeds as all the farmers interviewed practiced direct seeding. They sprayed 0.96 kg ai $ha^{-1}$ twice on average. The first application was done 16 DASe; then farmers wait for another 16 days for the follow-up application. They sprayed insecticides once, at a minimal amount of 0.07 kg ai $ha^{-1}$. Fungicides and molluscicides were not popular among farmers in North Cotabato, but rodenticide usage amounted to 0.74 kg ai $ha^{-1}$.

Chemical pesticides were not popular among upland red rice farmers in Samar (Table 6.4). Only 15% of them used insecticides and rodenticides. No one sprayed molluscicides and fungicides. Only pre-emergence herbicides at 0.54 kg ai $ha^{-1}$ were used by 40% of the farmers.

Red rice farmers in Bukidnon were minimal users of pesticides, except for insecticides (Table 6.4). They applied insecticides twice with the highest average usage among pesticides noted at 0.26 kg ai $ha^{-1}$. Manual weeding was practiced in controlling weeds, thus making herbicide use minimal, only 0.07 kg ai $ha^{-1}$. They did not spray fungicides and used molluscicides at only 0.05 kg ai $ha^{-1}$. Rodents were controlled using rodenticides at 0.12 kg ai $ha^{-1}$.

## Labor use and mechanization

Table 6.5 shows the labor used in producing red rice. Labor was supplied by both hired and OFE labor. Hired labor had the greatest contribution to almost all farm operations in all sites, except for Samar where farm operations were done predominantly by family labor. Total labor employed in red rice production ranged from 41 to 55 md $ha^{-1}$.

In North Cotabato, total labor spent in growing red rice was lowest at 41 md $ha^{-1}$. One major cause of this low labor requirement is the popularity of direct seeding, which only needs 1 md to cover 1 ha. Moreover, red rice farming only took 12 md $ha^{-1}$ to plow and harrow using hand tractors, four-wheel tractors, or carabaos. Crop care and maintenance, which included fertilizer and pesticide applications, required 12 md $ha^{-1}$, and this number did not differ much in Samar and Bukidnon. OFE and hired labor had an almost equal share in these activities at all sites. Harvesting was done manually using sickles and scythes by a majority of the farmers, except for the 5% who used combine harvesters.

Farmers in Samar and Bukidnon spent more labor in red rice production at 51 and 55 md $ha^{-1}$, respectively (Table 6.5). These were mostly spent on labor-intensive activities such as land preparation, crop establishment, and harvesting and threshing. Farmers in the upland areas of Samar practiced slash-and-burn agriculture. Weeding was manually done. They let the weeds dry for a month and later burn them, thus providing added fertilizer to the soil. Dry direct seeding was also popular among farmers in Bukidnon (79%), spending an average of 9 md ha$^{-1}$. Furrows were made through a plow pulled by a carabao or cow, followed by a laborer who sowed the seeds on the soil. On the other hand, Samar farmers (77%) practiced dibbling primarily on sloping or upland areas. They used a pointed stick to dig a hole where rice seeds would be dropped by hand. Dibbling was mainly done by hired labor, spending an average of 7 md ha$^{-1}$.

Another reason for the high labor use in Bukidnon is the practice of manual harvesting. Portable threshers were used in this province as well. In Samar, farmers do manual threshing through foot trampling thereby contributing to the high labor requirement. This farm activity was mostly done by OFE labor.

**Table 6.5.** Labor use in red rice production, North Cotabato, Samar, and Bukidnon, 2017.

| Item | North Cotabato | Samar | Bukidnon |
|---|---|---|---|
| | n=44 | n=47 | n=19 |
| Hired labor (md ha$^{-1}$) | | | |
| Land preparation | 7.34 | 7.61 | 5.97 |
| Crop establishment | 0.70 | 1.16 | 4.23 |
| Crop care & maintenance | 7.94 | 4.90 | 6.25 |
| Harvesting and threshing | 14.95 | 5.02 | 16.74 |
| Postharvest | 0.44 | 0.90 | 1.33 |
| OFE labor (md ha$^{-1}$) | | | |
| Land preparation | 4.60 | 7.01 | 7.55 |
| Crop establishment | 0.44 | 5.93 | 5.76 |
| Crop care & maintenance | 3.83 | 5.94 | 5.85 |
| Harvesting and threshing | - | 10.17 | 0.84 |
| Postharvest | 0.19 | 2.68 | 0.86 |
| Total labor (md ha$^{-1}$) | 40.44 | 51.28 | 54.87 |

## Production cost and input cost share

Farmers in North Cotabato produced the most expensive red rice, at P16 kg$^{-1}$ (Table 6.6). Their total cost of production reached P28,714 ha$^{-1}$. Decomposing this total cost, hired labor (44%) constituted a huge portion of farmers' production cost (Figure 6.5). This was mainly due to high labor use in land preparation and in harvesting and threshing. Harvesting and threshing cost is high since this is a percentage share of the total harvest that will be paid by the farmer. This is valued on the basis of the existing price of fresh paddy during the harvest period. Fertilizer cost contributed 15%, followed by chemicals at 11%. Land rent had 10% share to total cost (Figure 6.5). Land rent is composed of the actual as well as the imputed value of the land. Land rent paid out is the average actual amount paid by the lessee or renter to the landowner for the use of land in rice production. Farmers who are renters paid rent in the form of paddy, and these are valued using the prevailing price of paddy in the market. For landowners, rent was imputed to reflect the opportunity cost of using their land for their own production instead of renting it out or using it to grow other crops. These imputed values came from the average land rent of those farmers who are considered lessees or those with actual spending on rent.

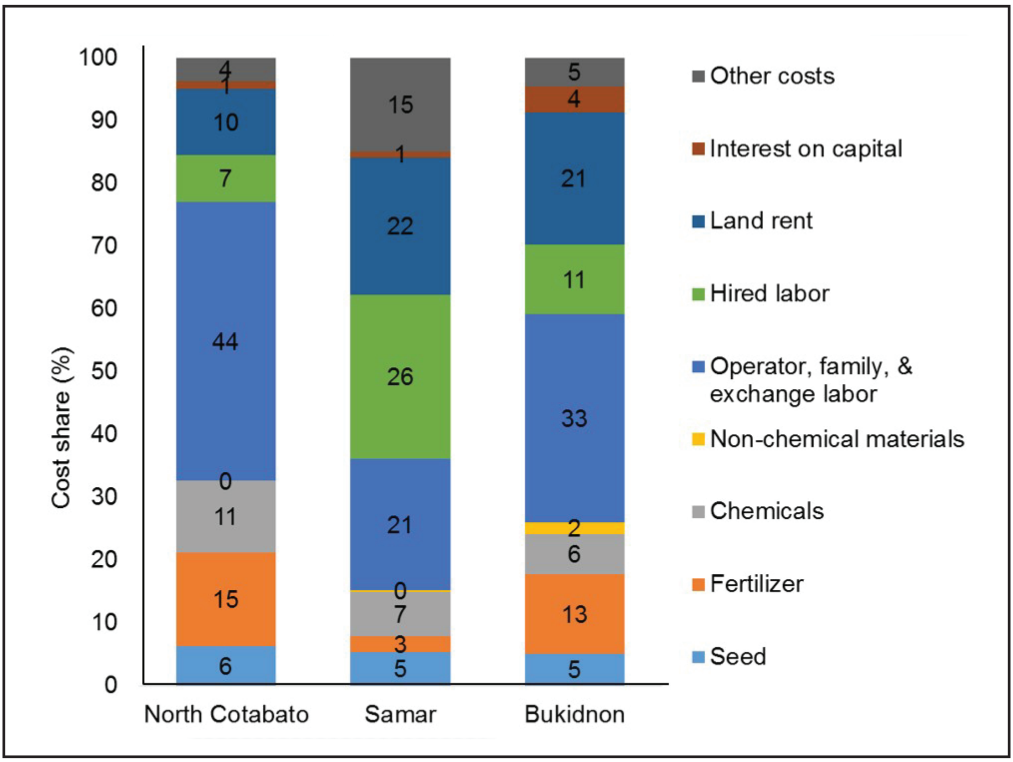


**Figure 6.5.** Cost shares (%) in red rice production items, North Cotabato, Samar, and Bukidnon, 2017

Note: Other costs include power, irrigation, transportation, food, and other input costs.

In Samar, labor cost comprised the largest share in total production cost (47%). This is because farming activities are done manually. Mechanization was also low inasmuch as farms are located in high-elevated areas. Land rent was next at 22%, with a large percentage coming from imputed cost. Other costs, which included power cost, irrigation fee, transportation fee, food expenses, and other input costs contributed 15% to the total cost.

Since manual labor is prevalent in Bukidnon, labor contributed the most to the total red rice production cost. A low level of mechanization was also observed in the area. Land rent was the second largest cost, accounting for imputed costs. Fertilizer costs were next since farmers use more fertilizers in the lowland areas.

## Profitability of red rice farming

Table 6.6 shows the profitability of red rice production across different sites. Farmers in North Cotabato received an average price of P21 $kg^{-1}$ of red rice. With the average yield of 1.85 t $ha^{-1}$, their average gross return amounted to P38,632 $ha^{-1}$. Net income was P9,919 $ha^{-1}$. When farmers own the land and capital and when opportunity cost of OFE labor was not included in the cost structure, net income from red rice farming would further increase to P15,369 $ha^{-1}$.

Gross returns received by farmers in Samar were almost the same as those obtained by their North Cotabato counterparts, since prices and yields did not differ much. However, net income was higher in Samar at P17,073 $ha^{-1}$ due to the lower production cost. This would further increase to P26,000 $ha^{-1}$ if the farmer has his own land and capital and OFE labor will not be included in the cost structure.

Net income was highest in Bukidnon despite receiving a lower price of red rice at P20 $kg^{-1}$ and having the highest cost of production. But with a relatively higher yield, net income from rice production was P28,010 $ha^{-1}$ and would further increase to P43,266 $ha^{-1}$ if OFE labor cost, land rent, and interest on capital were not considered.

**Table 6.6.** Cost and returns of red rice production in North Cotabato, Samar, and Bukidnon, 2017.

| Item | North Cotabato | Samar | Bukidnon |
|---|---|---|---|
| | n=44 | n=47 | n=19 |
| **Returns** | | | |
| Yield (kg $ha^{-1}$) | 1,848 | 1,813 | 3,574 |
| Paddy price (peso $kg^{-1}$) | 21 | 21 | 20 |
| Gross revenue (peso $ha^{-1}$) | 38,632 | 37,225 | 71,659 |
| **Costs (peso $ha^{-1}$)** | | | |
| Seed | 1,811 | 1,080 | 2,212 |
| Fertilizer | 4,279 | 515 | 5,520 |
| Chemicals | 3,272 | 1,410 | 2,793 |
| Non-chemical materials | 3 | 56 | 846 |
| Hired labor | 12,768 | 4,222 | 14,459 |
| Operator, family, & exchange labor | 2,148 | 5,259 | 4,844 |
| Land rent | 3,000 | 4,420 | 9,200 |
| Interest on capital | 370 | 189 | 1,810 |
| Other costs* | 1,062 | 3,001 | 1,966 |
| **Total paid out cost** | 23,263 | 11,225 | 28,393 |
| **Total cost (peso $ha^{-1}$)** | 28,714 | 20,152 | 43,649 |
| **Cost per unit (peso $kg^{-1}$)** | 16 | 11 | 12 |
| **Net income from rice farming (peso $ha^{-1}$)** | 9,919 | 17,073 | 28,010 |
| **Net returns over paid-out costs (peso $ha^{-1}$)** | 15,369 | 26,000 | 43,266 |

*Other costs include power, irrigation, transportation, food, and other input costs.

## Summary and implications

Red rice farmers were generally middle-aged (41-52 years old). Farmers in North Cotabato and Bukidnon have at least attended high school, whereas farmers in Samar were elementary graduates. In terms of farming experience, red rice farmers in Samar and Bukidnon have engaged in this venture for a long time. Organizational membership was encouraged among red rice farmers of Samar and Bukidnon to make rice-related government programs accessible to them. In relation to this, training is mostly needed. Moreover, credit assistance can be particularly helpful to red rice farmers in North Cotabato and Bukidnon where high borrowing rates were observed.

Red rice also has a big potential for commercial-scale production, thus, yield must be further improved and production cost reduced. Lack of access to high-quality red rice seeds must first be addressed. Farmers usually reuse seeds from their own harvests. This practice usually results in seed quality deteriorating over time due to variety mixtures or cross-pollinations. Similar to recommendations given for black rice, seeds from local suppliers and seed growers and community seed banks must be made available. Training on seed purification techniques must also be conducted to maintain the premium quality of red rice.

The best farming practices must be taught to farmers to maximize their production while minimizing cost. One recommendation for this is to review and promote the production module crafted for the Cotabato special rice, which is modeled after the *Dinorado* red rice production in Alamada and Banisilan. This module focuses on improving production practices of upland farming communities in order to achieve better yield and lower cost. Once refined, this can be used in training courses or in farmer field school (FFS) classes. The establishment of techno demo farms is also vital to speed up adoption (Abdula et al., 2018).

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# CONSUMER AND INSTITUTIONAL PREFERENCES

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With urbanization and increasing income, a growing number of consumers are now shifting to rice with premium qualities such as aromatic and pigmented rice (Beisiegel, 2014). Nowadays, aromatic, glutinous, black, and red rice are available in local supermarkets and other retail outlets, which show evidence of an increasing demand and supply for high-quality and nutritious rice. Two studies showed that Filipino consumers are now starting to shift their preference to specialty rice (SR). Exposure to massive rice imports from Vietnam and Thailand made urban Filipino rice consumers prefer rice that tends to be softer and stickier (Baldwin et al., 2012 as cited by Custodio et al., 2016). Bairagi et al. (2019) found that appearance and aroma are the two characteristics most preferred by rice consumers in the Philippines. Moreover, progress in manufacturing rice-based food products increased the demand for glutinous rice. Monthly import volume of glutinous rice was recorded at 23,770 t in April 2019 (BOC, 2019).

The willingness of consumers to pay for quality and high nutritional-value rice despite its high price indicates a great opportunity for farmers to increase their income by producing SR. This chapter aims to assess the potential supply and demand of SR producers and consumers in selected sites in the country. Specifically, it intends to (1) determine the quantity and quality requirements of SR end-users, (2) determine consumer preferences in terms of quality attributes of SR, and (3) identify strategies to strengthen market linkage between farmers and end-users of SR.

## Consumer demand preferences

A consumer survey was conducted among two main groups with demand for SR, household consumers and institutional buyers. Household consumers are families who either directly purchase SR from the market or from the farmers and consume them as table rice, snacks, and other forms. On the other hand, institutional buyers consist of hotels, restaurants, and food processors (e.g., establishment or stores processing/cooking SR) that procure SR in paddy or milled rice form and then process/cook and sell them as ready-to-consume products such as special table rice, cakes, pastry, and other dishes. However, these are mostly composed of small and medium businesses. Big food manufacturing businesses were not included because they are not willing to be interviewed. Conclusions thus derived from this study do not represent the entire institutional SR market.

### *Household consumers*

Sociodemographic profiles of household consumers

Prior to the survey proper, the researchers coordinated with the Provincial Agriculture Office (PAO) to have a list of municipalities that have a high production of SR. After short-listing the municipalities, the researchers sought the assistance of the Municipal Agriculture Office (MAO) to identify possible respondents. With MAO's help, a consumer household survey was conducted involving 147 rice consumers from these nine provinces: Abra, Apayao, Bukidnon, Camarines Sur, Iloilo, Negros Occidental, North Cotabato, Oriental Mindoro, and Samar. As to provinces in Luzon and the Visayas, 15 respondents were interviewed; there were 20 consumers from provinces in Mindanao. With the support of MAO, prospective respondents were requested to come at the municipal office. The respondent must not be a SR farm operator and must be consuming any of the four types of SR at least twice a month. Upon meeting these two requirements, interviewees were selected through snowball sampling. The respondents were either invited to the municipal office or they were visited in their residence by the researchers together with MAO personnel.

The survey lasted for about 15-20 minutes per consumer, depending on the number of types of SR they consume. There were instances that one consumer uses two types of SR in their household (e.g., red rice and black rice). The sociodemographic profiles of respondents including those of all household members consuming SR, household quantity requirements per year, source of SR consumed, and amount of SR consumed were recorded. The survey was conducted to determine their quality preference for both raw and cooked rice (see Chapter 10).

A total of 147 respondents were interviewed from nine provinces to assess the demand and preferences of household consumers for SR. These respondents were randomly chosen from urban areas usually near the major market of the nine provinces where we also did the interview of SR farmers (see Chapter 2). Ideally, additional samples from other urban areas outside the project sites could have been interviewed but this was not done due to limited budget and human resources.

The survey data showed minimal variation in the sociodemographic profiles of consumers regardless of province where they come from. SR-consuming households have an average size of about five members, which is consistent with the national average (Table 7.1). Majority of the household members were females. The heads of households have a mean age of 51 years with most of them having formal education (notably 63% have reached college).

Non-farm employment (59%) was the most common source of income among the consumers, followed by agricultural production at 22%. On the average, annual household income ranged between P106,000 and P409,000 per family. Abra exhibited the lowest annual household income, whereas Negros Occidental had the highest as the most of its sample respondents were from Bacolod City, an urbanized and progressive city in the Visayas. Except for those in Abra and Apayao, all consumer households were above the poverty threshold of about P25,154 per capita per annum or a monthly income of P10,481 for a family of five members (PSA, 2019).

<u>Most commonly used SR type and form</u>

Table 7.2 shows that glutinous (58%) and red rice (53%) were the most consumed SR by households. Aromatic and black rice were least used as these were less accessible due to limited supply and relatively high market price. Aromatic rice is popularly grown in Oriental Mindoro known for its native *Dinorado* rice variety, which has excellent aroma and eating quality (see Chapter 3). Black rice is mostly planted in some areas in Iloilo and Negros Occidental and in some areas in CAR (see Chapter 5). Glutinous rice was the

**Table 7.1.** Sociodemographic characteristics of household consumers of SR in selected provinces, Philippines, 2017-2018.

| Item | Oriental Mindoro | Negros Occidental | Iloilo | North Cotabato | Samar | Camarines Sur | Abra | Bukidnon | Apayao |
|---|---|---|---|---|---|---|---|---|---|
| Specialty rice type | 15 | 15 | 15 | 20 | 16 | 15 | 15 | 21 | 15 |
| Aromatic | 14 | - | 2 | 4 | 1 | - | 1 | 1 | 4 |
| Glutinous | 11 | 6 | 11 | 10 | 5 | 15 | 14 | 5 | 8 |
| Black | 1 | 7 | 10 | 1 | 4 | 1 | 1 | 3 | 3 |
| Red | 1 | 11 | 4 | 17 | 16 | 1 | 6 | 18 | 4 |
| Average household size | 4 | 5 | 4 | 5 | 6 | 5 | 5 | 4 | 6 |
| Average male to female ratio | 2:2 | 2:3 | 2:3 | 2:3 | 2:3 | 2:2 | 2:3 | 2:2 | 2:3 |
| Average no. of SR-consuming members per household | 4 | 4 | 4 | 5 | 6 | 5 | 5 | 4 | 6 |
| Profile of household head | | | | | | | | | |
| Average age | 54 | 53 | 54 | 49 | 54 | 45 | 53 | 48 | 46 |
| Civil status (%) | | | | | | | | | |
| Married | 87 | 60 | 93 | 100 | 88 | 100 | 73 | 81 | 80 |
| Single | - | 20 | 7 | - | 6 | - | 13 | 5 | - |
| Widow/widower | 13 | 20 | - | - | 6 | - | 13 | 14 | 20 |
| Highest educational attainment (%) | | | | | | | | | |
| Elementary level | 33 | - | 13 | 10 | - | 20 | 13 | 10 | 13 |
| High school level | 27 | - | - | 15 | - | 47 | 20 | 24 | 33 |
| Vocational level | 7 | 7 | 13 | 5 | - | - | 20 | 5 | - |
| College level | 33 | 93 | 73 | 70 | 100 | 33 | 47 | 62 | 53 |
| Major source of income (%) | | | | | | | | | |
| Agricultural production | 7 | 7 | 13 | 35 | 13 | - | 40 | 38 | 40 |
| Business | - | - | 13 | 5 | - | 7 | 7 | 14 | - |
| Employment | 60 | 87 | 60 | 55 | 81 | 87 | 33 | 29 | 47 |
| Non- agricultural service | - | - | - | - | - | - | 13 | 10 | - |
| None | 7 | 7 | 13 | 5 | - | - | - | 5 | 7 |
| Off-farm income | 13 | - | - | - | - | - | - | 5 | 7 |
| Pension | 7 | - | - | - | 6 | 7 | 7 | - | - |
| Remittance | 7 | - | - | - | - | - | - | - | - |
| Average household income (peso year$^{-1}$) | 172,400 | 409,280 | 133,010 | 179,650 | 255,750 | 144,000 | 105,850 | 157,714 | 112,692 |
| Average per capita income (peso year$^{-1}$) | 41,710 | 86,468 | 29,778 | 35,225 | 45,978 | 29,589 | 20,620 | 37,213 | 19,887 |

most consumed SR variety in many provinces due to the availability of supply and the households' fancy for rice-based food processed products such as rice cakes, *suman*, and other native delicacies. Results from previous surveys showed that farmers usually plant a small portion of their rice field to glutinous rice for home consumption and some even sell it occasionally. It is rare to observe rice fields wholly planted to glutinous rice, but it is in Camarines Sur where farmers allocated almost their entire areas to it (see Chapter 4). Meanwhile, red rice is prominent in Negros Occidental, Samar, and Bukidnon, albeit grown in limited areas (see Chapter 6).

Aromatic and glutinous rice were consumed in polished or well milled form and were the most commonly sold in the market (Table 7.2). However, pigmented rice (black and red) were utilized in unpolished or lightly polished forms and were very popular among health-conscious households due to its high anthocyanin content.

**Table 7.2.** Forms of rice procured and type of utilization, by SR type, selected provinces, Philippines, 2017-2018.

| Item | Aromatic | Glutinous | Black | Red |
|---|---|---|---|---|
| Mostly used SR type (% users)* | 18 | 58 | 21 | 53 |
| Forms of SR procured (%) | | | | |
| Unpolished | - | 2 | 38 | 16 |
| Semi-polished | - | - | 62 | 84 |
| Polished or well-milled | 100 | 92 | - | - |
| Flour | - | 6 | - | - |
| Uses of SR (%) | | | | |
| Table rice | 96 | 4 | 74 | 94 |
| Processed food products/ dishes | 4 | 96 | 26 | 6 |

*There are multiple users, meaning one household may consume one or more types of SR.

In terms of use, aromatic and pigmented types were consumed as table rice, although 26% reported that black rice was also used for rice-based food products (Table 7.2). Glutinous rice is commonly used as the main ingredient in processed rice-based food products or dishes due its distinct cohesiveness, which is suitable for making rice cakes or *kakanin*, *champorado*, and *arroz caldo*. But, unlike other SR, glutinous rice is also used as flour to produce special food products like tikoy, *palitaw*, and *bilo-bilo*.

Quantity requirement of SR

More than 70% of the households interviewed regularly consumed all SR types, except for glutinous rice, which was eaten by more than half on a seasonal basis (Table 7.3). Results showed a wide variation in the annual household consumption of SR, depending on its accessibility in a specific area. As reported, a certain SR type was only regularly produced in some provinces where demand was high. This implies that a type of SR is mostly consumed in provinces where it is popularly produced.

**Table 7.3.** Frequency of use and volume of household consumption, by SR type, selected provinces, Philippines, 2017-2018.

| Item | Aromatic | Glutinous | Black | Red |
|---|---|---|---|---|
| Frequency of use (%) | | | | |
| Regular | 93 | 44 | 71 | 85 |
| Seasonal | 7 | 56 | 29 | 15 |
| Volume of consumption (kg $year^{-1}$) | | | | |
| Maximum | 1095 | 600 | 1643 | 1095 |
| Minimum | 25 | 3 | 1 | 3 |
| Average | 433 | 53 | 233 | 371 |

Given the difference in the frequency of use, average consumption of aromatic and pigmented rice (red and black) was higher than that of glutinous rice (Table 7.3). On a per-capita basis, average consumption of aromatic rice was around 87 kg $year^{-1}$ in project sites, which is close to the average annual per capita consumption (110 kg) of ordinary rice in the country. For pigmented rice, average per capita consumption per year was 74 kg for red rice and 47 kg for black rice. The relatively smaller amount of black rice consumption is attributed to its limited supply, higher price, and seasonal consumption of 29% of the households. On the other hand, glutinous rice was least consumed with an average of 10 kg per capita per annum since this is consumed seasonally (e.g., birthdays, feasts, Christmas, and New Year) and most of the time is used in processed form.

Quality requirements of SR as rated by households

Majority of the households reported high-quality trait of rice as one of the factors that influence their buying decision. Respondents commonly rated rice quality based on inherent characteristics such as taste, nutritional value, color, texture, and aroma.

Using a set of parameters for raw and cooked rice, sample households were asked about what qualities of SR type they prefer. For raw rice form, majority of the households indicated their specific color preference as very white and white for aromatic rice and creamish white for glutinous rice. However, black rice was favored with intense (38%) to very intense (42%) color, while red rice was desired with intense (34%) and slightly intense (48%) color.

Majority of the households preferred a high percentage of head rice for the milled grains of all SR types, indicating the importance given to quality of milling (Table 7.4). In terms of grain length, they preferred long and intermediate size for aromatic, red, and black rice. However, grain length of glutinous rice was immaterial as revealed by the different responses: 36% long, 29% medium, and 23% short. Majority of the respondents preferred the slender shape of SR types with the exception of glutinous rice– many (45%) wanted a bold shape. Likewise, more than half preferred translucent and glossy appearance for aromatic and pigmented black rice. In contrast, many favored opaque grains for glutinous and pigmented black rice (Table 7.4).

Aside from glutinous rice, more than half of the households preferred cooked rice of SR types with *pandan* scent or aroma. For glutinous, answers were diverse, which means that aroma is not a primary concern since it is not consumed as table rice but as processed rice-based food products. In terms of cohesiveness or stickiness, slightly cohesive was the most desired quality of SR types; for glutinous rice, however, majority liked a very cohesive trait. Households preferred cooked rice that is tender, tasty, and which remains soft upon staling (Table 7.4).

Problems encountered in consuming SR

Almost half of the respondents did not encounter any problems in the purchase and consumption of SR (Table 7.5) implying that households were generally satisfied in their SR consumption. However, for those who had

**Table 7.4.** Household consumers' preference for distinct qualities, by SR type, selected provinces, Philippines, 2017-2018.

| Parameter | Description | Preference (%) | | | |
|---|---|---|---|---|---|
| | | Aromatic | Glutinous | Black | Red |
| ***Raw*** | | | | | |
| Color (white, polished) | Very white | 59 | 63 | | |
| | White | 41 | 28 | n/a | n/a |
| | Creamish white | 0 | 3 | | |
| | Grayish white | 0 | 6 | | |
| Pigmented (red or black, unpolished) | Very intense | | | 42 | 17 |
| | Intense | n/a | n/a | 38 | 48 |
| | Slightly intense | | | 16 | 34 |
| | Weak | | | 4 | 1 |
| Percent head rice | 76-100 | 77 | 64 | 76 | 71 |
| | 50-75 | 10 | 26 | 12 | 7 |
| | 26-50 | - | 3 | 0 | 6 |
| | 0-25 | 13 | 7 | 12 | 16 |
| Length | Extra long | 27 | 12 | 16 | 19 |
| | Long | 47 | 36 | 48 | 40 |
| | Medium | 23 | 29 | 20 | 18 |
| | Short | 3 | 23 | 16 | 23 |
| Shape | Slender | 30 | 17 | 24 | 32 |
| | Intermediate | 70 | 38 | 52 | 42 |
| | Bold | - | 45 | 24 | 26 |
| Translucency | Translucent | 50 | 3 | 35 | 57 |
| | White belly | 17 | 3 | 6 | 16 |
| | Chalky | 27 | 1 | 18 | 21 |
| | Opaque | 6 | 93 | 41 | 6 |
| Gloss | Very glossy | - | - | - | - |
| | Glossy | 52 | 14 | 39 | 51 |
| | Slightly glossy | 34 | 19 | 15 | 13 |
| | Dull | 14 | 67 | 46 | 36 |
| ***Cooked*** | | | | | |
| Aroma | Very aromatic | 23 | 1 | - | 13 |
| | Aromatic | 57 | 33 | 52 | 62 |
| | Slightly aromatic | 17 | 32 | 30 | 18 |
| | No aroma | 3 | 34 | 18 | 7 |
| Cohesiveness | Very cohesive | 3 | 63 | 19 | 1 |
| | Cohesive | 40 | 25 | 35 | 57 |
| | Slightly cohesive | 50 | 12 | 38 | 34 |
| | Separated | 7 | - | 8 | 8 |
| Tenderness (freshly cooked) | Very tender | 7 | 51 | 19 | 1 |
| | Tender | 83 | 42 | 35 | 57 |
| | Slightly tender | 7 | 7 | 38 | 34 |
| | Hard | 3 | - | 8 | 8 |
| Tenderness (upon staling) | Very tender | 10 | 42 | 15 | - |
| | Tender | 90 | 46 | 52 | 78 |
| | Slightly tender | - | 10 | 33 | 19 |
| | Hard | - | 2 | - | 3 |
| Taste | Very tasty | 13 | 5 | 7 | 8 |
| | Tasty | 80 | 62 | 63 | 74 |
| | Slightly tasty | 7 | 26 | 26 | 15 |
| | Bland | 0 | 7 | 4 | 3 |

problems, the most common complaints were the high price and unstable supply. These problems limited the consumption and demand of household consumer for all types of SR. SR commands a higher price than other ordinary rice varieties sold in the market because of its high nutritional value, aroma, softness, and special qualities such as stickiness for glutinous rice. Furthermore, as these varieties are not widely grown in the country, their limited availability and accessibility constrain household consumption.

**Table 7.5.** Problems encountered by households using SR, selected provinces, Philippines, 2017-2018.

| Item | Aromatic | Glutinous | Black | Red | All types |
|---|---|---|---|---|---|
| High price | 22 | 33 | 29 | 32 | 31 |
| Unstable supply | 26 | 16 | 23 | 22 | 21 |
| Long cooking time | 4 | 1 | - | 2 | 2 |
| Others* | 4 | 5 | 10 | 6 | 6 |
| None | 63 | 45 | 52 | 47 | 49 |

*Others include negative perceptions of households on SR (impure, hard, not too sticky, bland).
Note: Total percentage is not equal to 100 due to multiple responses.

***Institutional buyers***

This section discusses the characteristics, preferences, demand requirements, and problems encountered by the institutional consumers included in the study.

Sociodemographic profiles of institutional buyers

As mentioned earlier, institutional buyers were grouped into rice-based food processors and hotels/restaurants. Table 7.6 shows a summary of the profiles of these sample institutional buyers of SR (see Chapter 2). There were more female company owners in the three major Philippine islands, indicating that females are more inclined to venture into this type of business than their male counterparts. All the owners of hotels and restaurants were college graduates, while some in the food processing establishments were not able to complete their education.

In Luzon and Visayas, food processing businesses were more commonly found under single proprietorship, whereas the hotel and restaurant business was usually run by corporations. In Mindanao however, both of these establishments were managed as family business These businesses were usually more complex to manage, given the number of employees that need to be supervised and the activities involved in operating and managing them. Except for hotels and restaurants in the Visayas, institutional buyers in the country have been operating for more than a decade already.

**Table 7.6.** Profile of respondents and the company owned or operated, by major island, selected provinces, Philippines, 2017-2018.

| Item | LUZON | | VISAYAS | | MINDANAO | |
|---|---|---|---|---|---|---|
| | Food processors | Hotels and restaurants | Food processors | Hotels and restaurants | Food processors | Hotels and restaurants |
| **Respondents** | | | | | | |
| Average age (years) | 56 | 47 | 52 | 41 | 53 | 54 |
| Sex (M:F) | 21:79 | 38:62 | 18:82 | 14:86 | 14:86 | 0:100 |
| Civil status (%) | | | | | | |
| Single | 7 | 25 | 10 | 14 | 14 | 25 |
| Married | 93 | 75 | 90 | 86 | 86 | 75 |
| College graduate (%) | 83 | 100 | 50 | 100 | 86 | 100 |
| **Company** | | | | | | |
| No. of employees | | | | | | |
| Minimum | 3 | 7 | 2 | 16 | 6 | 16 |
| Maximum | 410 | 350 | 65 | 400 | 58 | 71 |
| Average | 73 | 105 | 18 | 87 | 22 | 49 |
| Type of ownership (%) | | | | | | |
| Cooperative | - | - | 10 | - | - | - |
| Corporation | 14 | 33 | - | 14 | 14 | - |
| Family business | 29 | 11 | 30 | 14 | 57 | 75 |
| Partnership | | 22 | 10 | 14 | - | - |
| Single | 50 | 11 | 50 | 29 | 29 | 25 |
| Years of operation | | | | | | |
| Minimum | 6 | 1 | 1 | - | 5 | 3 |
| Maximum | 58 | 49 | 53 | 38 | 43 | 56 |
| Average | 29 | 14 | 19 | 8 | 14 | 21 |

Most common SR types used by institutional buyers

Similar to household consumers, institutional buyers also preferred aromatic rice in polished or milled form as they used or served it as table rice, except for glutinous rice, which was more often processed into rice-based food products. However, the unpolished form was preferred for pigmented rice. In Luzon and Visayas, aromatic, red, and black rice were normally used as table rice. Black rice was also used as an ingredient to make assorted *kakanin* in Luzon and Mindanao. Being the only SR variety preferred by some institutional buyers as flour, glutinous rice in flour form was also more often used for the same purpose by both food processors and hotels and restaurants in the sample provinces (Table 7.7).

SR were sourced either from the local or international market. Aromatic rice was mostly imported by hotel and restaurant operators due to limited supply in the local market. In addition, they have tested and proven its grain quality, which they perceived to be superior to locally produced aromatic rice. Glutinous rice and flour were also sourced from both domestic and international markets by food processors. Through established rice traders, about one-third obtained their supply from countries such as Thailand and Vietnam. On the other hand, pigmented red and black rice were sourced mostly from local producers. Across major islands, pigmented rice was sourced from farmers by food processors, while the supply sources of hotel and restaurant operators included cooperatives, rice traders, and wholesalers in the Visayas. Hotel and restaurant operators and food processors in Luzon and Mindanao sourced their supply of black rice from supermarkets, wholesalers, retailers, and farmers. Majority of these consumers have been using a particular SR type for about 2-5 years and were satisfied with the quality of SR type provided by their sources (Table 7.7).

Quantity requirements by SR type

The amount of SR required by institutional buyers varied a lot, ranging from as low as 10 kg to as high as 1,295 kg per month, regardless of SR type. Glutinous rice was the most used SR type by institutional buyers. The average monthly volume requirement of food processors was 919 kg in Luzon, 407 kg in the Visayas, and 652 kg in Mindanao, while hotel and restaurant operators used 313-1,295 kg per month. These volume requirements were oftentimes met by suppliers, although food processors in Luzon experienced difficulty in procuring glutinous black rice. On the other hand, demand for aromatic rice was smaller than that for other SR types, at an average of 175 kg. Demand for red rice ranged from 63 to 78 kg per month (Table 7.7).

Price of SR

Unlike prices of ordinary milled rice, those of SR varied widely due to their unique characteristics. Half of the aromatic rice consumers in Luzon considered price as a major factor in buying the said SR type. For glutinous rice, price was a big consideration for food processors and hotel and restaurant operators. In contrast, price was not an issue in the Visayas and Mindanao, where quality was the most important criterion (Table 7.7). Similarly, the price of pigmented rice was not a significant factor in Luzon and Mindanao (i.e., interviewees were willing to pay the market price of any SR type). This can be a great opportunity for farmers in the major islands to diversify their rice production and increase their income as there is a niche market for pigmented rice, particularly glutinous black.

Variation in SR price was apparent in the three major islands. Black rice appeared to be the most expensive with its price ranging from P85 to P100 or P86 $kg^{-1}$. Glutinous rice was generally the cheapest among the SR types (P41 to P66 $kg^{-1}$). The price of pigmented red rice ranged from P68 to P78 $kg^{-1}$, while aromatic rice was sold at P72 $kg^{-1}$. Compared with the market price of commercial ordinary milled rice, SR prices were notably higher (Table 7.7).

SR quality preference of institutional buyers

Quality preference is specific for each SR type. Aromatic rice varieties that are aromatic, tender, white, not easily spoiled, and have high volume expansion were viewed as high-quality by institutional buyers across the major islands. As to pigmented rice, they preferred tender, dark color, long grain, and good texture when cooked. Cohesiveness was the most preferred quality in glutinous rice.

Problems encountered in using SR

Impurity, high broken percentage, and gritty texture were the major problems noted by institutional consumers in using SR. The other problems reported were presence of insects in the packaging, short shelf life, low volume expansion, and low cohesiveness. However, one problem worth considering for SR producers was unstable (or lack of) supply.

## Determinants of potential supply of SR

### *Market participation of SR farmers*

Production and marketing of SR is an option for rice farmers to increase their revenue as these varieties command higher prices than ordinary white rice. However, not all farmers were able to utilize its high market potential primarily because of lack of market linkages and low yield. Figure 7.1 shows some of the areas where majority of the farmers engaged in marketing their SR produce regularly. Farmers in Oriental Mindoro (95%), Camarines Sur (87%), North Cotabato (78%), and Abra (68%) were regularly selling SR due to high demand and better market prices. As such, the revenue from SR could enable them to meet their financial needs and provide capital for the next cropping season.

Only about half of the SR farmers in Negros Occidental (56%) and Iloilo (51%) regularly sold their SR harvest. They are those who have negotiated trade agreements with associations and regular buyers. SR (mostly pigmented) in the area has a high market price ranging from P14 to P19 $kg^{-1}$ for fresh paddy and from P54 to P86 $kg^{-1}$ for milled rice. The markets of SR in these sites were not as established as compared with those found in the previously mentioned four provinces. However, a significant proportion of farmers in these two provinces also marketed their product occasionally when there was surplus.

While there was a high percentage of farmers who realize the market potential of SR, there are producers who are still into subsistence farming. Such farmers who are into subsistence farming or who do not participate in marketing activities were more dominant in Samar (47%), Bukidnon (51%), and Apayao (57%). Most of the SR varieties planted in these areas were traditional varieties, with yields lower than those of modern varieties. Farmers in these areas can only plant once because of rainfall dependence and their *kaingin* practice. Hence, harvests were just enough for home consumption.

To further confirm the potential supply of SR in the market, data on SR output disposition were also collected from farmers. Basically, farmers disposed of their harvest in four major ways: home consumption, selling, in-kind payments, and seeds. In-kind payments included payments given to harvesters, threshers, and permanent hired labor and payments to cover land rent, irrigation fee, and loans. Usually, a small amount of harvest was set aside as seeds for the next cropping season.

From the project sites, representative provinces with a significant number of farmers planting a particular SR were chosen for each SR type: Oriental Mindoro and Apayao for aromatic rice, Camarines Sur for glutinous rice, Negros Occidental for black rice, and North Cotabato for red rice (see Chapter 2). Figure 7.2 shows the percentage allocation of each output disposition item to total gross harvest of SR farmers.

Volume sold had the biggest share in the product disposition in Oriental Mindoro (69%), Camarines Sur (77%), Negros Occidental (49%), and North Cotabato (45%). These areas have high demand for SR and assured market

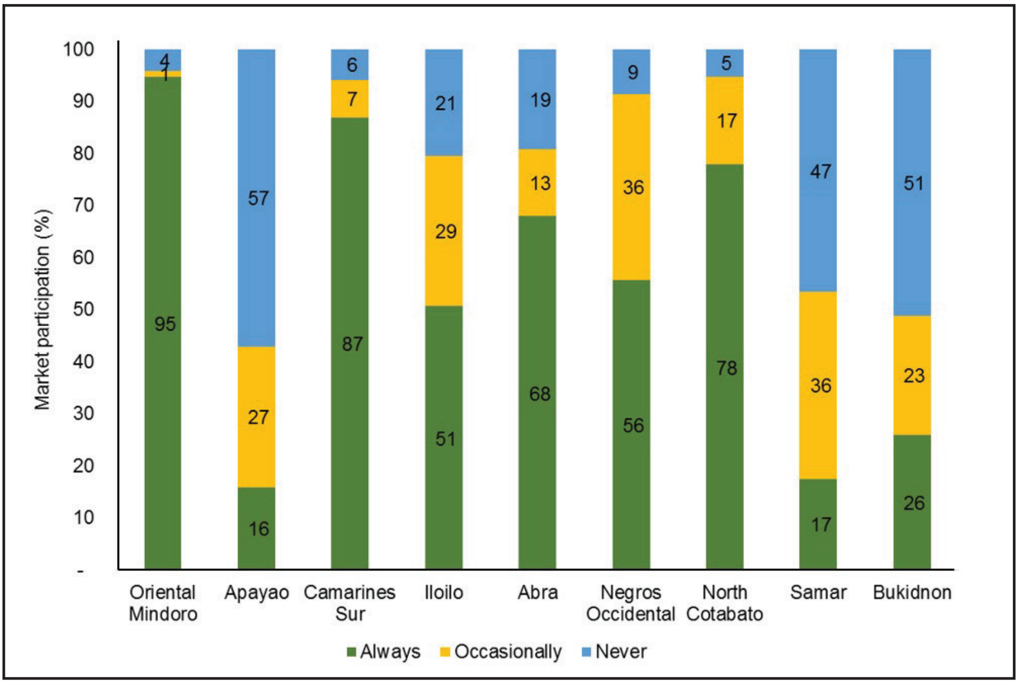


**Figure 7.1.** Distribution (%) of SR farmers, by market participation, selected provinces, Philippines, 2017-2018.

linkage for farmers. This result is consistent with the aforementioned findings on high market participation of farmers in these four provinces.

As to traditional aromatic variety from Apayao, inasmuch as farmers from the said area are still into subsistence farming, a huge portion (70%) of their produce was allotted to family consumption.

**Table 7.7.** Institutional buyers' demand for and sources of SR, by major island, by SR type, selected provinces, Philippines, 2017-2018.

| Item | Aromatic | Glutinous | | | | | | Pigmented (red) | | | Pigmented (black) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hotels & restaurants | Food processors | | | Hotels & restaurants | | | Food processors | Hotels & restaurants | | Food processors | | | Hotels & restaurants | | |
| | L | L | V | M | L | V | M | V | L | M | L | V | M | L | V | M |
| **Form (%)** | | | | | | | | | | | | | | | | |
| Flour | | 13 | | 13 | | 25 | 25 | | | | | | | | | |
| Polished | 100 | 87 | 100 | 88 | 100 | 75 | 75 | 100 | | | | | | | | |
| Unpolished/lightly polished | | | | | | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| **SR usage (%)** | | | | | | | | | | | | | | | | |
| *Kakanin* | | 87 | 100 | 100 | 50 | 75 | 75 | 67 | | | 100 | | 100 | | | |
| Porridge | | 7 | | | 25 | | 25 | | | | | | | | | |
| Table rice | 100 | 7 | | | | | | 33 | 100 | 100 | | 100 | | 100 | 100 | |
| Hot soup and *kakanin* | | | | | | 25 | | | | | | | | | | |
| Porridge and *suman* | | | | | 25 | | | | | | | | | | | |
| **Volume requirement (kg mo$^{-1}$)** | | | | | | | | | | | | | | | | |
| Average | 175 | 919 | 407 | 652 | 313 | 1295 | 410 | 35 | 59 | 327 | | 10 | 43 | 78 | 183 | 120 |
| Minimum | 50 | 370 | 34 | 210 | 50 | 760 | 310 | 10 | 25 | 220 | | 10 | 10 | 25 | 113 | 120 |
| Maximum | 250 | 28000 | 5250 | 3150 | 550 | 2250 | 560 | 2400 | 113 | 500 | 25000 | 10 | 100 | 150 | 260 | 120 |
| **Price (peso kg$^{-1}$)** | | | | | | | | | | | | | | | | |
| Average | 72 | 60 | 63 | 65 | 66 | 41 | 60 | 68 | 73 | 78 | 60 | 70 | 70 | 85 | 86 | 100 |
| Minimum | 48 | 54 | 50 | 95 | 55 | 40 | 59 | 53 | 58 | 68 | 60 | 70 | 50 | 60 | 73 | 100 |
| Maximum | 88 | 70 | 100 | 103 | 80 | 43 | 60 | 80 | 100 | 98 | 60 | 70 | 90 | 101 | 101 | 100 |
| **Consideration of price (%)** | | | | | | | | | | | | | | | | |
| Yes | 50 | 71 | 40 | | 100 | | | | 67 | | | | | | 100 | |
| No | 50 | 29 | 60 | 100 | | 100 | 100 | 100 | 33 | 100 | | | | 100 | | 100 |
| **Sufficiency of supply (%)** | | | | | | | | | | | | | | | | |
| Yes | 67 | 100 | 78 | 100 | 100 | 100 | 100 | 67 | 100 | 75 | | 100 | 67 | 100 | 83 | 100 |
| No | 33 | | 22 | | | | | 33 | | 25 | 100 | | 33 | | 17 | |
| **Source (%)** | | | | | | | | | | | | | | | | |
| Local | 33 | 80 | | 63 | | 50 | 25 | 100 | 100 | | 100 | 100 | 100 | 100 | 100 | 100 |
| Imported | 67 | 20 | | 25 | | 50 | 25 | | | | | | | | | |
| Both | | | | 12 | | | 50 | | | | | | | | | |
| **Satisfied on SR quality (%)** | | | | | | | | | | | | | | | | |
| Yes | 100 | 93 | 89 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 67 | 100 | 100 |
| No | | 7 | 11 | | | | | | | | | | | 33 | | |

Note: L-Luzon; V-Visayas; M-Mindanao

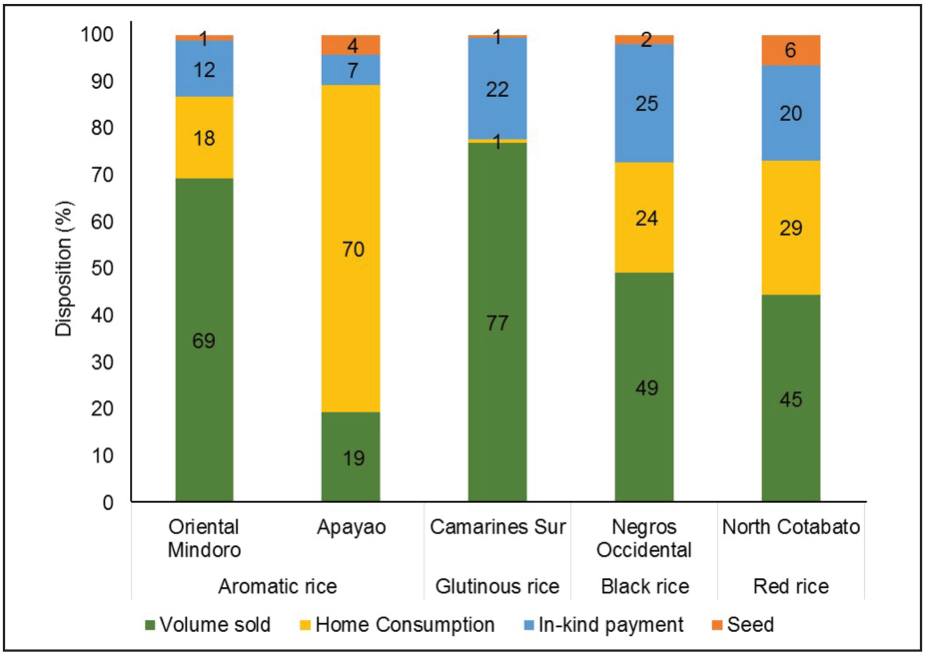


**Figure 7.2.** Percentage disposition of the total gross harvest, by SR type, selected provinces, Philippines, 2017-2018.

### *Marketable surplus*

Marketable surplus or the quantity available for sale was used in determining the potential supply of SR in the project sites since the actual amount sold from one time period may not be equal to the total volume available for the market. For example, seed allocation may not be utilized for the next cropping season and may thus be marketed in dried form or be processed and sold as milled rice. Potential volumes may be combined to derive the marketable surplus. Thus, marketable surplus was calculated by deducting the in-kind payment and amount set aside for consumption from the total gross harvest.

Figure 7.3 presents the marketable surplus (% of harvests) of each province by SR type. Marketable surplus for glutinous rice in Camarines Sur (77%) was the highest. A minimal portion of glutinous rice harvest (less than 1%) was allotted to home consumption as farm households consume glutinous rice only during special occasions or as snacks and not as table rice. In addition, yield of glutinous rice was relatively higher compared with those of other SR types (see Chapter 4). Marketable surplus for aromatic rice in Oriental Mindoro (71%)

was also high (despite the fact that aromatic rice is eaten as table rice) because it is planted in a bigger area and it is a high yielder (see Chapter 3).

As for black rice in Negros Occidental and red rice in North Cotabato, only half (51%) of the total gross harvest were considered as marketable surplus. The lowest marketable surplus was observed in Apayao (25%). Varieties planted in these areas were low-yielding (see Chapters 3, 5, and 6) so there was lower amount left for the market after setting aside some amounts for home consumption.

These marketable surpluses may be sold either in fresh, dried, milled, or unpolished form, depending on prevailing marketing practices, consumer demand, and availability and accessibility of postharvest facilities in the area. Glutinous rice in Camarines Sur was most commonly sold in milled form. For modern aromatic rice in Oriental Mindoro, selling fresh paddy to paddy traders right after harvest was the most common practice. They did not engage in further postharvest activities as they needed the cash right away. In contrast, marketed traditional aromatic rice in Apayao were custom-milled. The same situation was observed in the marketing of black rice in Negros Occidental. Lastly, red rice in North Cotabato was sold in both paddy and milled rice forms.

## Market linkages between SR producers and institutional consumers

As previously discussed, institutional buyers require large-scale and sustainable supply, thus, contributing immensely to the increasing demand for SR in the country. With limited supply, some of these consumers choose to import to satisfy their quantity and quality requirements. SR producers should take advantage of this opportunity to generate better profits. Linkage of farmers to food processors and hotels and restaurants must be logistically organized since institutional buyers have systematized operations.

Aside from quantity and quality requirements, logistics are also very important to institutional buyers: timely delivery must be ensured. Rice is delivered weekly, bi-weekly, or as needed. Similarly, these companies require a sales invoice, which is standard operating procedure (SOP) for receipt transactions, purchase declarations, auditing purposes, and compliance to Bureau of Internal Revenue (BIR) requirements. Majority paid in cash, but they preferred check as mode of payment. Normally, institutional buyers deal with preferred suppliers who are known to meet consistently their quantity and quality requirements.

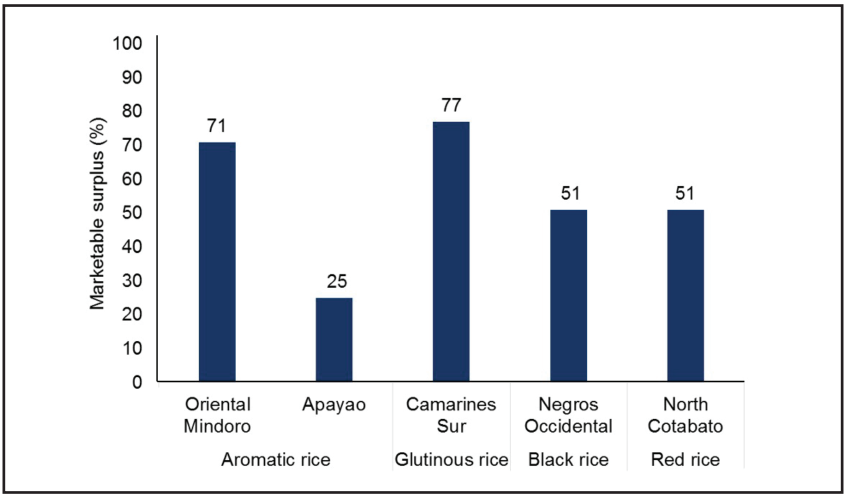


**Figure 7.3.** Percentage of SR marketable surplus to total gross harvest, by SR type, selected provinces, Philippines, 2017-2018.

Institutional buyers liked the idea of buying directly from SR producers. They agreed that buying rice directly from farmers would provide them with better margins because of lower procurement price compared with regular trader-supplied rice. Besides, it would reduce the market tiers or layers in the supply chain. However, they recognized also that farmers might have logistics constraints and might have a hard time meeting their regular volume requirements because farmers' rice production is seasonal. Without bulk production and huge inventory, farmers would not be able to compete with experienced traders.

For farmers to increase their share in the SR market, they need to increase the volume of production and overcome constraints in terms of logistics. They could form cooperatives or farmers' associations so they can engage in collective marketing of SR and thus, meet the volume requirements of institutional buyers.

## Summary and implications

Aromatic rice has the highest demand from household consumers, being considered as table rice. Its volume requirement is the largest among the SR types but only a few households purchase this type due to its high price. Black and red rice are also regarded table rice based on their respective volume requirements. On the other hand, more households are consuming glutinous rice but only on a seasonal basis, thus the smaller volume requirement. Due to its sticky characteristics, it cannot be consumed as table rice but can be used as raw ingredient for different kinds of rice-based products.

On the institutional side, hotels and restaurants prefer pigmented rice over other SR types. These high-valued rice are served as table rice because of their perceived nutritional and health benefits. Only a few serve aromatic rice. For food processors, glutinous rice is highly in demand because of its role in processing rice-based products. Aside from purchasing grains, these institutional buyers also demand glutinous rice in flour form.

Overall, there is a market for aromatic, glutinous, black, and red rice Of these types, glutinous rice is the most in demand as there is an increasing number of institutional buyers (rice-based food processors and hotels and restaurants) that can provide an assured market for SR. Producers of SR must be able to access this market. However, they cannot sell directly to institutional buyers since they are not business entities. To help rice farmers take advantage of this market opportunity, farmer groups must be organized to be accredited and registered as business entities. This setup will enable farmers to engage in value-adding a ctivities such as drying, milling, packaging, and flour processing. Organized farmer groups will also allow them to practice collective marketing and thus meet the demand of institutional buyers.

After farmer groups are organized, government agencies such as the Department of Agriculture-Agribusiness and Marketing Assistance Service (DA-AMAS) may tie up with private organizations (PAG-ASA/PASI) to identify potential markets for them. Technical assistance can be provided by the government through seminars that will enhance the knowledge of these farmers' groups on the rice trading business. In addition, the government can provide them financial assistance through loans with low interest that may serve as startup capital investment.

SR can be used for other purposes aside from being eaten as table rice. Other potential uses of SR must be explored to devise strategies to increase demand. More of these are discussed in Chapters 9 and 10.

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8

# MARKETING SYSTEMS AND PRICE STRUCTURES

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After being harvested, fresh paddy undergoes a series of processes to become milled rice and courses through different channels before it becomes available to consumers. These processes between supply and demand entail additional costs in terms of transportation, storage, drying, milling, and other postharvest activities. These costs translate into added value of specialty rice (SR). Since SR has premium qualities, it is expected that this industry's marketing system may differ from the system commonly practiced for ordinary white rice. As demand for SR increases through time, production must keep up and be linked to consumers through sustained marketing. The marketing aspect of SR industry provides a great opportunity for farmers to increase their profit through value addition. Thus, SR farmers must not stop with the production aspect but also venture into marketing activities.

This section discusses the existing marketing practices in the SR industry. Geographical movements of paddy and milled rice from the producing areas to the consumers are determined. The market key players and their roles in linking production and consumption are also presented. The costs associated with the activities are estimated. Value added through each activity as reflected in the price structure is analyzed. Lastly, recommendations are provided to improve the marketing system of SR.

## Geographical flow of SR

Geographical flow gives a snapshot of the movement of paddy and milled rice from the point of production to consumption areas. In Oriental Mindoro, aromatic rice moves either in paddy or milled form (Figure 8.1). Fresh paddy is shipped from Mindoro to Batangas. This occurs during harvest season when millers from Batangas commission a local agent from Oriental Mindoro to procure fresh paddy directly from the farmers for them. Afterward, paddy is processed into milled rice in Batangas. Another way of movement is in milled rice form. Pre-sale processing happens in Calapan City because modern drying and milling facilities are available in the area. Milled rice is shipped from Calapan to Batangas port. From hereon, the product is delivered within the province of Batangas and then to Cavite, Laguna, Metro Manila, and as far as Bulacan, indicating widespread distribution of aromatic rice.

Figure 8.2 illustrates the movement of aromatic rice in Apayao. The movement of aromatic rice differs between Upper and Lower Apayao. In Upper Apayao, aromatic rice is marketed within the area since it is far from the trading areas in nearby provinces. The volume of produce that the farmers are willing to sell sufficiently meets the demand in the area. Fortunately, available facilities for drying, custom milling, and storage are enough to process paddy into milled rice.

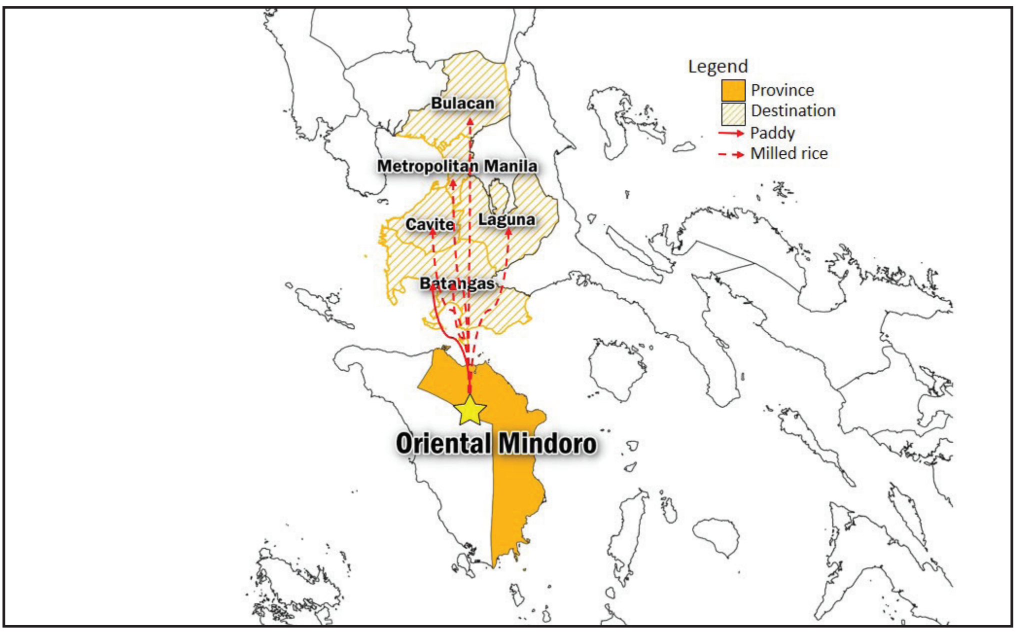



**Figure 8.1.** Geographical flow of aromatic rice in Oriental Mindoro.

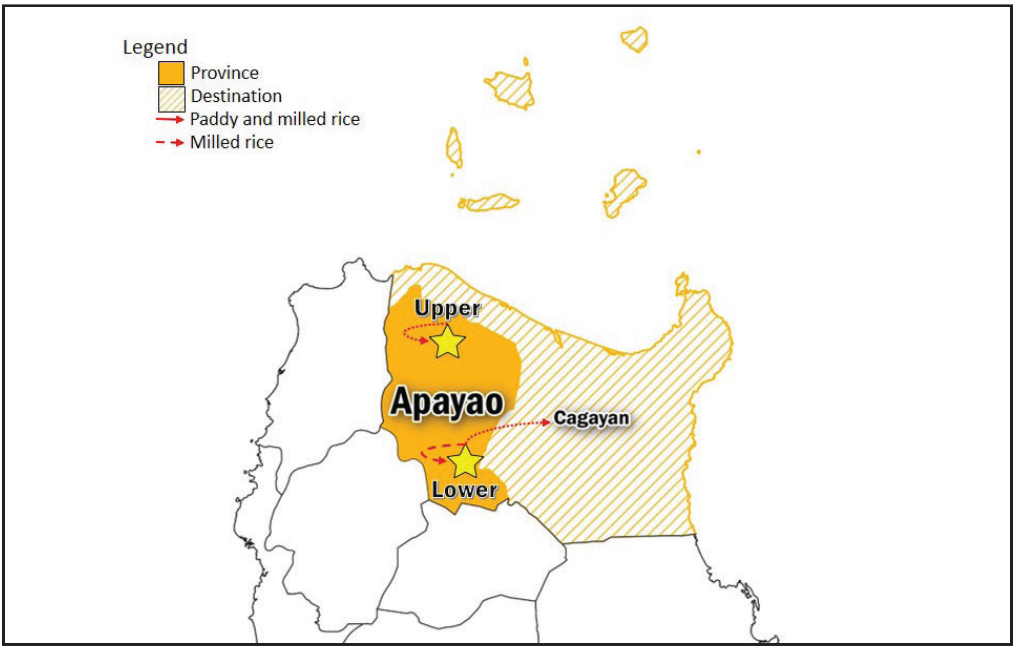



**Figure 8.2.** Geographical flow of aromatic rice in Apayao.

In Lower Apayao, aromatic rice moves as paddy and in milled rice form. As dried paddy, it moves from Kabugao and Conner and is sold in the trading area of Tuao, Cagayan. On the other hand, as milled rice, it is sold within Lower Apayao or in the towns of Tuao and Solana. The presence of milling facilities in Kabugao and Conner made this possible.

Glutinous rice is being marketed by farmers both as paddy and in milled form in Camarines Sur. Selling in milled form is possible due to the presence of numerous rice mills in the area. The high demand for glutinous rice allows the farmers to sell around 50% of their output within the municipality of Ocampo (Figure 8.3). Selling within the production areas would also entail lower transportation cost to farmers. Moreover, the remaining amount of milled rice is brought to other provinces through paddy and rice traders. They would supply adjacent provinces, such as Camarines Norte and Albay. Mostly through orders, glutinous rice is also distributed and sold in the CALABARZON region (e.g., Batangas, Cavite, and Rizal) and in Metro Manila.

In Negros Occidental (Figure 8.4), the existing demand for black rice enables farmers to sell it in milled rice form directly to consumers. In addition, they also sell paddy to rice millers and paddy traders. Majority of the black

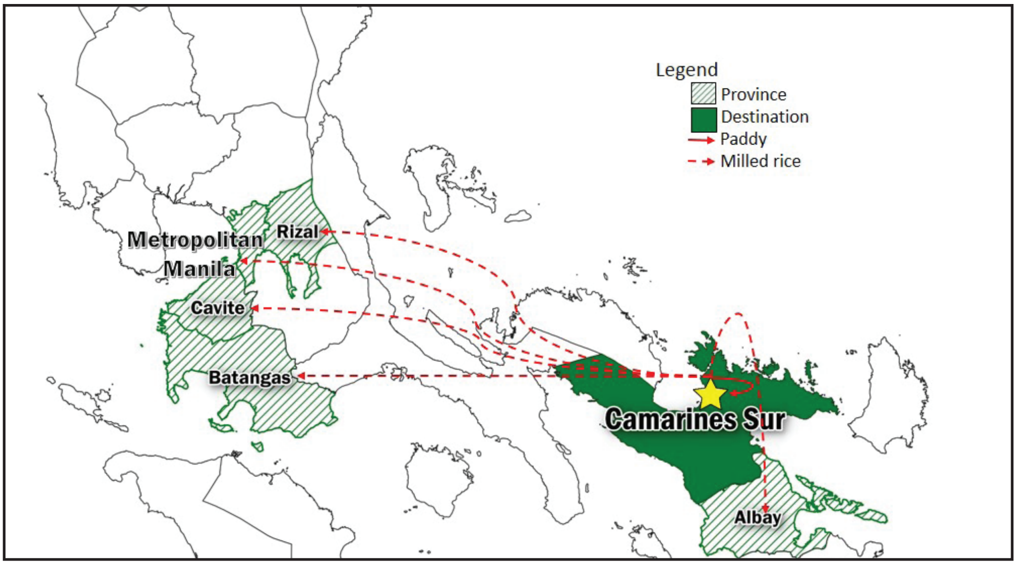



**Figure 8.3.** Geographical flow of glutinous rice in Camarines Sur.

rice-producing municipalities supply black rice to Bacolod City, the center in the province. A portion of the marketable surplus in the municipality of Don Salvador Benedicto (DSB) is shipped to Cebu province. Geographically, DSB is near the port of San Carlos City, which allows farmers to have access to traders coming from Cebu.

As for *Dinorado* red rice of North Cotabato, most of the demand comes from the Islamic areas of Lanao Del Sur and Maguindanao. Historically, they have adapted the taste and texture of red rice. Depending on customers' preference, red rice is demanded either in paddy or milled rice forms. Millers usually order in paddy form, while wholesalers and retailers order milled rice. As *Dinorado* red rice provides nutritional benefits, there is big demand from people wishing to have better and healthier diet. Thus, the produce of North Cotabato reaches the provinces of Misamis Oriental and Bukidnon (Figure 8.5).

## Market players

Different market players have roles in bringing the product from production to consumption. Once harvested, paddy undergoes a series of postharvest processes, which may be simple or intricate, until it transforms into rice and reaches the consumers' plate. This section presents the market players for SR, describing their roles and connection. This also shows the distribution of how and to whom farmers sell their output, including the estimated costs incurred for the whole process. Overall, the major players observed in the SR market channels (paddy traders, millers, and rice traders) are also found in ordinary white rice market. In special cases, cooperatives play the role of assemblers, millers, and rice traders.

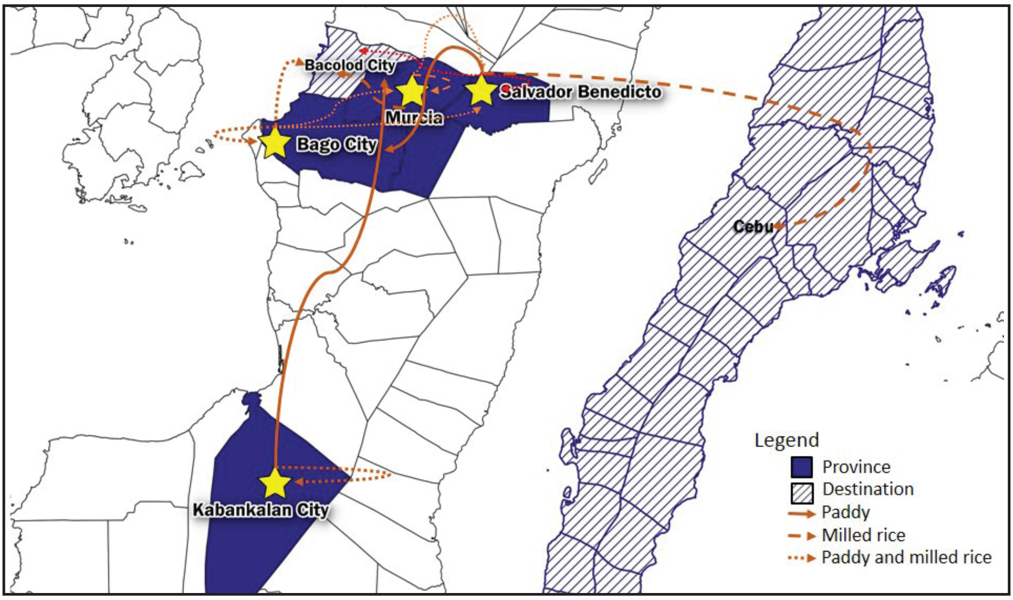



**Figure 8.4.** Geographical flow of black rice in Negros Occidental.

***Paddy traders***

Paddy traders procure fresh paddy from farmers and perform drying activities. They also act as assembler for millers who cannot procure directly from farmers. They shoulder the transportation and handling (loading and unloading) expenses from source to destination. In some cases, paddy traders also perform wholesaling and retailing services. Paddy traders *cum* wholesalers/retailers may have rice stores but not milling facilities. Thus, they avail of custom milling services from local millers. Included in the milling fee charged to them is the storage fee as these traders wait for a higher price before selling the output.

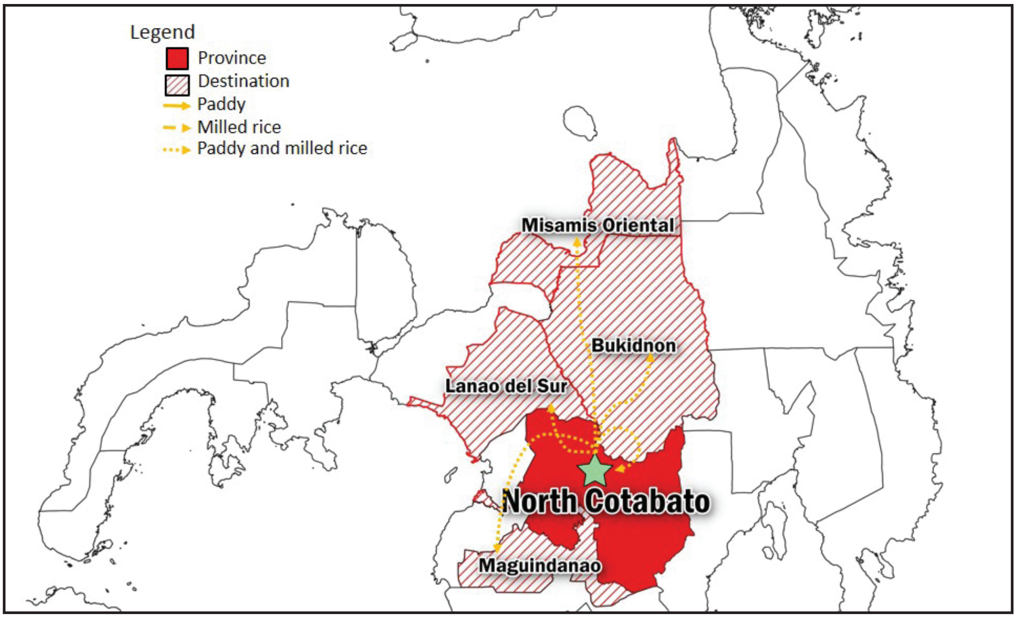



**Figure 8.5.** Geographical flow of red rice in North Cotabato.

*Millers*

Millers account for the largest value addition in rice as they perform processing activities. These players may procure paddy directly from farmers either picked up from the source or delivered by the farmers. Millers shoulder the handling expenses. Once procured, drying takes place in the miller's drying pavement. There are also a significant number of cases where millers buy through their agents, which requires a commission fee. They can also purchase dry paddy through the traders. They also provide storage facilities for paddy/rice traders for a certain fee.

Small-scale production usually requires single-pass milling facilities only. Such type of milling facility is ideal for black and red rice to retain the pigment. For large-scale business, multi-pass milling facilities are available to cater to a large volume of paddy (usually for aromatic rice since this is regarded as table rice). Aside from dehullers, these facilities may have aspirators, separators, whiteners, mist polishers, sorters, graders, and mixers.

Aside from processing rice for selling, some millers also offer custom milling services. As mentioned earlier, such services are availed of by paddy traders *cum* wholesalers because they do not own a milling facility despite having rice stations.

Custom milling services are also popular among farmer households that process rice for their own consumption. These customers are charged either in cash or in kind.

### *Wholesalers*

After processing, output is shipped to wholesalers within or outside the vicinity. Millers shoulder the loading expenses, whereas wholesalers pay for the transportation and unloading fees. These wholesalers would sell milled rice through bulk orders to supermarkets, grocery stores, and retailers. As wholesalers need to procure in large volume, they are always in need of storage area and delivery vehicles. Additional cost incurred at this level includes storing, packaging, branding, and shipping to retail outlets.

Majority of wholesalers operate in the major cities and other urban areas in the country such as Metro Manila, Metro Cebu, Iloilo, Cagayan de Oro, General Santos, and Davao. Some big wholesalers have also imported rice from other countries, even before the Rice Trade Liberalization Law (RTL) (Mataia et al., 2018). As dictated by the nature of their business, wholesalers have vast networks and immense knowledge about rice marketing and pricing. There are also cases where these wholesalers have their own retail stores in their respective towns.

### *Retailers*

The rice retailers' role is to buy milled rice for direct reselling to the ultimate consumers. They normally procure milled rice in small volume as most of them do not have spacious storage area. Display fee and packaging fee are the additional cost incurred at this level. Mataia et al. (2018) categorize rice retailers into two classes, traditional and modern. Traditional retailers are those who rent stalls in the public market or have their own *sari-sari* stores. They normally sell milled rice along with other products such as daily household needs, animal feed, planting materials, and other agro-vet supplies.

In comparison, modern retailers include big groceries, convenience stores, supermarkets, and hypermarkets. These retailers have a more formal way of doing business. They purchase regularly from established suppliers such as corporations, known wholesalers, and millers. Convenience and quality are their promoted edge in selling milled rice.

### *Cooperatives*

As observed in the SR market channels, some of the farmer groups operate as cooperatives. These cooperatives allow farmers to consolidate a bigger volume of harvests. This gives them the opportunity to be connected to institutional consumers, thus, providing them with sure buyers. Farmer-members pledge a certain volume of their harvest to the cooperative to achieve the target volume. Another advantage of organizing cooperatives is that the farmers' harvests are dried and processed at the cooperative-owned postharvest facilities. Once processed, outputs are sold to supermarkets, grocery stores, or retail stores. Products can also be displayed at exhibits. These cooperatives can also serve as a gateway for export opportunities.

**What is a COOPERATIVE?**

As stated by University of California (2020), a cooperative "is a private business organization that is owned and controlled by the people who use its products, supplies or services." Moreover, it is defined by the International Co-Operative Alliance as "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise."

One type is an agricultural cooperative. In the Philippine agriculture setting, cooperatives were initiated during the commencement of the agrarian reform program in order to the boost the small-hold farm industry. Agricultural cooperatives engage in seed-to-seed processes, postharvest and marketing activities, and financial matters (Araullo, 2006).

## Market channels by SR type

There are significant differences in how different types of SR are marketed by farmers. It could be sold as paddy or milled rice. It could also pass through various channels before it reaches the final consumers or it could be sold directly to the consumer as milled rice. These variations, including the various marketing activities, done are shown in the following discussions and diagrams that explain how each type of SR is marketed from the farmers' field to the consumer.

### *Modern aromatic rice*

Figure 8.6 shows that farmers sell their produce either to traders or rice millers. On the average, 51% of the marketable surplus is sold to paddy traders who dry the paddy and transport it to custom millers who then act as rice wholesalers. The other 49% is marketed to rice millers who procure paddy either directly from the farmers or through a local commissioned agent. The latter assembles and facilitates the delivery of paddy to the miller's facility. The peak period of procurement for traders or millers is during the harvest seasons, which are from September to October (wet season, WS) and March (dry season, DS). Most of the products come from the towns of Calapan, Naujan, and Victoria where modern aromatic rice such as NSIC Rc 218 are produced. The mode of sale can either be through pick-up or delivery, depending on the resources and capital availability of the farmer.

Handling cost is shouldered by the trader or miller when the product arrives in their area. Paddy is then prepared immediately for drying, which is done in drying pavements of milling facilities. During DS, solar drying for 2-3 days is enough to achieve the desirable MC of 13-14%. However, when the drying pavement capacity is not enough to accommodate the total volume of fresh paddy to be dried, millers/traders usually practice solar drying for a day, then continue with mechanical drying. Through these combined methods, they are able to ensure the proper MC of paddy before storage. In WS, millers and traders still try to perform solar drying if the weather would allow it; otherwise, they employ mechanical drying for 2-3 days.

Paddy traders *cum* wholesalers pay custom millers in order to mill dried paddy. Common millers in Calapan and Naujan are big businesses with modern double-pass milling machines with color sorter. They have more than four units of mechanical dryer. Their facilities also include a spacious drying pavement, garage, and storage areas. During peak periods, most mills operate for more than 12 hours per day. During a typical period, operation lasts for 8 hours per day. Note that some millers also own rice fields planted with aromatic rice. Milled rice is kept in storage facilities of custom millers until the buying price of milled rice becomes favorable. Frequently, they sell their produce during the lean period (August) and Christmas season, when the price of aromatic rice is at its peak (more than P50 $kg^{-1}$ wholesale).

Modern aromatic varieties from Oriental Mindoro have 62% milling recovery. More than 90% of this portion is head rice, while broken rice is only around 8%. Broken rice can be sold at P12.58 $kg^{-1}$. Meanwhile, bran accounts for 9%, which has an average price of P12 $kg^{-1}$. The remaining portion is composed of coarse bran and hull. Millers frequently use the hull as fuel for mechanical drying. They also sell rice hull to companies that produce hollow blocks.

Processed rice is stored in the warehouse until the miller sells it to mainland Luzon or a wholesaler directly procures it. The delivery cost varies from

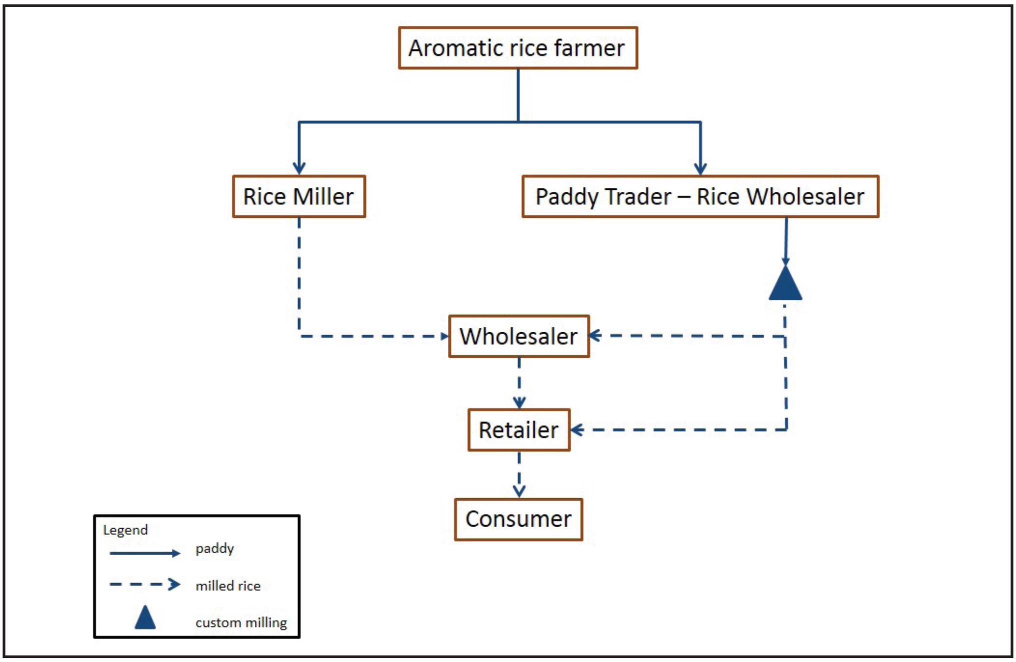



**Figure 8.6.** Marketing channels of aromatic rice in Oriental Mindoro.

P50 to P75 $sack^{-1}$, depending on the distance from the unloading site. The cost of delivery includes fuel, shipping, handling, and truck driver's fee. Shipping fee is also incurred in bringing rice to the mainland using a boat or a ship. Unloading of sacks is another expense for the wholesaler after the arrival of the delivery truck. Most of these wholesalers have already developed a strong business relationship with local millers in Mindoro, thus, only a phone call is needed to settle the deal between them. The wholesalers commonly distribute Mindoro's aromatic rice in Luzon, mostly to retailers. Often, wholesalers also have their own outlets and act as retailers.

Retailers within Calapan and Naujan source their products directly from the millers. They usually incur a transport cost of P10-20 sack$^{-1}$. They also shoulder the handling during the procurement, which is P2 sack$^{-1}$ for every move. Retailers display their procured rice inside their rented stalls in the market. In a month, they usually incur P3,300 up to P3,700 for both rental and electricity fees. The plastic bags used for packaging usually cost them P1,000-4,000 per month, depending on their sale.

On average, retailers from both Calapan and Naujan charge the same markup (P 50-100 sack$^{-1}$) for premium-milled aromatic rice. Regularly milled aromatic rice is also available in Naujan. Some retailers in Naujan custom-mill either their own produce or procured paddy in small single-pass milling facility located in their town only. Thus, the appearance of this rice is inferior to that of one coming from a modern milling facility with misting function. This commands a lower price than premium-milled rice even if the variety and inherent qualities are the same.

***Traditional aromatic rice***

The situation of farmers in Upper Apayao deviates from the general situation in the province (Figure 8.7). Farmers in the area do not actively participate in the market. Most of them solar-dry, custom-mill, and consume their produce. Aromatic rice in Upper Apayao is occasionally sold since harvests are mainly allocated for home consumption. Farmers only engage in marketing if there is a surplus. Another reason for the occasional marketing is that during postharvest period, farmers exchange their supply to cheaper ordinary white rice if their harvests would not suffice family consumption until the next cropping season.

Aromatic rice farmers in Upper Apayao are selling within the municipality as reflected by the existing practices in the area. On the average, more than half (54%) of the marketable surplus was custom-milled to reach retailers and consumers. When farmers decide to mill another batch of harvests, they transport their produce to custom millers through a hired hauler. These haulers transport produce using private vehicles, motorcycles, "*kulong-kulong*" or "*kuliglig*". As practiced, the miller would automatically deduct one-eighth to one-fourth portion of the output as an in-kind payment. From this collected portion, one-third will be given to the hauler and two-thirds will be kept by the custom miller as payment for the service. If the custom miller is able to mill 2,500 sacks from

September to January, around 100 sacks of milled aromatic rice will be paid to them by the farmers. This volume will be sold by the custom miller directly to household consumers. The haulers and the laborers of the millers who also have their own share may also sell their accumulated rice to the neighborhood. After the period of harvest, a small volume of aromatic rice is milled until the month of July. During lean months, the custom miller commonly collects only around a sack per month. Farmers may pay in cash, which would be equal to the monetary value of the in-kind payment to avoid deduction from their rice supply. Retailers in municipality of Pudtol are open to this kind of trade.

In Lower Apayao (Kabugao and Conner), miller-traders are present in the market channels. Farmers solar-dry and store their produce near their production areas. They consider this venture as a source of income, so they actively sell their rice surplus. Also, they prefer to avoid any deduction from their rice supply, hence, they pay in cash rather than in-kind. Custom millers charge P50 for every can of milled rice. They sell dried paddy during the months of October to November, then transport the output from their storage unit in the upland to the lowland using manual labor or carts pulled by carabaos. Paddy would be loaded in private vehicles or multi-cabs to be delivered to miller-trader stations.

The custom millers of Lower Apayao use diesel-powered, small, single-pass milling machines. The milling recovery of aromatic rice ranges from 50% to 60%, with only 1-2% broken. Bran is around 10% to 20% with a price of P7-12 $kg^{-1}$. Rice hull on the average have 22-25% share in the recovery. Sometimes, the miller uses the hull as additional fertilizer for their own agricultural venture.

Miller-traders procure dry paddy and mill a little portion to be sold to *sari-sari* stores and grocery shops. The major portion of the accumulated dried paddy is delivered to rice retailers in Tuao, Cagayan. These retailers facilitate the custom milling of paddy. Normally, the fee for milling is P 2.5 $kg^{-1}$ of output rice. Retailers also shoulder the handling and transport cost to and back from the custom miller. Milled rice would be stored and displayed in the rented stores of retailers.

Most of the retailers in Upper Apayao are located in public markets where they store and display their product. They usually incur a monthly rental and electricity fee of P1,750. Commonly, retailers hire one assistant for the store with an average salary of P5,000-6,000 per month. They also have to pay the necessary permit, ranging from P15,000 to P30,000 in a year. To expand sales, some retailers in Upper Apayao have *sari-sari* store partners where they can also display and sell their product. In contrast, retailers from Lower Apayao do not have stalls in the public markets. The retailers in Lower Apayao are usually big *sari-sari* stores or mini-groceries.

In general, retailers of traditional aromatic rice perceive the product as a fast-moving item. After displaying the item, they expect it to be sold within 2 weeks. This shows that demand for traditional aromatic rice is high and the supply side cannot fill the gap as of this time. Also, data collected from the survey showed that some farmers sometimes sell milled rice to their friends or relatives who have rice retail stores in Benguet and Mountain Province. It is worthy to note that demand is not just within Apayao but also extends to nearby provinces and cities.

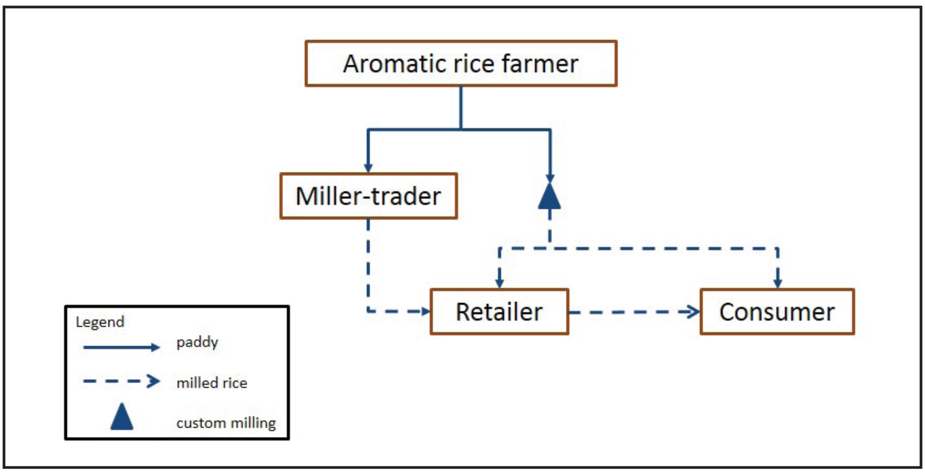



**Figure 8.7.** Marketing channels of aromatic rice in Apayao.

### *Glutinous rice*

Figure 8.8 shows that glutinous rice from Camarines Sur passes through various market players before reaching the consumers. Twenty six percent of the glutinous rice supply is sold to paddy traders and 25% to rice millers. The peak season of procurement is usually from September to November (WS) and March to April (DS). Traders procure fresh paddy from farmers in Ocampo and Pili and spend P 0.20 $kg^{-1}$ for the pick-up. They then shoulder the costs for loading and unloading of procured paddy at P 0.10 $kg^{-1}$. For drying, the solar method is adopted, which usually lasts for 2 days. If the desirable MC level is still not achieved, some traders and millers would use mechanical drying for another 2 days. Overall, the drying activity costs P 0.60 $kg^{-1}$.

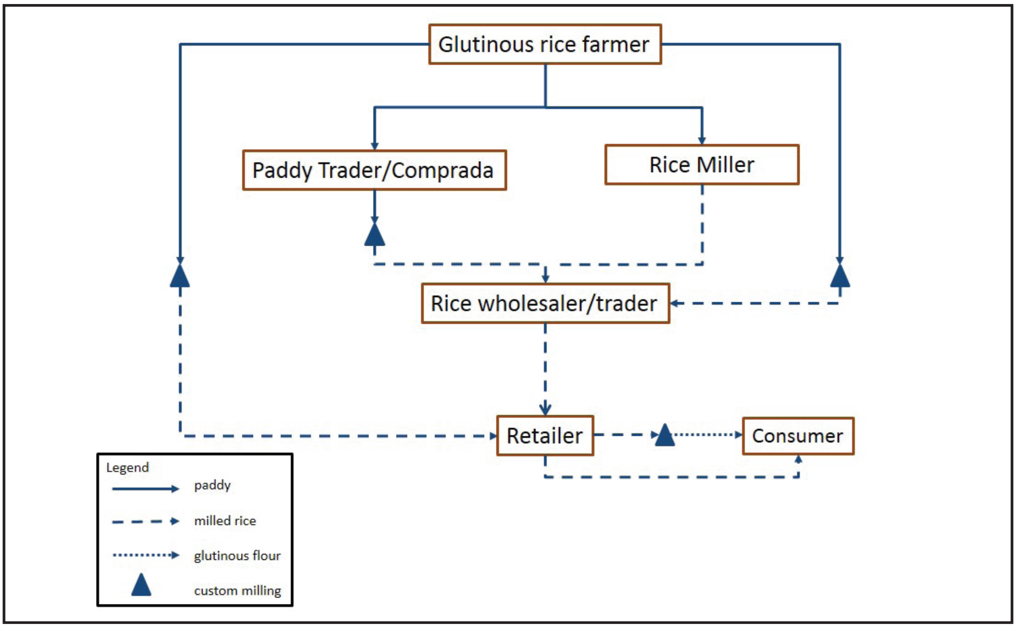



**Figure 8.8.** Marketing channels of glutinous rice in Camarines Sur.

Rice millers provide custom-milling services to traders and farmers aside from processing their own procured paddy. Customers are charged with P 1.88 $kg^{-1}$ for the milling services. Single-pass mill is the most commonly used facility in the area with a capacity of 8 to 10 bags per hour. During peak seasons, milling facilities can operate up to 7 days a week, 24 hours a day, depending on current demand. For the remaining months, milling facilities may only run for 4-6 hours per day as needed.

Glutinous rice in the area has a milling recovery of 50%. Eighty percent of this recovered portion is head rice, while 20% is broken rice. The remaining 50% comes out as rice hull (17%), rice grit (10%), and rice bran (23%). Rice hull and rice bran are usually sold at P1.50 $kg^{-1}$ and P10 $kg^{-1}$, respectively. Rice grit, on the other hand, is typically given away. However, there are a few who sell this at P10 to P20 $kg^{-1}$.

Traders and millers sell milled rice to wholesalers. The peak season of milled rice disposal is from March to April and from August to December. The high volume of marketed glutinous rice can be attributed to numerous special occasions celebrated during these months. There are a few orders from May to July, only around half of the total volume sold during peak season is being marketed. At an average market price of P53 $kg^{-1}$, milled glutinous rice is usually sold around Camarines Sur, Albay, and Metro Manila. Around 90% of the total volume sold to wholesalers is picked-up, while the remaining 10% is delivered. For pick-up, millers and traders only shoulder the loading fee. If delivered, transportation costs may range from P25 to P50 $sack^{-1}$ (average of P1.44 $kg^{-1}$), depending on the distance from the point of sale to the destination. This cost already includes the driver's fee and fuel cost. Another payment will be given to those who load and unload the output, usually at P5 per movement.

The other half of the farmer-respondents resort to custom milling so that they can sell 24% and 25% of the supply to wholesalers and retailers, respectively. In this way, they are able to generate higher revenue due to better market prices. These market outlets are stationed in Camarines Sur, Camarines Norte, Albay, and Batangas. Some of the farmer-respondents deliver glutinous milled rice with an average delivery cost of P2.75 $kg^{-1}$, while others have pick-up agreements with their buyers.

After procuring milled rice either through pick-up or delivery, rice wholesalers continue the chain by delivering to retailers located in Camarines Sur, Camarines Norte, Batangas, Cavite, and Metro Manila. Deliveries made within Camarines Sur incur a transportation cost of P30 $sack^{-1}$. Transactions with retailers from adjacent provinces would entail a charge of P50 $sack^{-1}$ for the delivery. For distant areas such as Manila, transportation may cost up to P80 $sack^{-1}$. Aside from this, cost for hauling labor at P10 $sack^{-1}$ is added. Average selling price imposed by wholesalers surges at P50 $kg^{-1}$, accounting for all the additional costs.

Even if custom milling is a predominant practice in the area, selling milled rice directly to consumers is not observed. All glutinous rice circulating in the market are consolidated in the retail level before reaching the consumers. These retailers either sell milled rice directly to consumers or have it custom-milled to be processed as glutinous flour.

***Black rice***

Market channels of black rice in Negros Occidental involve several key players, but they are generally simpler (only two levels) until consumption area is reached (Figure 8.9). This can be explained by the significant percentage of farmers who occasionally sell their produce. In general, custom milling is a typical practice in the area. Peak season of milling is September to October. The common milling facility used is a single-pass mill with a capacity of 1,250 kg processed for 12 straight hours. Milling fee is P1.73 kg$^{-1}$. Once processed, 60% is recovered as milled rice. Rice bran is sometimes given away or sold at P8 kg$^{-1}$ while rice hull is used as fuel for milling facilities. Only 14% of the supply is sold in paddy form to rice millers.

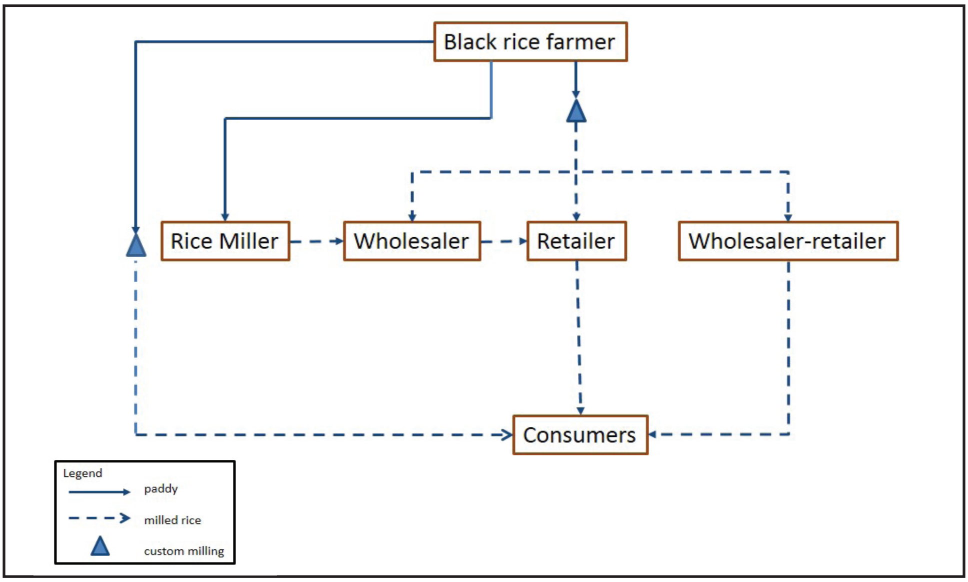



**Figure 8.9.** Marketing channels of black rice in Negros Occidental.

As a common practice, farmers have their harvests custom-milled for their own whole-year consumption. Once the estimated annual consumption needs are satisfied, surplus from the custom-milled rice is sold directly to consumers (29%), usually within the area. Majority of this volume is picked up by buyers, implying no transportation cost to farmers.

More than half of the supply (57%) is custom-milled, which is picked up and bought by wholesalers, wholesaler-retailers, and retailers at P0.61 kg$^{-1}$ delivery cost. Some of these outlets operate as cooperatives and they procure black rice in bulk from local municipalities. The distance from the farm to the storage area of the cooperative is around 70 km. The black rice acquired is then displayed and sold in Bacolod City usually during Saturdays. These are either vacuum-packed (may vary as 1, 2, or 5 kg) or sold in a 50-kg sack at P65-70 kg$^{-1}$.

***Red rice***

As previously discussed, the traditional *Dinorado* red rice of North Cotabato is planted by the upland farmers. Majority of these farmers are from the municipalities of Alamada, M'lang, and Pigkawayan. After harvest, some farmers sell rice to paddy traders – rice wholesalers, while others sell to millers (Figure 8.10). On the average, 23% and 36% of the supply is sold to paddy traders *cum* wholesalers and millers, respectively. The trader-wholesalers and the millers commonly procure paddy at P20-22 $kg^{-1}$. Aside from basic qualities of the grain, the intensity of pigmentation is likewise assessed: the higher the intensity of redness, the higher the market price.

After selling their fresh paddy, the farmers facilitate the drying of the remaining harvests. They only employ 2-3 days of solar drying to ensure proper MC of paddy before storage. Meanwhile, millers and trader-wholesalers would also facilitate the pre-sale processing of fresh paddy they procure. The trader-wholesalers would pick up the product and would proceed to solar drying for 2-3 days. In the case of millers, they would prioritize solar drying, but in the event of bad weather, they could resort to mechanical drying since they own such an equipment. The average drying losses of red rice is 15%. Some farmers dry first their produce before selling it to either miller or trader-wholesaler, with a markup of P1 $kg^{-1}$.

Aside from being sold as paddy, rice may often be custom-milled (41%) in order to cater to wholesalers and retailers. The outlets of farmers for milled rice are the wholesalers and retailers in the local area. This percentage also accounts for the speedy transactions as farmers need to sell to get emergency fund.

The millers of North Cotabato, particularly those in Midsayap, Pigkawayan, and M'lang, have modern milling machinery (double-pass with sorter), mechanical dryers, hauling trucks, spacious garage, and big warehouses. Moreover, they also have drying pavements that can accommodate 800-1,000 bags of paddy. Millers in the area follow a standard milling fee of P1.80 $kg^{-1}$. Millers then sell these through their own retail stores or to wholesalers in Cotabato City and other Islamic areas. It is common for millers to 'ride-on' the red rice in their deliveries of ordinary rice to wholesalers.

The milling recovery of *Dinorado* red rice is relatively high, ranging from 55% to 71%. Head rice recovery, which is greatly affected by the drying process, can range from 45% to 70%. Bran accounts for 10% to 15% with a price of P11 $kg^{-1}$. Unlike the bran of ordinary rice, that of red rice is usually thrown away. Due to color, animal growers are hesitant to use it as feed additive. The remaining portion would account for the hull (20-30%), which are left to decompose and sometimes used for composting.

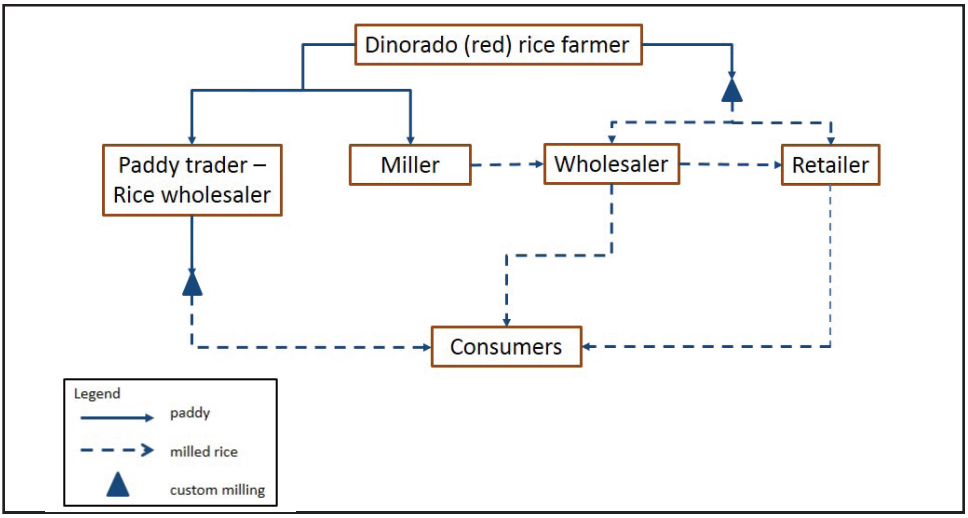



**Figure 8.10.** Marketing channels of red rice in North Cotabato.

The trader-wholesaler, on the other hand, acts as the consolidator of the upland produce. Commonly, he would have a strong business relationship with the farmers. Unlike the millers, the trader wholesaler would pick up the upland produce from the highland. They have various outlets such as millers, wholesalers, and cooperatives. The trader-wholesaler is willing to sell fresh paddy during harvest period. Either way, he can also sell dried or milled rice on- or off-harvest season. Just like the miller, the trader-miller also reaches customers from far provinces. When the trader-wholesaler needs to sell in milled rice form, he employs the services of custom millers.

The wholesalers of *Dinorado* red rice are located in different cities and provinces in Mindanao. These wholesalers normally have their own retail outlets. For wholesale, they usually charge a markup of P30-50 sack$^{-1}$; it is P150 sack$^{-1}$ for retail. Wholesalers in far provinces usually prefer products to be delivered while wholesalers from nearby areas such as Cotabato City are willing to pick up the product at a cost of P25 sack$^{-1}$. Wholesaler peak of procurement is from August to September.

Retailers of *Dinorado* red rice outside North Cotabato source their product from the wholesaler and charge P100-150 sack$^{-1}$ markup for the product. On the other hand, retailers within North Cotabato source their product from the farmers. Local retailers can buy from friends or relatives who grow upland red rice. On average, retailers of red rice incur around P3,000-5,000 month$^{-1}$ for both rent and electricity in a month and P200-600 day$^{-1}$ for labor, while the cost incurred for plastic used for packaging sums up to P2000 month$^{-1}$.

## Market costs and price structure

It has been established that paddy passes through two or more channels before it reaches the final consumers.  Similarly, it undergoes various processes such as drying, storage, milling, transport, and packaging before it is ready for final consumption. Consequently, it could be expected that it would incur costs along the way. The price of the product would thus increase as it moves from channel to channel up to the end-user. This is due to the charging of pre-sale processes/services and the addition of marketing gains in each channel.

Table 8.1 presents the total marketing cost for each type of SR. The major marketing costs included in this analysis are drying, transport, milling, storage, packaging, and cost of working capital. Across all SR types, milling cost had the largest share of total marketing cost. Commonly used milling facilities are modernized and require electricity and fuel, thus, adding costs on top of labor expenses. The operation of milling facilities at full capacity also imposes additional cost on repair and maintenance.

Transportation accounts for the second largest share in total marketing cost. This includes expenses in moving the product from the farm to the wholesale market: loading, unloading, shipping, and delivery. Transporting paddy and rice uses vehicles such as multi-cabs and hauling trucks, requiring costs for fuel and driver's fee. Some use manual labor or a cart pulled by a carabao. The differences in transportation cost across SR types are due to geographical situation. As mentioned earlier, transport of modern aromatic rice in Oriental Mindoro entails the addition of shipping fee to cater to demand from mainland Luzon. On the other hand, glutinous rice in Camarines Sur outflows outside Bicol region, giving off higher transportation cost.

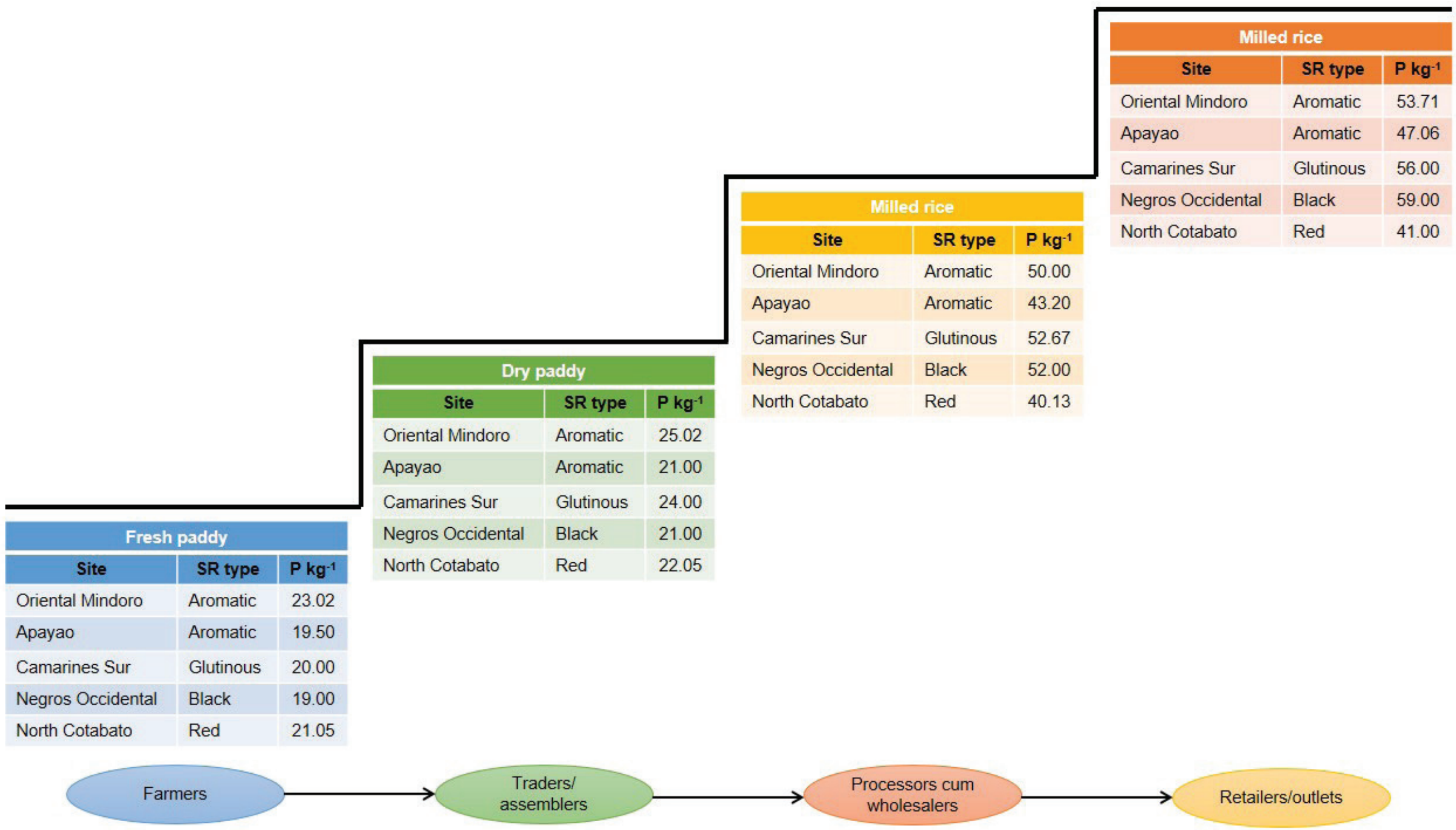
Drying is another major postharvest activity that contributes to total marketing cost. Drying cost covers labor expenses in undertaking this postharvest activity. Solar drying is the most commonly used method. Some farmers use mechanical dryers after solar drying, thus further adding to the cost. In between postharvest activities, paddy and rice are stored in warehouses. In the absence of storage cost, the estimated storage fee of P0.19 $kg^{-1}$ is adopted based on recommendations from the book *Competitiveness of Philippine Rice in Asia* (Beltran et al., 2016). As to packaging cost, sacks for paddy and plastic for milled rice are considered.

**Table 8.1.** Major costs of marketing milled specialty rice in selected provinces, Philippines.

| Item | Modern aromatic rice | Traditional aromatic rice | Glutinous rice | Black rice | Red rice |
|---|---|---|---|---|---|
| Drying cost | 0.13 | 0.67 | 0.43 | 0.37 | 0.27 |
| Transport cost | 1.25 | 0.83 | 1.47 | 0.61 | 0.74 |
| Milling cost | 2.32 | 2.50 | 1.88 | 1.73 | 1.80 |
| Storage cost | 0.19 | 0.19 | 0.19 | 0.19 | 0.19 |
| Packaging cost | 0.20 | 0.25 | 0.40 | 0.37 | 0.20 |
| Cost of working capital | 0.61 | 0.59 | 0.66 | 0.58 | 0.55 |
| Total major marketing cost (peso $kg^{-1}$) | 4.71 | 5.03 | 5.03 | 3.85 | 3.75 |

To compute for the cost of working capital, dry paddy price is multiplied by the prevailing interest rate of banks in the Philippines and by the storage period. Interest rate used in this study is 6% per annum and common storage period is 3 months. For standardization, results are converted into milled rice equivalent using milling recovery. Since glutinous rice and modern aromatic rice have the highest dry paddy price among the SR types, marketing of these two types incurred the highest cost of working capital.

Marketing costs result in higher price value every time SR crosses another market intermediary. In Figure 8.11, the market price for each level is presented. Note that these prices may slightly differ from the farm household survey results since these were extracted from the market player survey. SR farmgate prices, in general, are higher compared with that of ordinary white rice. At the trader/assembler level, price increases by P1-4 $kg^{-1}$. This margin covers the cost of drying, transporting, and marketing returns of the trader. Prices indicated in the figure with the approximation sign (~) are just estimates, since the study revealed that no such form is sold in the area as discussed in the previous parts. These prices were estimated based on the cost of drying in the respective areas.




| Fresh paddy | | |
|---|---|---|
| Site | SR type | P $kg^{-1}$ |
| Oriental Mindoro | Aromatic | 23.02 |
| Apayao | Aromatic | 19.50 |
| Camarines Sur | Glutinous | 20.00 |
| Negros Occidental | Black | 19.00 |
| North Cotabato | Red | 21.05 |

| Dry paddy | | |
|---|---|---|
| Site | SR type | P $kg^{-1}$ |
| Oriental Mindoro | Aromatic | 25.02 |
| Apayao | Aromatic | 21.00 |
| Camarines Sur | Glutinous | 24.00 |
| Negros Occidental | Black | 21.00 |
| North Cotabato | Red | 22.05 |

| Milled rice | | |
|---|---|---|
| Site | SR type | P $kg^{-1}$ |
| Oriental Mindoro | Aromatic | 50.00 |
| Apayao | Aromatic | 43.20 |
| Camarines Sur | Glutinous | 52.67 |
| Negros Occidental | Black | 52.00 |
| North Cotabato | Red | 40.13 |

| Milled rice | | |
|---|---|---|
| Site | SR type | P $kg^{-1}$ |
| Oriental Mindoro | Aromatic | 53.71 |
| Apayao | Aromatic | 47.06 |
| Camarines Sur | Glutinous | 56.00 |
| Negros Occidental | Black | 59.00 |
| North Cotabato | Red | 41.00 |

**Figure 8.11.** Price structure of paddy and milled rice by SR type, selected provinces, Philippines.

The selling prices of the miller *cum* wholesaler are doubled that of their procurement price. This happens as costs for milling, operation, packaging, handling, and transporting are included in this margin. In addition, this channel also has to account for their gains in their selling price. Their gains should be enough to cover management and capital cost.

From the miller *cum* wholesaler, the product is passed to retailers. The marginal increase in price ranges from P1 to P7 $kg^{-1}$, depending on the packaging and branding strategy adopted by retailers. Notably, the market price of milled black rice in Negros Occidental at the retail level has the highest margin as this type of rice is commonly sold in supermarkets and grocery stores. Certainly, retailers also consider profit and cost of capital in their pricing method. Since the margin that retailers put on top of their procurement cost is just less than 5%, the way for them to earn a living is to rely largely on the volume of sales.

## Summary and implications

The inflow and outflow systems of SR in one area differ from another area based on geographic situation, type of rice, and availability of postharvest facilities. The volume of SR planted in the upland areas commonly revolves within the production vicinity and nearby provinces. Varieties usually planted in lowland areas (such as modern aromatic rice of Oriental Mindoro and glutinous rice of Camarines Sur) have attained consumer demand from farther provinces. Outflow of these types implies higher transportation cost. The availability of postharvest facilities within the province allows the inflow of SR in milled form.

In terms of postharvest activities, there are common practices observed across marketing of all SR types. For one, solar drying is the most prevalent practice, thereby reducing the cost incurred for mechanical drying. As for milling, majority of the machinery used are already modernized. Custom milling is also observed as a common practice. Drying pavements and storage warehouses of millers are commonly used by farmers and traders as they do not own such postharvest facilities.

The high cost of producing SR, coupled with low milling recovery, high marketing costs, and profit margin translate into high milled rice prices. High marketing costs prevent farmers from venturing into the processing and marketing of their produce. With the idea of entering the marketing industry, SR farmers should be able to generate higher income and at the same time reduce the marketing margin.

The marketing system of SR is simpler than that of ordinary white rice as the former usually has two to three levels of market channels. However, since SR has distinct characteristics, SR must be processed separately to maintain its premium qualities. In milling pigmented rice, the requirement is a machine with features that can be adjusted to produce the unpolished or lightly polished form. In addition, separate facilities that could accommodate smaller volumes for processing pigmented rice are needed to avoid mixing of varieties. For glutinous rice, it will be an advantage to farmers if they can market this type in milled rice and flour forms. Many institutional buyers require glutinous flour in bulk volume for their business operation. To take advantage of this opportunity, local postharvest facilities for glutinous flour processing must be made available to farmers.

Instead of individually acquiring the aforementioned facilities, it will be more cost-efficient for farmers to organize cooperatives. Through these cooperatives, postharvest facilities for drying, storage, and milling can be made available to farmer-members at a low cost. Accumulated funds from the collected fees can be used for repair and maintenance of the facilities. This group marketing strategy can also create linkages between farmers and consumers. Farmer-members may pledge a certain volume to be marketed through the cooperatives. The volume obtained from the farmer-members may be packaged and marketed as local products of their area. Organized cooperatives may also look for institutional buyers and make arrangements for the cooperatives to become official suppliers of SR.

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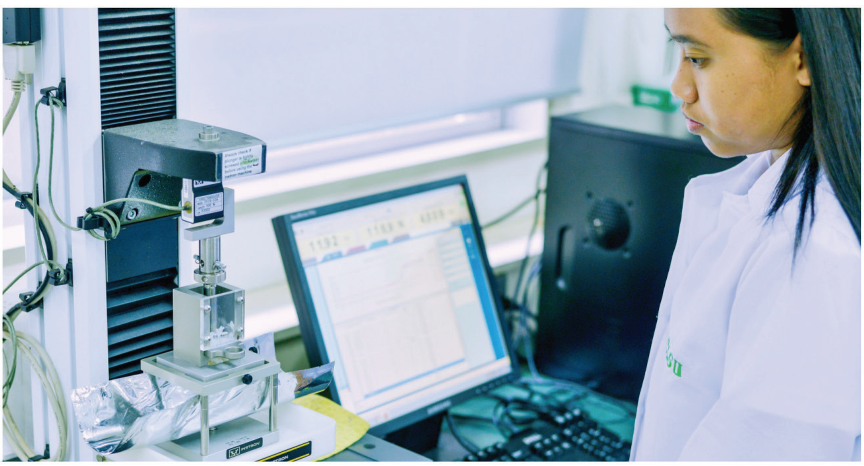
# III

# CHARACTERIZATION OF SPECIALTY RICE



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# GRAIN QUALITY AND HEALTH-PROMOTING PROPERTIES

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As staple food, polished or milled white rice is the most commonly consumed. However, there are other types, the so-called specialty rice (SR), which command a premium price due to their unique quality traits. Included here are aromatic, glutinous, and pigmented rice, specifically black and red rice. These SR have distinct applications or purpose in culinary and food processing beyond just being ordinary boiled table rice.

In the Philippines, the National Cooperative Test (NCT) program is responsible for the evaluation and recommendation of rice lines for registration by the National Seed Industry Council (NSIC) (NCT, 1997). The goal of attaining rice self-sufficiency in the country drives the different local breeding programs to focus on yield in their efforts to produce modern varieties suitable as table rice. Consequently, majority of farmers use certified seeds of these varieties that are approved for commercial release by the NSIC. Interestingly, however, there are farmers who still cultivate SR for economic and/or cultural reasons. Most of these farmers usually utilize traditional rice varieties (TRV) and conventional crop management practices in their SR production, which give them modest yield and income. Recognizing the limitations and challenges SR farmers face in increasing their productivity and profitability, rice breeders have initiated the development and improvement of premium rice, including aromatic, glutinous, and pigmented rice.

With the superior quality traits of SR, it is imperative to evaluate the relevant quality attributes throughout the breeding program. This ensures that the respective quality traits of the different SR are consistently present to qualify as genuine or true-to-type. Rice quality is quite complex as it pertains to a wide array of parameters under the general categories of milling recoveries, physical attributes, physicochemical properties, cooking parameters, sensory characteristics, and nutritional value.

It is well known that rice contains mostly carbohydrates. In addition, there are also other nutrients present, including protein, fiber, good fats, vitamins, and minerals. In pigmented rice, there are other compounds with additional health-promoting properties. Black and red rice contain antioxidants that can scavenge free-radicals, the major cause of common non-communicable diseases such as diabetes, cardiovascular disease, and cancer. There are various kinds of antioxidants in rice, including the anthocyanins and phenolic compounds with hydroxyl groups. These are effective free-radical scavengers. Incidentally, anthocyanins are also the major pigments responsible for the color in rice. In the total antioxidant assay, all compounds that have antioxidant activity are measured, including anthocyanins, phenolics, oryzanol, vitamins, and other antioxidants.

In this study, SR varieties were collected from local farmers in different provinces and subsequently assessed comprehensively for various quality parameters and health-promoting properties. This chapter describes the detailed grain quality and antioxidant profiles of the different SR types grown in the Philippines.

## Grain quality characteristics of SR

### *SR samples and sources*

A total of 63 SR varieties in the form of paddy, categorized into aromatic, glutinous, black, and red rice, were collected from farmers in different project sites in the Philippines. These included Apayao (9), Abra (4), Camarines Sur (2), Oriental Mindoro (6), Iloilo (12), Negros Occidental (7), Samar (5), Bukidnon (8), and North Cotabato (10) with percent distribution shown in Figure 9.1. The samples were cleaned and processed in the Rice Chemistry and Food Science Division (RCFSD) laboratory of PhilRice and stored properly prior to analyses.

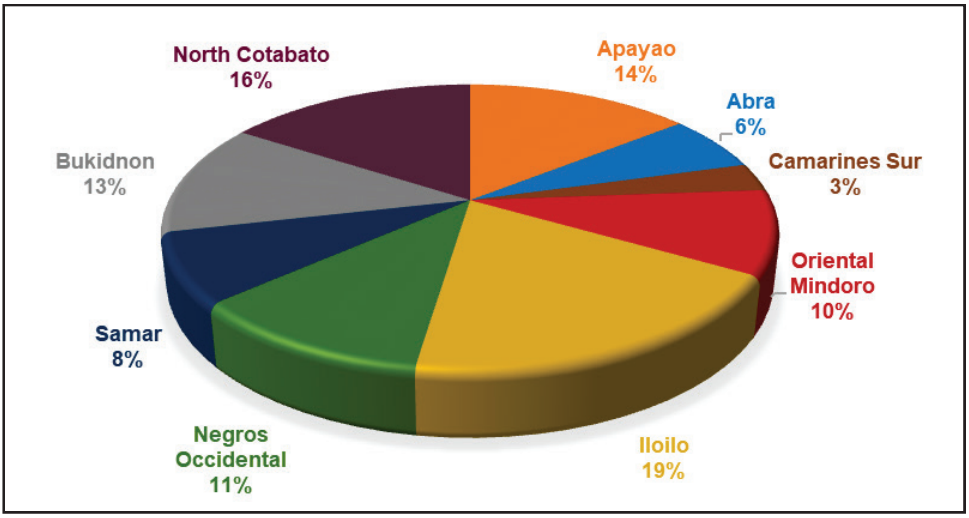


**Figure 9.1.** Percentage distribution of collected SR varieties in nine project sites.

### *Evaluation of grain quality*

After processing the samples, the grain quality parameters were evaluated following the NCT standard protocols, which consist of determination of milling recoveries, physical attributes, physicochemical properties, cooking parameters, and sensory characteristics.

Milling recovery includes percent brown rice (BR), total milled rice (TMR), and head rice (HR). About 125 grams (g) of rough rice were passed through a dehuller to obtain BR grains, then placed into a rice polisher to remove the bran and embryo. The resulting TMR was weighed and calculated. Milled rice grains were graded to separate the HR from the broken grains. Grain length and width were measured using a calibrated caliper. Shape was determined by dividing the grain's length by its width.

For physicochemical properties, the method described by Williams et al. (1958), modified by Perez and Juliano (1978), was used to determine amylose content (AC) of SR. Rice flour was weighed and soaked overnight with reagents and percent amylose was computed. Gelatinization temperature (GT) was evaluated based on the alkali spreading value (ASV) following a numerical scale described by Little et al. (1958) and Bhattacharya (1979). Six whole grains were spaced evenly in a small Petri dish added with sodium hydroxide (enough to submerge the grains in solution). The dish was covered and left undisturbed for 23 hours at room temperature and visually evaluated using a seven-point numerical scale.

The optimum cooking water and time of the rice samples were determined using standard procedures. The hardness of cooked grains was evaluated using a texture machine (Instron 3342, USA). Cooked unpolished and polished rice samples were cooled for about 45 minutes and subsequently weighed and transferred into the Instron cell. The force required to extrude the cooked grains into the cell was measured. Lastly, sensory quality of the SR samples was evaluated by trained laboratory panelists of RCFSD considering the different characteristics of raw and cooked rice grains.

***Grain quality characteristics***

The collected SR samples composed of aromatic, glutinous, black, and red rice (Figure 9.2) were subjected to comprehensive grain quality evaluation. The classification and recommended values of the different parameters are shown in Table 9.1.

Milling recovery indicates the amounts of brown, total milled, and head rice from a given amount of *palay* or paddy. It is a very important grain quality parameter to farmers, traders, millers, and even consumers as it greatly influences the pricing and marketability of rice. The Rice Varietal Improvement Group (RVIG) of the NCT recommends a recovery of ≥75.0% (fair) for BR, ≥65.1% (Grade 1) for TMR, and ≥48.0% (Grade 1) for HR.

Grain dimensions in terms of length and shape constitute the physical attributes. The uniformity in these parameters enhances the consumers' acceptability of raw rice. Preference for grain size and shape varies from one group of consumers to another. For instance, Japanese and Koreans generally prefer short and bold grains, while Indians and Pakistanis favor the extra long and slender grains. Based on the long experience of PhilRice in conducting sensory evaluation, Filipinos usually prefer long (6.6 – 7.4 mm) and slender (>3.0) grains for their table rice. This is similar to the preference in other Southeast Asian countries such as Thailand and Vietnam.

The most important factors that influence the cooking and eating qualities of rice are the physicochemical properties, particularly AC and GT. Rice is classified according to its AC as waxy, very low, low, intermediate, and high.

**Table 9.1.** Classification and recommended values for grain quality parameters.

| Parameter | Classification | | Recommended/ preferred value |
|---|---|---|---|
| **Milling recoveries** | | | |
| Brown rice | Good (G) | 80.0% and above | 75.0% and above (Fair to good) |
| | Fair (F) | 75.0 – 79.9% | |
| | Poor (P) | below 75.0% | |
| Total milled rice | Premium (Pr) | 70.1% and above | 65.1% and above (Grade 1 to premium) |
| | Grade 1 (G1) | 65.1 – 70.0% | |
| | Grade 2 (G2) | 60.1 – 65.0% | |
| | Grade 3 (G3) | 55.1 – 60.0% | |
| Head rice | Premium (Pr) | 57.0% and above | 48.0% and above (Grade 1 to premium) |
| | Grade 1 (G1) | 48.0 – 56.9% | |
| | Grade 2 (G2) | 39.0 – 47.9% | |
| | Grade 3 (G3) | 30.0 – 38.9% | |
| **Physical attributes** | | | |
| Grain length | Extra long (EL) | 7.5 mm and above | 6.6 – 7.4 mm (Long) |
| | Long (L) | 6.6 – 7.4 mm | |
| | Medium (M) | 5.5 – 6.5 mm | |
| | Short (Sh) | 5.4 mm and below | |
| Grain shape | Slender (S) | More than 3.0 | More than 3.0 (Slender) |
| | Intermediate (I) | 2.0 – 3.0 | |
| | Bold (B) | Less than 2.0 | |
| **Physicochemical properties** | | | |
| Amylose content | Waxy/glutinous (W) | 0.0 – 2.0% | 17.1 – 22.0% (Intermediate) |
| | Very low (VL) | 2.1–10.0% | |
| | Low (L) | 10.1 – 17.0% | |
| | Intermediate (I) | 17.1 – 22.0% | |
| | High (H) | 22.1% and above | |
| Gelatinization temperature | High (H) | 1 – 2 (74.5 – 80.0°C) | 4 – 5 (Intermediate) |
| | High-Intermediate (HI) | 3 | |
| | Intermediate (I) | 4 – 5 (70.0 – 74.0°C) | |
| | Low (L) | 6 – 7 (<70.0°C) | |
| Crude protein | | 6 – 9% | |
| Instron cooked rice hardness | Hard | 2.6 $kg/cm^2$ and above | 1.1 – 2.5 $kg/cm^2$ (Soft to medium) |
| | Medium | 1.9 – 2.5 $kg/cm^2$ | |
| | Soft | 1.1 – 1.8 $kg/cm^2$ | |
| | Very soft | 0.5 – 1.0 $kg/cm^2$ | |

Rice with high AC is likely to cook hard and dry, while low AC rice tends to have softer and stickier cooked grains. At the other end of the spectrum is the waxy or glutinous rice with very soft and very cohesive cooked rice. For table rice, Filipino consumers generally prefer somewhere in between cooked rice texture that is neither too soft nor too hard. This usually corresponds to low or intermediate AC. Meanwhile, GT is the temperature at which the starch granules begin to swell irreversibly in hot water. It affects the behavior of rice upon cooking, thus GT is used as indicator to predict cooking time. The extent of alkali spreading of raw milled rice is used to estimate GT. Rice varieties have GT ranging from 55 to 79°C, grouped according to their ASV into low, intermediate, high-intermediate, and high GT. Low-GT rice cooks faster, whereas high-GT rice elongates less and requires more water and time for cooking.

Aside from carbohydrates, rice contains about 6-10% protein. This contributes to the nutritional value of rice. Thus, people who eat rice only because of limited access to other protein-rich foods get both their carbohydrates and protein requirement from rice. Lastly, cooked rice hardness measured by an Instron machine is an objective parameter that indicates the texture of rice. Lower cooked rice hardness values correspond to softer cooked rice. To be properly cooked, rice requires varying amounts of water and lengths of time. Therefore, the optimum cooking water and time must be determined prior to the conduct of sensory evaluation. The acceptability of rice among consumers depends largely on its sensory characteristics, which are evaluated based on the sensations perceived by humans.

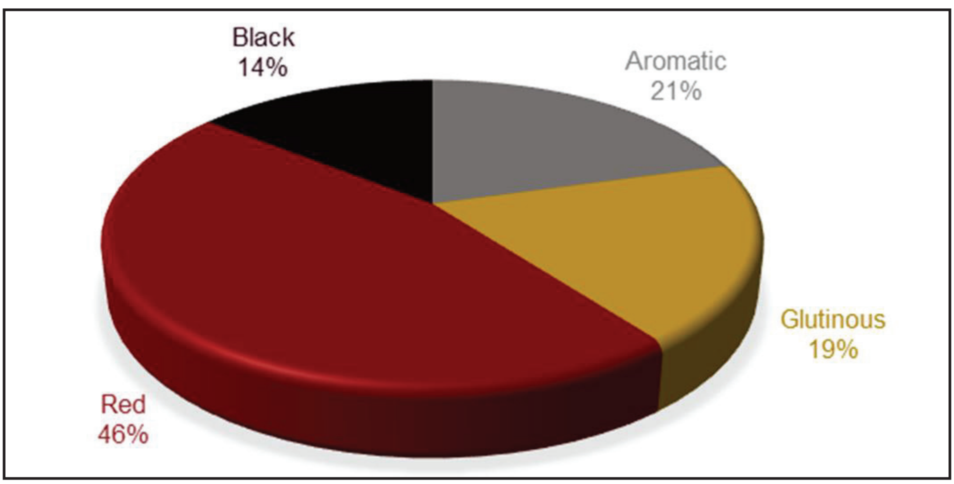


**Figure 9.2.** Percentage distribution of SR types.

**Table 9.2.** Standard rating of attributes used in the laboratory sensory evaluation of SR.

| Attribute | Rating | Description |
|---|---|---|
| **Raw** | | |
| Aroma | 4 | Very aromatic |
| | 3 | Aromatic |
| | 2 | Slightly aromatic |
| | 1 | No aroma |
| Color (aromatic and glutinous) | 4 | Very white |
| | 3 | White |
| | 2 | Creamish white |
| | 1 | Grayish white |
| Color (unpolished and polished black and red) | 4 | Very intense |
| | 3 | Intense |
| | 2 | Slightly intense |
| | 1 | Weak |
| Gloss | 4 | Very glossy |
| | 3 | Glossy |
| | 2 | Slightly glossy |
| | 1 | Dull |
| Translucency | 4 | Translucent |
| | 3 | White belly |
| | 2 | Chalky |
| | 1 | Opaque |
| **Cooked** | | |
| Aroma (freshly cooked and staled) | 4 | Very aromatic |
| | 3 | Aromatic |
| | 2 | Slightly aromatic |
| | 1 | No aroma |
| Color (unpolished and polished black and red) | 4 | Very intense |
| | 3 | Intense |
| | 2 | Slightly intense |
| | 1 | Weak |

*Table 9.2. Continuation.*

| Attribute | Rating | Description |
|---|---|---|
| Gloss | 4 | Very glossy |
| | 3 | Glossy |
| | 2 | Slightly glossy |
| | 1 | Dull |
| Cohesiveness | 4 | Very cohesive |
| | 3 | Cohesive |
| | 2 | Slightly cohesive |
| | 1 | Separated |
| Tenderness | 4 | Very tender |
| | 3 | Tender |
| | 2 | Slightly tender |
| | 1 | Hard |
| Smoothness | 4 | Very smooth |
| | 3 | Smooth |
| | 2 | Slightly smooth |
| | 1 | Rough |
| Taste | 4 | Very tasty |
| | 3 | Tasty |
| | 2 | Slightly tasty |
| | 1 | Bland |

Sensory evaluation is oftentimes conducted by a laboratory panel who are trained to measure the sensory differences of both raw and cooked rice. Some of the characteristics being evaluated for raw rice include aroma, color, gloss, and translucency. Meanwhile, aroma, color, gloss, cohesiveness, tenderness, smoothness, and taste are usually considered for cooked rice (Table 9.2).

In the succeeding section, each SR type is discussed in detail in terms of the various grain quality characteristics. Emphasis is given to the different unique quality traits that make each individual type premium with corresponding suitable special application or utilization. Considering the most important grain quality traits for each type, the top aromatic, glutinous, black, and red rice were also identified.

Aromatic rice

Aroma is one of the most attractive characteristics of SR. Several chemical constituents, including different volatile compounds, are responsible for the aroma in cooked rice (Yajima et. al, 1979). Because of its natural chemical compounds that give its distinctive scent or aroma when cooked, aromatic rice commands a higher price than does ordinary rice. Aroma in rice is widely appreciated by more people who are willing to pay a premium price for aromatic or fragrant rice (Sarhadi et al., 2008; Sakthivel et al., 2009). The main aroma compound in both Jasmine- and Basmati-type rice varieties is 2-acetyl-1-pyrroline (2AP) (Buttery and Ling, 1982; Widjaja et al., 1996).

A total of 13 aromatic rice varieties from Apayao, Oriental Mindoro, Iloilo, Negros Occidental, Samar, and North Cotabato were collected and evaluated for grain quality (Table 9.3). The ranges of values obtained for milling recoveries, physical attributes, physicochemical properties, and sensory characteristics in both raw and cooked forms are enumerated in Table 9.4.

The % BR, % TMR, and % HR recoveries of the 13 aromatic rice are presented in Figure 9.3. Majority of the aromatic rice (62%) passed the recommended value for % BR recovery, which is equivalent to fair to good. In terms of % TMR, 69% of the samples fell under the recommended classifications of premium to Grade 1. The top aromatic rice with the highest % TMR are *Tumindog* from North Cotabato, *Kalapdos* from Samar, Palawan and *Gobyerno* from Apayao, and *Salapiin* also from North Cotabato (Table 9.5). The samples had relatively low % HR recovery as only 38% met the recommended values of premium to Grade 1. The susceptibility to cracking or fissure that results in lower milling recovery is partly genetic but it is also highly influenced by postharvest management, particularly drying. Therefore, farmers must ensure that proper drying practices are employed.

Figure 9.4 shows the grain length and shape of the aromatic rice samples. Although majority (54%) of them were long, a significant portion had also medium-sized grain length. In terms of grain shape, most of the samples (85%) were intermediate while the remaining were slender.

Majority of the aromatic rice fell under low (38%) to intermediate (54%) AC classifications (Figure 9.5). This caters to the preference of most Filipinos for lower amounts of amylose, which translates to acceptable softer texture. Based on ASV, 92% of the aromatic rice scored intermediate GT while the rest

**Table 9.3.** Aromatic rice varieties and sources.

| Variety | Source |
|---|---|
| *Azucena* | Apayao |
| *Gobyerno* | Apayao |
| Palawan | Apayao |
| *Dinorado* | Oriental Mindoro |
| *Dinurado (Haba)* | Oriental Mindoro |
| NSIC Rc 218 A | Oriental Mindoro |
| NSIC Rc 218 B | Oriental Mindoro |
| BIS-Rice | Iloilo |
| *Azucena* | Negros Occidental |
| *Biganti* Plus | Negros Occidental |
| *Kalapdos* | Samar |
| *Salapiin* | North Cotabato |
| *Tumindog* | North Cotabato |

**Table 9.4.** Grain quality characteristics of aromatic rice.

| Parameter | Range | Classification |
|---|---|---|
| **Milling recoveries** | | |
| Brown rice (%) | 68.8 – 80.0 | Poor to good |
| Total milled rice (%) | 59.2 – 72.3 | Grade 3 to premium |
| Head rice (%) | 23.3 – 68.3 | Below classification to premium |
| **Physical attributes** | | |
| Grain length (mm) | 4.6 – 7.4 | Short to long |
| Grain shape | 2.1 – 3.1 | Intermediate to slender |
| **Physicochemical properties** | | |
| Amylose content (%) | 13.2 – 22.2 | Low to high |
| Gelatinization temperature | <70.0 to 74.0°C | Low to intermediate |
| Crude protein (%) | 4.1 – 8.3 | |
| Instron cooked rice hardness (kg/cm$^2$) | 1.2 – 2.1 | Soft to medium |
| **Sensory characteristics** | | |
| <u>Raw</u> | | |
| Aroma | 1 – 2 | No aroma to slightly aromatic |
| Color | 1 – 3 | Grayish white to white |
| Gloss | 1 – 2 | Dull to slightly glossy |
| Translucency | 2 – 4 | Chalky to translucent |
| Hardness | 2 – 3 | Slightly hard to hard |

*Table 9.4. Continuation.*

| Parameter | Parameter | Classification |
|---|---|---|
| Cooked | | |
| Aroma (freshly cooked) | 1 – 2 | No aroma to slightly aromatic |
| Aroma (staled) | 1 – 3 | No aroma to aromatic |
| Color | 1 – 3 | Grayish white to white |
| Gloss | 1 – 3 | Dull to glossy |
| Cohesiveness | 1 – 3 | Separated to cohesive |
| Tenderness | 2 – 3 | Slightly tender to tender |
| Smoothness | 1 – 3 | Rough to smooth |
| Taste | 1 – 2 | Bland to slightly tasty |

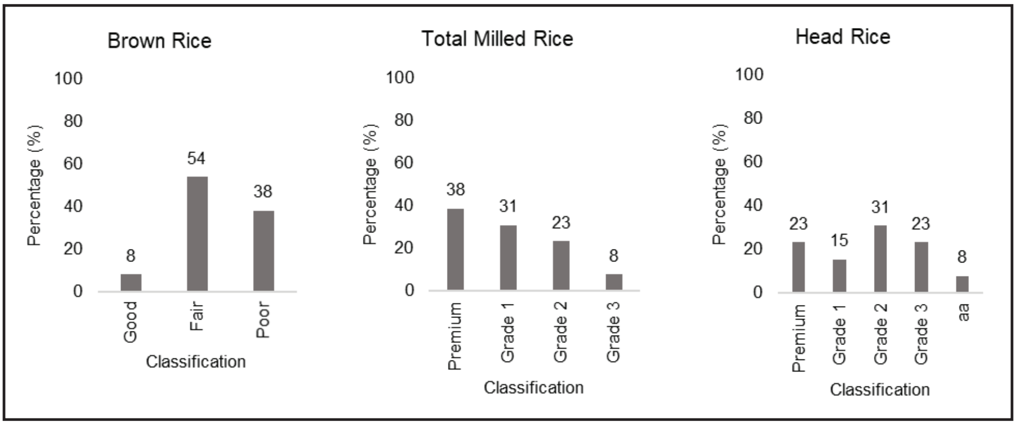


**Figure 9.3.** Percentage distribution of aromatic rice in terms of milling recovery classifications.

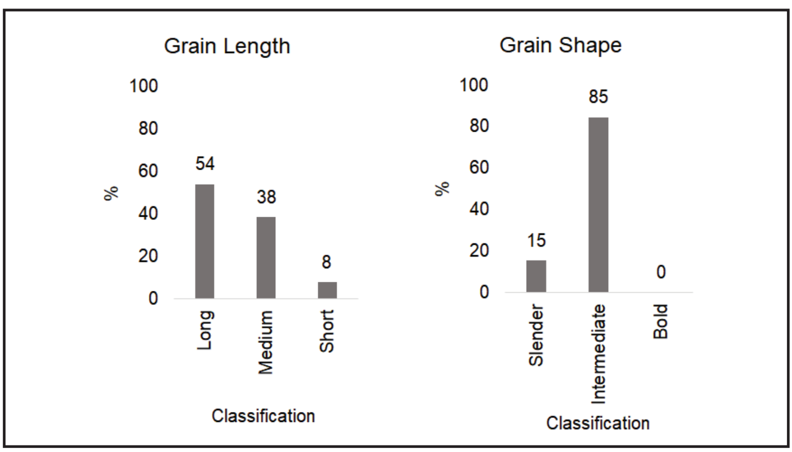


**Figure 9.4.** Percentage distribution of aromatic rice in terms of physical attribute classifications.

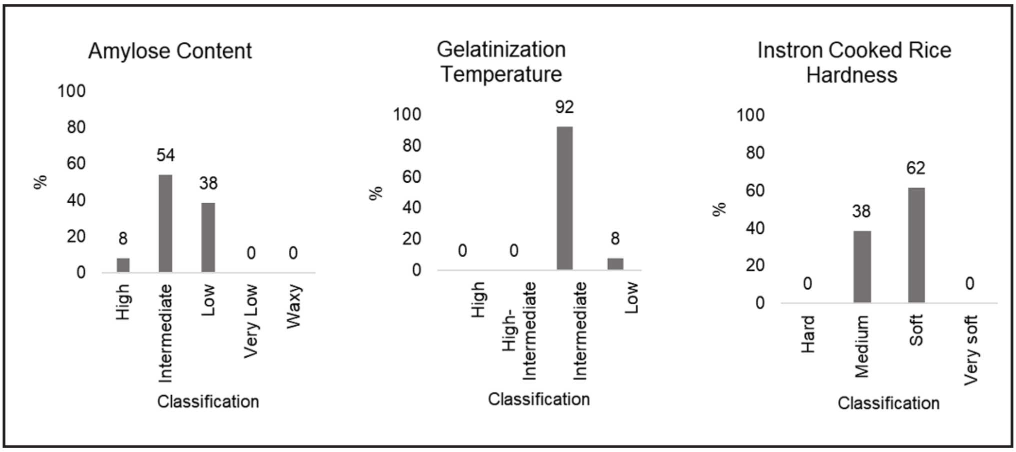


**Figure 9.5.** Percentage distribution of aromatic rice in terms of physicochemical property classifications.

had low GT. The relatively low GT indicates shorter cooking time of these samples; thus, their starch granules gelatinize at much lower temperature and consequently cook faster. In terms of cooked rice hardness, 62% of the aromatic rice had soft texture while the others had medium. No sample fell under the hard category. This is favorable since consumers in the Philippines prefer rice with softer cooked rice texture. The top samples with the lowest Instron hardness are NSIC Rc 218 B, NSIC Rc 218 A, and *Dinorado*, which are all from Oriental Mindoro, *Kalapdos* from Samar, and *Dinurado (Haba)* also from Oriental Mindoro (Table 9.5). Meanwhile, the protein content of the aromatic rice ranged from 4.1 to 8.3% (Table 9.4). In rice, protein content is usually 7.1 to 8.3% in unpolished and 5.8 to 7.1% in polished forms.

Figure 9.6 shows the sensory properties of raw milled aromatic rice in terms of color, translucency, and aroma. Majority were creamish white (62%) and only a small portion was white. There was a low percentage of translucent grains as 77% of them were chalky. This is a downside because chalkiness is associated with susceptibility to fissure or cracking that can lower HR recovery.

The most important quality trait of aromatic rice is obviously its aroma. The scent perceived is due to hundreds of aromatic compounds that contribute to the overall flavor profile of rice. However, 2AP is recognized as the key aromatic compound. Therefore, it is common to quantify the amount of this compound in aromatic rice. Although 2AP is present in both Jasmine- and

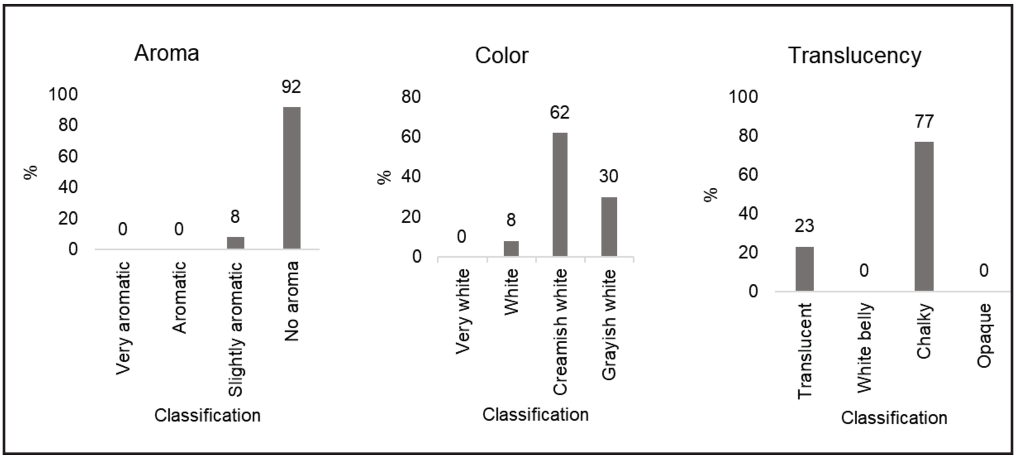


**Figure 9.6.** Percentage distribution of aromatic rice in terms of sensory characteristic classifications in raw form.

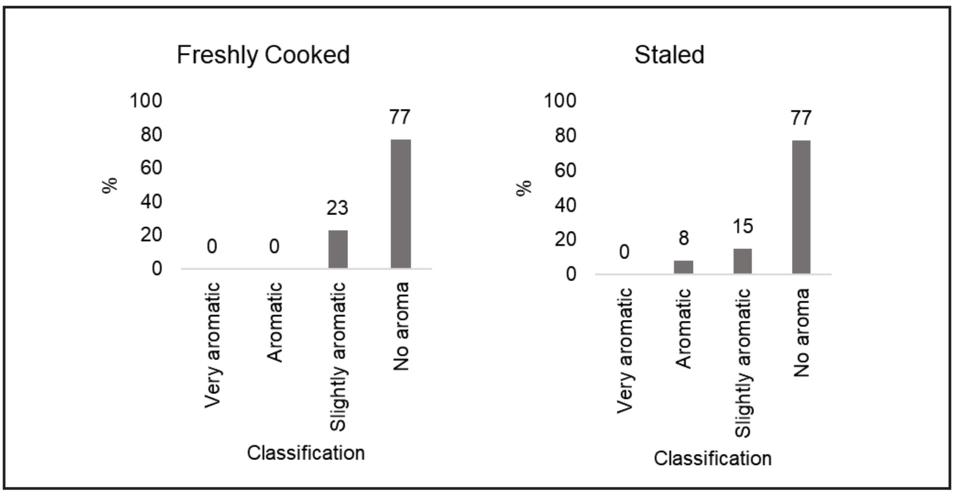


**Figure 9.7.** Percentage distribution of aromatic rice in terms of aroma classifications in cooked form.

Basmati-type aromatic rice, there is a major difference in the overall flavor profile of these kinds of rice. This provides evidence that there are other aromatic compounds that are responsible for the distinctive scent of each type. Raw milled rice is seldom aromatic so it is good to know that 8% of the samples had slightly aromatic *pandan*-like scent.

For the freshly cooked aromatic rice, it is quite disappointing that most of them had no aroma and only 23% had slightly aromatic *pandan*-like scent (Figure 9.7). Upon staling, however, 8% were perceived to be aromatic by the sensory panelists who indicated that the aroma of these rice varieties intensified when kept at room temperature for about 6 h. The top five aromatic rice varieties with the strongest aroma are *Gobyerno* and *Azucena* from Apayao, NSIC Rc 218 A from Oriental Mindoro, *Tumindog* from North Cotabato, and *Biganti* Plus from Negros Occidental (Table 9.5). One possible reason for the low number of aromatic rice samples with detectable *pandan*-like scent is that many of these rice varieties that were considered by farmers to be aromatic are actually merely ordinary rice. It can also be attributed to the old age of the paddy or poor storage conditions that accelerate the dissipation of the volatile compounds responsible for aroma.

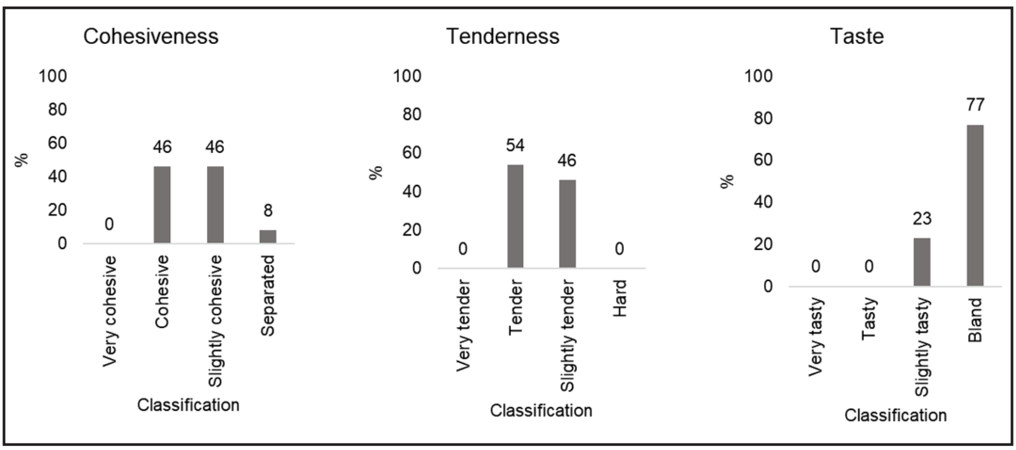


**Figure 9.8.** Percentage distribution of aromatic rice in terms of sensory property classifications in cooked form.

In terms of cohesiveness, 92% of the aromatic rice samples were acceptable as they were perceived to be either cohesive or slightly cohesive (Figure 9.8). Likewise, the samples registered the preferred tenderness, majority of which were tender at 54%. The aromatic rice with the softest texture are NSIC Rc 218 A, NSIC Rc 218 B, and *Dinorado*, all from Oriental Mindoro, and *Azucena* from Apayao (Table 9.5). Although majority of the freshly cooked aromatic rice had the usual bland taste, it is interesting to note that 23% were perceived by the sensory panelists as slightly tasty. This is exactly the equivalent percentage of aromatic rice with detectable *pandan*-like scent. Since the nose and mouth are interconnected, there is a close linkage between smell and taste in sensory evaluation. Hence, it is common that a sample identified with a pleasant aroma is also considered to have a pleasant taste. The identified best-tasting aromatic rice were NSIC Rc 218 A from Oriental Mindoro and Apayao's *Azucena* and *Gobyerno* (Table 9.5).

**Table 9.5.** Top aromatic rice varieties in terms of their important grain quality characteristics.

| Attribute | Variety |
|---|---|
| Aroma (cooked) | *Gobyerno* (Apayao), *Azucena* (Apayao), NSIC Rc 218 A (Oriental Mindoro), *Tumindog* (North Cotabato), *Biganti* Plus (Negros Occidental) |
| Tenderness<br>(Instron cooked rice hardness) | NSIC Rc 218 B (Oriental Mindoro), NSIC Rc 218 A (Oriental Mindoro), *Dinorado* (Oriental Mindoro), *Kalapdos* (Samar), *Dinurado* (Haba) (Oriental Mindoro) |
| Tenderness (sensory) | NSIC Rc 218 A (Oriental Mindoro), NSIC Rc 218 B (Oriental Mindoro), *Dinorado* (Oriental Mindoro), *Azucena* (Apayao) |
| Taste | NSIC Rc 218 A (Oriental Mindoro), *Azucena* (Apayao), *Gobyerno* (Apayao) |
| Total milled rice | *Tumindog* (North Cotabato), *Kalapdos* (Samar), Palawan (Apayao), *Gobyerno* (Apayao), *Salapiin* (North Cotabato) |

Table 9.5 summarizes the top aromatic rice varieties in terms of the important grain quality attributes for this type of SR, particularly aroma (cooked), tenderness (Instron cooked rice hardness), tenderness (sensory), taste, and TMR. Meanwhile, Figure 9.9 depicts the top five aromatic rice varieties that obtained the highest scores in aroma based on sensory evaluation.

Considering all the important grain quality attributes, *Gobyerno* and *Azucena* (Apayao) and NSIC Rc 218 A (Oriental Mindoro) were identified as the top three aromatic varieties (Figure 9.10). They produced the strongest *pandan*-like scent with tasty and tender cooked rice.

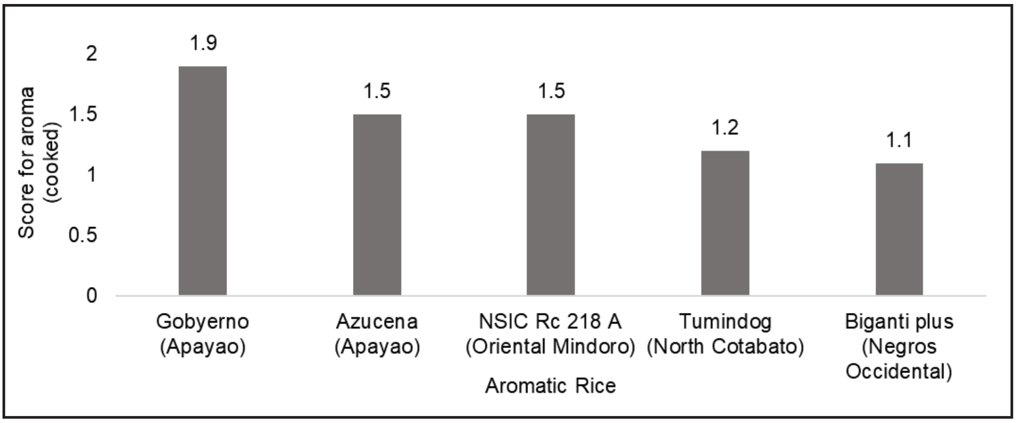


**Figure 9.9.** Sensory scores for aroma of top aromatic rice varieties.

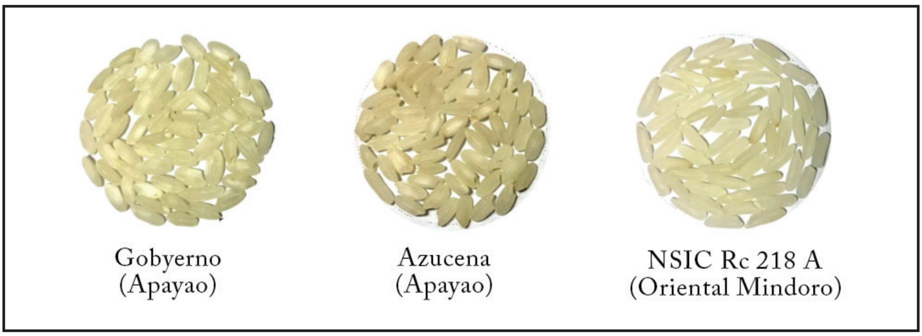


**Figure 9.10.** Best aromatic rice varieties based on overall grain quality.

<u>Glutinous rice</u>

Glutinous rice differs from other types of rice in that the grain starch contains essentially no amylose (0 – 2%) and high amount of amylopectin (Juliano, 1979), which is responsible for the sticky quality of cooked glutinous rice. The starchiness in sticky rice gives it a distinct opaque whiteness different from the more translucent appearance of regular rice grains (Wittenberg, 2007). Despite the very low-amylose and high-amylopectin contents, each waxy rice variety gives different eating quality characteristics to the processed rice food products (Kim et al., 1996; Keeratipibul et al., 2008). Such differences are correlated with other physicochemical characteristics of glutinous rice. Therefore, it is important to elucidate them in order to evaluate the potential uses and applications of glutinous rice in food processing.

Twelve glutinous rice varieties were obtained from Abra, Camarines Sur, Oriental Mindoro, Iloilo, Negros Occidental, and Samar, which were eventually evaluated for grain quality (Table 9.6). The ranges of values obtained for milling recoveries, physical attributes, physicochemical properties, and sensory properties in both raw and cooked forms are listed in Table 9.7.

The 12 glutinous rice samples fared poorly in overall milling recovery since only 58% of them passed the recommended classifications for both BR and TMR recoveries (Figure 9.11). It is even worse for HR recovery because only a quarter of the total number of samples passed the recommended classification of Grade 1. The others only rated as Grade 2, Grade 3, or with even lower classification. The identified top performers in terms of TMR are the following glutinous rice varieties: *Pinalwa* from Samar, *Sinongsong-Malagkit* from Oriental Mindoro, *Pilit* White D from Iloilo, *Kinalabaw* from Samar, and Miracle also from Oriental Mindoro.

**Table 9.6.** Glutinous rice varieties and sources.

| Variety | Source |
|---|---|
| *Waray* | Abra |
| *Gurung-gurong* | Camarines Sur |
| *Sinongsong-Malagkit* | Oriental Mindoro |
| Miracle | Oriental Mindoro |
| *Pilit* White A | Iloilo |
| *Pilit* White B | Iloilo |
| *Pilit* White C | Iloilo |
| *Pilit* White D | Iloilo |
| *Pilit* | Negros Occidental |
| *Narra* | Negros Occidental |
| *Pinalwa* | Samar |
| *Kinalabaw* | Samar |

Contrary to the more popular short and bold glutinous rice, most of the samples evaluated had either long (33%) or medium (50%) grain length, and mostly intermediate (92%) in shape (Figure 9.12). It is interesting to probe into the reasons why SR farmers prefer glutinous rice with relatively longer grain length and slender shape.

**Table 9.7.** Grain quality characteristics of glutinous rice.

| Parameter | Range | Classification |
|---|---|---|
| ***Milling recoveries*** | | |
| Brown rice (%) | 67.9 – 79.8 | Poor to fair |
| Total milled rice (%) | 60.4 – 72.0 | Grade 2 to premium |
| Head rice (%) | 24.2 – 55.9 | Below classification to Grade 1 |
| ***Physical attributes*** | | |
| Grain length (mm) | 4.9 – 6.7 | Short to long |
| Grain shape | 1.8 – 2.9 | Bold to intermediate |
| ***Physicochemical properties*** | | |
| Amylose content (%) | 0.2 – 9.2 | Waxy to very low |
| Gelatinization temperature | <70.0 – 74.0°C | Low to intermediate |
| Crude protein (%) | 5.4 – 8.8 | |
| Instron cooked rice hardness ($kg/cm^2$) | 0.6 – 1.8 | Very soft to soft |
| ***Sensory characteristics*** | | |
| *Raw* | | |
| Aroma | 1 | No aroma |
| Color | 1 – 3 | Grayish white to white |
| Gloss | 1 | Dull |
| Translucency | 1 – 3 | Opaque to white belly |
| Hardness | 1 – 3 | Soft to hard |
| *Cooked* | | |
| Aroma (freshly cooked) | 1 – 2 | No aroma to slightly aromatic |
| Aroma (staled) | 1 – 2 | No aroma to slightly aromatic |
| Color | 1 – 2 | Grayish white to creamish white |
| Gloss | 2 – 4 | Slightly glossy to very glossy |
| Cohesiveness | 2 – 4 | Slightly cohesive to very cohesive |
| Tenderness | 2 – 4 | Slightly tender to very tender |
| Smoothness | 2 – 4 | Slightly smooth to very smooth |
| Taste | 1 – 2 | Bland to slightly tasty |

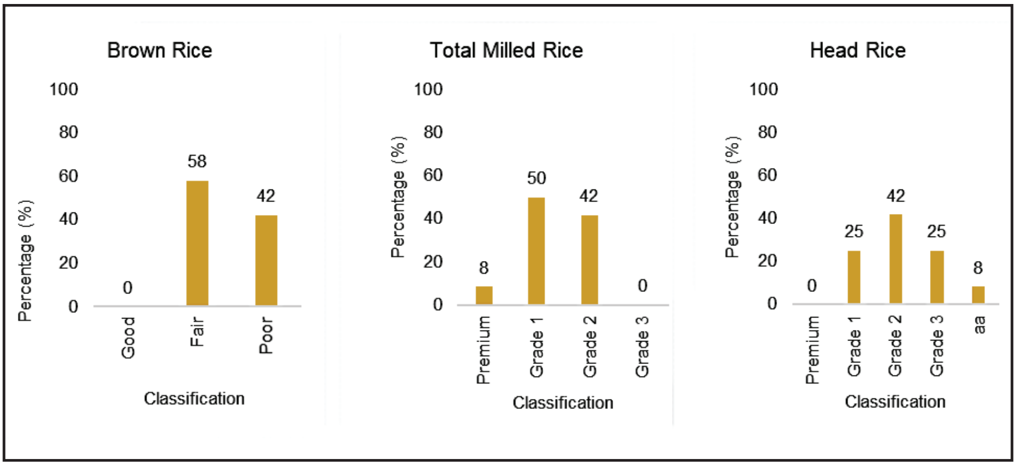


**Figure 9.11.** Percentage distribution of glutinous rice in terms of milling recovery classifications.

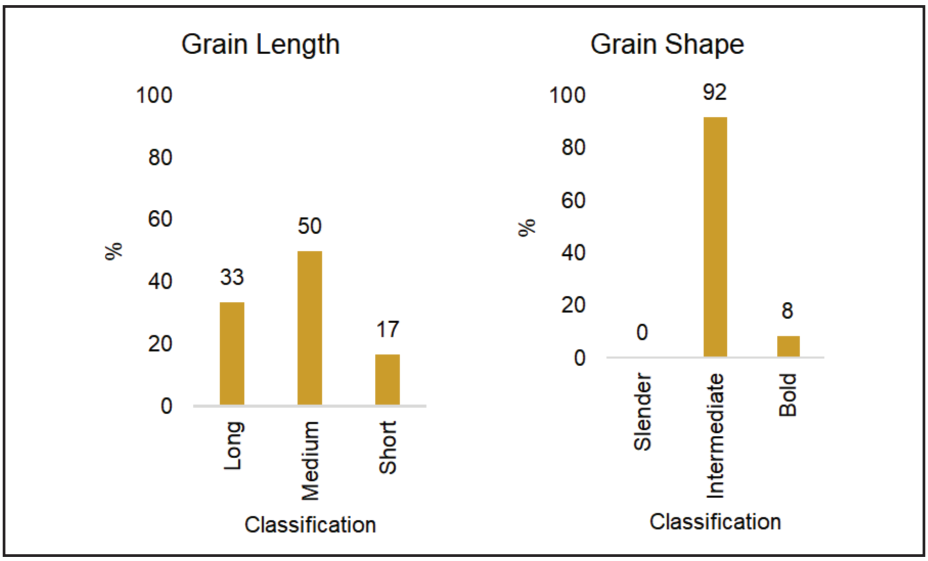


**Figure 9.12.** Percentage distribution of glutinous rice in terms of physical attribute classifications.

The physicochemical properties of the glutinous rice varieties are shown in Figure 9.13. Amylose is the most unique quality trait of glutinous rice. Technically, it should have 0 – 2% AC, with waxy classification. Based on laboratory analysis, however, only 42% were true-to-type glutinous rice. The remaining samples had higher AC values with very low classification only. It is possible

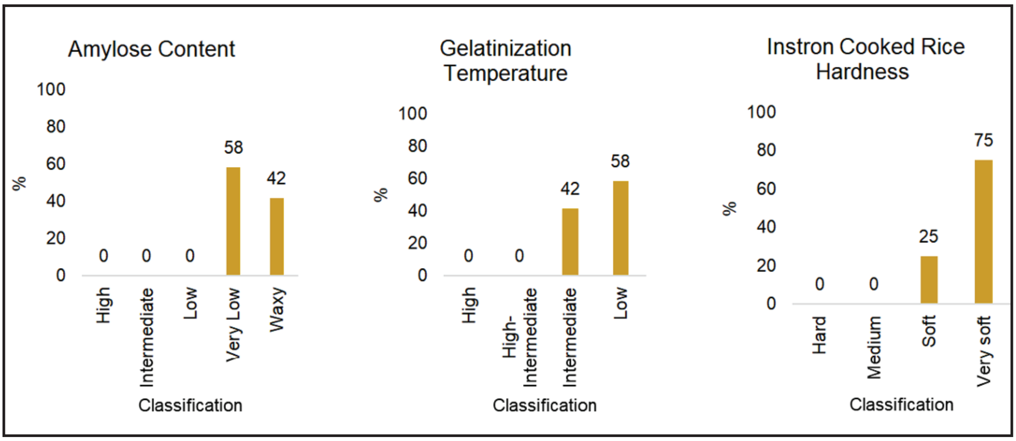


**Figure 9.13.** Percentage distribution of glutinous rice in terms of physicochemical property classifications.

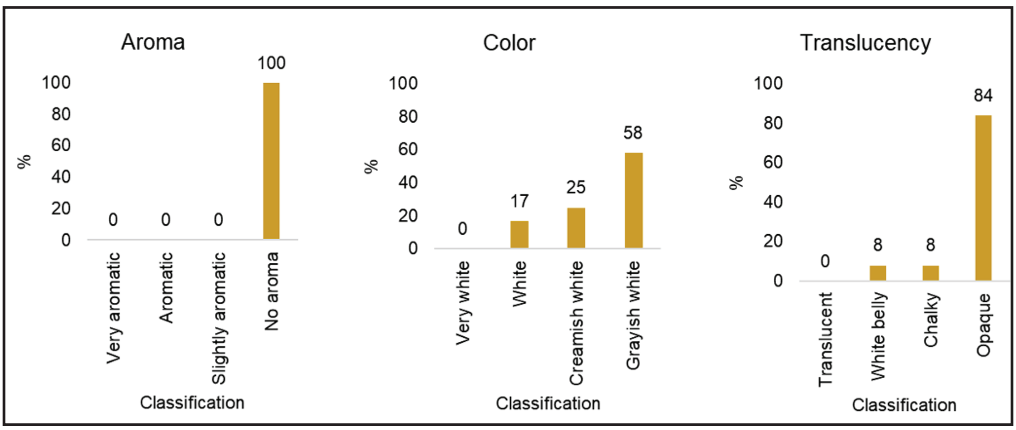


**Figure 9.14.** Percentage distribution of glutinous rice in terms of sensory characteristic classifications in raw form.

that these glutinous rice varieties are not pure, with the mixtures contributing to the increase in AC. The samples with the lowest AC are *Waray* from Abra, *Pinalwa* from Samar, *Gurung-gurong* from Camarines Sur, and Oriental Mindoro's Miracle and *Sinongsong-Malagkit* (Table 9.8).

All glutinous rice samples had either low or intermediate GT, corresponding to shorter cooking time. As expected, majority (75%) of the glutinous rice evaluated for Instron hardness had very soft cooked rice texture. Tenderness is another quality trait that is intrinsic to glutinous rice. The top samples with the softest texture are *Sinongsong-Malagkit* from Oriental Mindoro, *Gurung-gurong* from Camarines Sur, *Pilit* from Negros Occidental, *Kinalabaw* from Samar, and *Pilit* White (B, D) from Iloilo (Table 9.8). Meanwhile, crude protein content of the glutinous rice varieties ranged from 5.4 to 8.8% (Table 9.7).

Based on sensory evaluation, 58% of the glutinous rice were identified to be grayish white (Figure 9.14). This can be attributed to poor postharvest management such as drying. Grain opacity is another important quality trait of glutinous rice. Strangely, 16% of them instead had either white belly or chalky grains. These non-opaque samples could then be either not genuine glutinous varieties or not pure. The top glutinous varieties with the highest percentage of opaque grains are *Sinongsong-Malagkit* and Miracle from Oriental Mindoro, *Pilit* White B and D from Iloilo, *Gurung-gurong* from Camarines Sur, and *Waray* from Abra (Table 9.8).

Since glutinous rice has an inherent pleasant scent, the sensory panelists perceived 42% of the freshly cooked samples to be slightly aromatic (Figure 9.15). More than half of them were very glossy. The degree of cohesiveness is also a much sought-after characteristic of glutinous rice. Except for 8%, all glutinous rice samples were very cohesive and cohesive. The most cohesive samples are Miracle from Oriental Mindoro, *Pilit* from Negros Occidental, *Sinong-song-Malagkit* from Oriental Mindoro, *Pilit* White D and A from Iloilo, and *Narra* from Negros Occidental (Table 9.8). Meanwhile, the texture of freshly cooked glutinous samples was mostly very tender (84%). The softest glutinous rice samples are *Waray* from Abra, Miracle and *Sinongsong-Malagkit* from Oriental Mindoro, *Pilit* from Negros Occidental, and *Pilit* White D from Iloilo (Table 9.8). Finally, the sensory panelists perceived the majority of the freshly cooked glutinous rice to be slightly tasty (63%) due to its characteristic flavor.

Table 9.8 enumerates the top glutinous rice varieties in terms of the important grain quality attributes of this SR type, particularly amylose, opacity, cohesiveness, tenderness (Instron cooked rice hardness), and tenderness (sensory). Meanwhile, Figure 9.16 shows the top five glutinous rice varieties that obtained the highest scores in AC.

Based on the important grain quality attributes indicated in Table 9.8, *Waray* (Abra) and *Sinongsong-Malagkit* and Miracle (Oriental Mindoro) were the three best performing glutinous rice among the samples (Figure 9.17). They were recognized for their true-to-type amylose classification (waxy), 100% opaque grains, and cohesive to very cohesive, and very tender cooked rice grains.

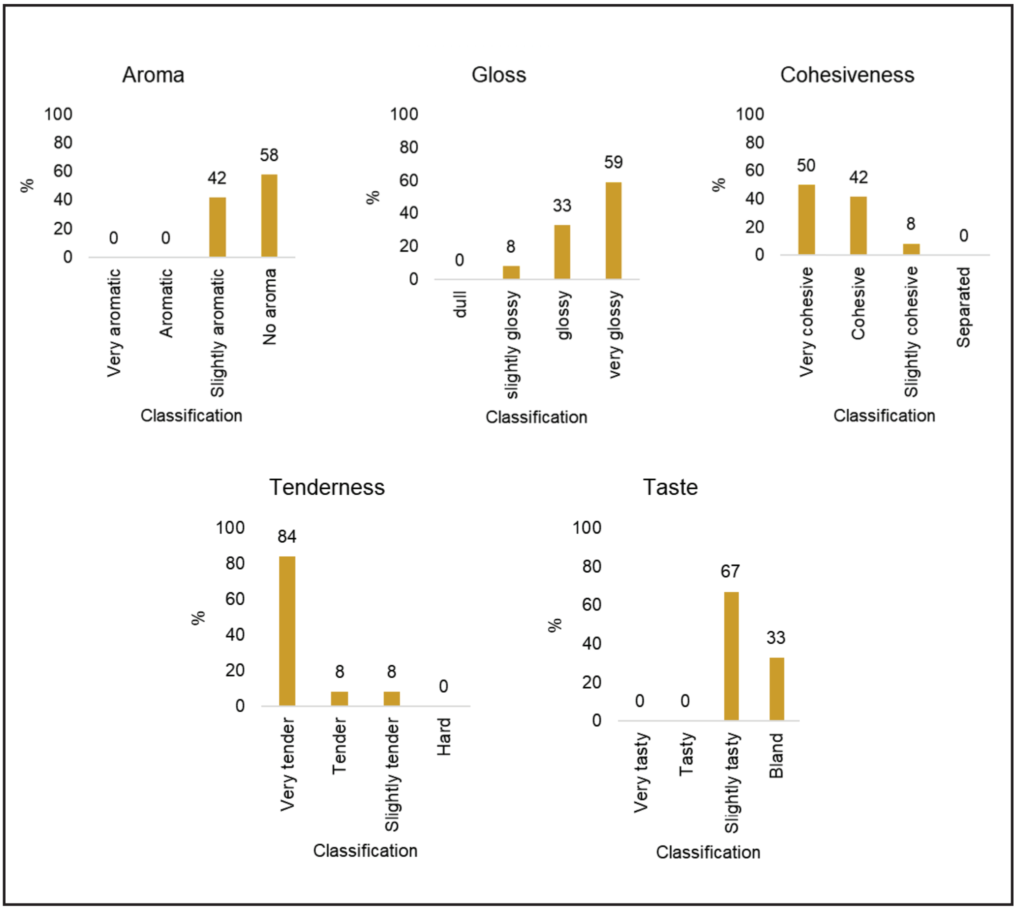


**Figure 9.15.** Percentage distribution of glutinous rice in terms of sensory characteristic classifications in cooked form.

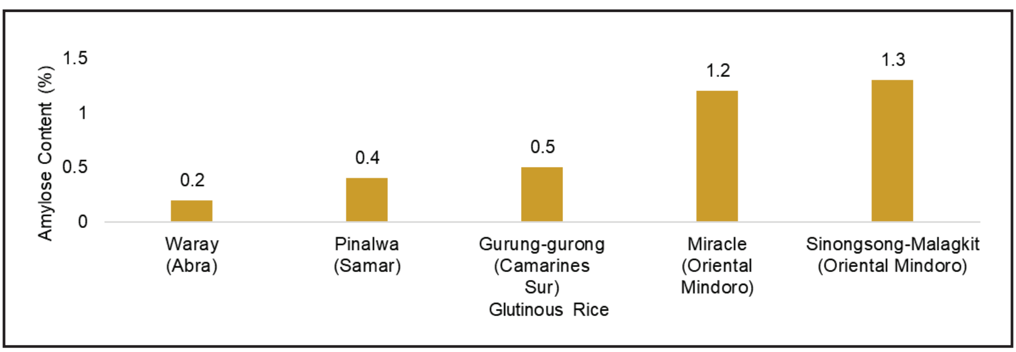


**Figure 9.16.** Amylose content of top glutinous rice varieties.

**Table 9.8.** Top glutinous rice varieties in terms of their important grain quality characteristics.

| Attribute | Variety |
|---|---|
| Amylose content | *Waray* (Abra), *Pinalwa* (Samar), *Gurung-gurong* (Camarines Sur), Miracle (Oriental Mindoro), *Sinongsong-Malagkit* (Oriental Mindoro) |
| Opacity | *Sinongsong-Malagkit* (Oriental Mindoro), Miracle (Oriental Mindoro), *Pilit* White B (Iloilo), *Pilit* White D (Iloilo), *Gurung-gurong* (Camarines Sur), *Waray* (Abra) |
| Cohesiveness | Miracle (Oriental Mindoro), *Pilit* (Negros Occidental), *Sinongsong-Malagkit* (Oriental Mindoro), *Pilit* White D (Iloilo), *Pilit* White A (Iloilo), *Narra* (Negros Occidental) |
| Tenderness (Instron cooked rice hardness) | *Sinongsong-Malagkit* (Oriental Mindoro), *Gurong-gurong* (Camarines Sur), *Pilit* (Negros Occidental), *Kinalabaw* (Samar), *Pilit* White B (Iloilo), *Pilit* White D (Iloilo) |
| Tenderness (sensory) | *Waray* (Abra), Miracle (Oriental Mindoro), *Sinong-song-Malagkit* (Oriental Mindoro), *Pilit* (Negros Occidental), *Pilit* White D (Iloilo) |


**Figure 9.17.** Best glutinous rice varieties based on overall grain quality.

<u>Black rice</u>

In recent years, pigmented rice such as black rice have gained considerable attention because of their health benefits. This is attributed to the bioactive pigments located in its bran layer, which contains higher phenolic compounds (Paiva et al., 2014; Vargas et al., 2018). Anthocyanins are the major pigments responsible for the color of rice. Black rice contains a higher lipid content than non-pigmented or even red rice, which makes it more palatable and attractive (Choi et al., 2019). Black rice is becoming popular not only in the development of functional foods, but also in the genetic variability of cultivars, which causes diversity in pigmentation, nutritional value, and phytochemical properties. However, black rice is still less popular than white rice and red rice as table rice.

Nine black rice varieties were collected from six provinces in the country (Table 9.9). The ranges of values obtained for milling recoveries, physical attributes, physicochemical properties, and sensory characteristics in both raw and cooked forms are indicated in Table 9.10.

Most of the black rice samples (nine) achieved acceptable % TMR recovery with 55% passing the recommended classification (Figure 9.18) but they registered low BR and HR recoveries. The best black rice in terms of TMR recovery are *Sinelat* from Apayao, Mindoro Black from Negros Occidental, BR 261 from Iloilo, Black Rice from Bukidnon, and *Bingawan* again from Iloilo.

For physical attributes, a little more than half of the samples had long grains (Figure 9.19), the usual preference of Filipino consumers. However, 89% exhibited intermediate shape, which is contrary to the preferred slender grains.

**Table 9.9.** Black rice samples and sources.

| Variety | Source |
|---|---|
| *Sinelat* | Apayao |
| *Balatinaw* A | Abra |
| *Balatinaw* B | Abra |
| Black *Polotan* | Camarines Sur |
| BR 261 | Iloilo |
| *Calatrava* | Iloilo |
| *Bingawan* | Iloilo |
| Mindoro Black | Negros Occidental |
| Black Rice | Bukidnon |

The black rice samples were quite diverse in terms of AC, with all categories represented (Figure 9.20). The most number of samples (44%) fell under low AC, while 11% were waxy. They scored intermediate (56%) and low (33%) GT, indicating relatively shorter cooking time. Since the samples spanned a wide variety of AC, their cooked rice texture also varied from hard to soft. The protein content of the unpolished black rice ranged from 7.0 to

12.5% (Table 9.10), with the highest obtained from Black Rice collected from Bukidnon. All samples were dull with no aroma (Figure 9.21).

**Table 9.10.** Grain quality characteristics of black rice.

| Parameter | Range | Classification |
|---|---|---|
| ***Milling recoveries*** | | |
| Brown rice (%) | 70.5 – 77.5 | Poor to fair |
| Total milled rice (%) | 58.2 – 71.5 | Grade 3 to premium |
| Head rice (%) | 24.8 – 60.3 | Below classification to premium |
| ***Physical attributes*** | | |
| Grain length (mm) | 5.4 – 6.9 | Short to long |
| Grain shape | 1.7 – 2.8 | Bold to intermediate |
| ***Physicochemical properties*** | | |
| Amylose content (%) | 1.7 – 23.9 | Waxy to high |
| Gelatinization temperature | <70.0 to 80.0°C | Low to high |
| Crude protein (%) | 7.0 – 12.5 (unpolished)<br>5.5 – 10.6 (polished) | |
| Instron cooked rice hardness (kg/cm$^2$) | 1.6 – 3.2 (unpolished)<br>0.8 – 2.5 (polished) | Soft to hard<br>Very soft to medium |
| ***Sensory characteristics (polished)*** | | |
| *Raw* | | |
| Aroma | 1 | No aroma |
| Color | 1 – 2 | Weak to slightly intense |
| Gloss | 1 | Dull |
| Translucency | 2 – 4 | Chalky to translucent |
| Hardness | 1 – 3 | Soft to hard |
| *Cooked* | | |
| Aroma (freshly cooked) | 1 – 3 | No aroma to aromatic |
| Aroma (staled) | 1 – 3 | No aroma to aromatic |
| Color | 1 – 3 | Weak to intense |
| Gloss | 2 – 4 | Slightly glossy to very glossy |
| Cohesiveness | 2 – 4 | Slightly cohesive to very cohesive |
| Tenderness | 2 – 4 | Slightly tender to very tender |
| Smoothness | 2 – 4 | Slightly smooth to very smooth |
| Taste | 1 – 3 | Bland to tasty |

Color is what distinguishes pigmented rice from other kinds of rice. As mentioned above, the major pigment responsible for its color is anthocyanin and it is mostly concentrated in the rice bran. Thus, the color of the pigmented rice samples was evaluated by the sensory panelists in both unpolished and polished forms. The intensity of the black color is quite strong as 89% of the samples were evaluated to be intense to very intense for the raw unpolished form (Figure 9.22). However, the removal of the bran resulted in the reduction of its color intensity. The same is true for the cooked black rice (Figure 9.23). The samples with the most intense black color included BR 261, *Bingawan*, and *Calatrava* from Iloilo and Mindoro Black from Negros Occidental (Table 9.11).

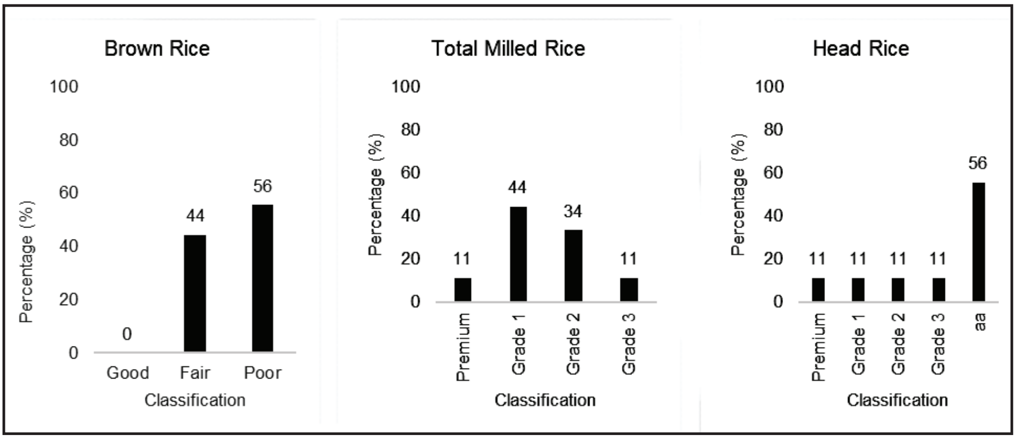


**Figure 9.18.** Percentage distribution of black rice in terms of milling recovery classifications.

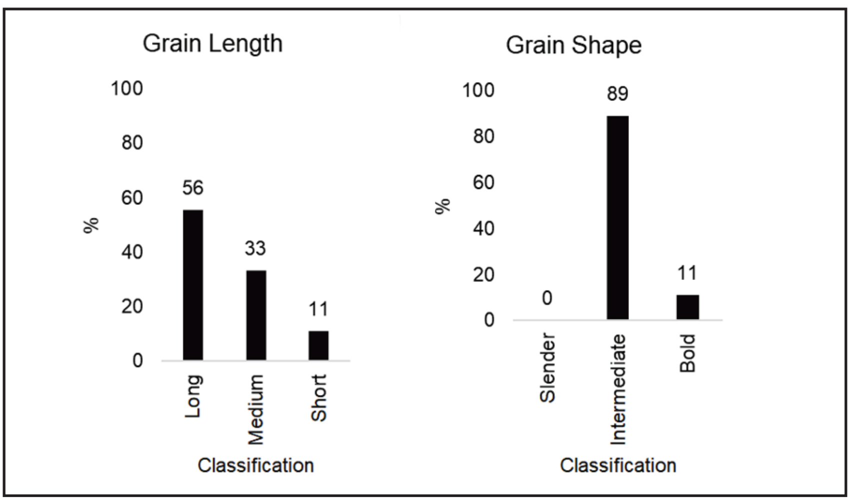


**Figure 9.19.** Percentage distribution of black rice in terms of physical attribute classifications.

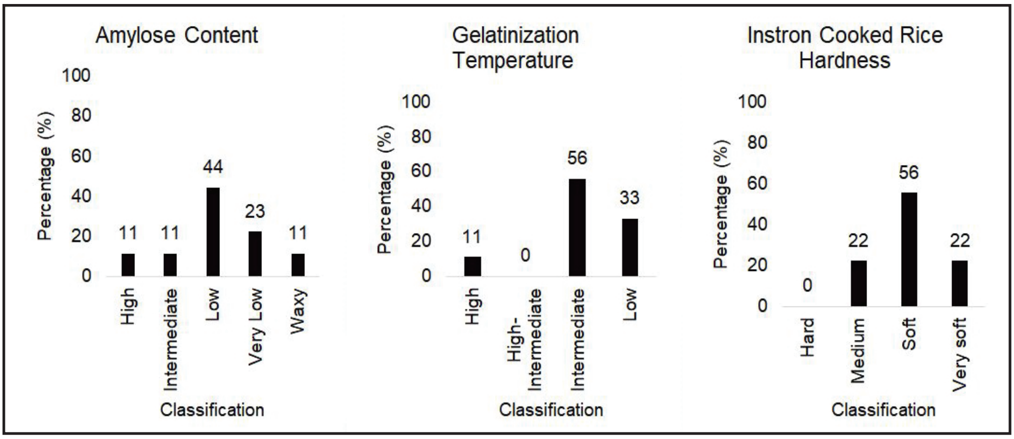


**Figure 9.20.** Percentage distribution of black rice in terms of physicochemical property classifications.

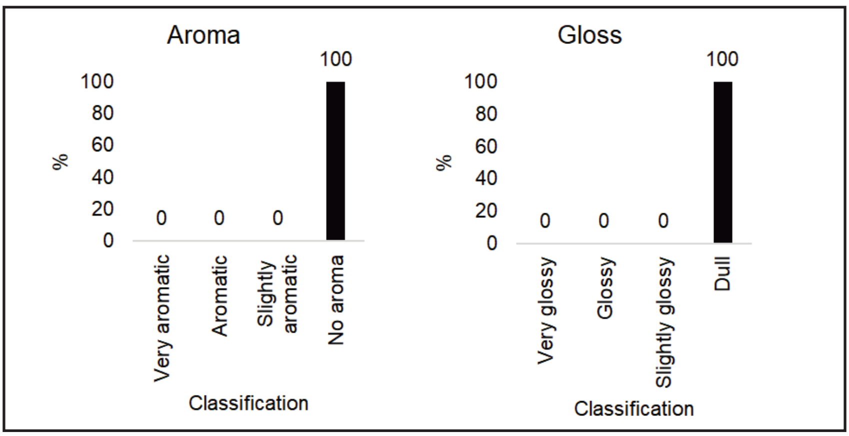


**Figure 9.21.** Percentage distribution of black rice in terms of aroma and gloss classifications in raw form.

Consistent with the characteristic pleasant scent of black rice, 78% of the freshly cooked were perceived to be either aromatic or slightly aromatic (Figure 9.24). The diversity in the AC of the black rice samples is also reflected in the variations in cohesiveness and tenderness. As in aroma, black rice has a characteristic pleasant taste. Consequently, 78% of the samples were rated as either tasty or slightly tasty by the sensory panelists.

Table 9.11 lists the top black rice varieties in terms of the important grain quality attributes, particularly color (cooked), tenderness (Instron cooked rice hardness), aroma (cooked), taste, and %BR. Meanwhile, Figure 9.25 demonstrates the top samples that obtained the highest scores in color based on sensory evaluation.

Among the top black rice samples, *Calatrava* (Iloilo) and Mindoro Black (Negros Occidental) were the top performing varieties due their very intense black grains (Figure 9.26). Aside from this, Calatrava produced good cooked rice texture (Instron cooked rice hardness), while Mindoro Black yielded considerably high amount of brown rice.

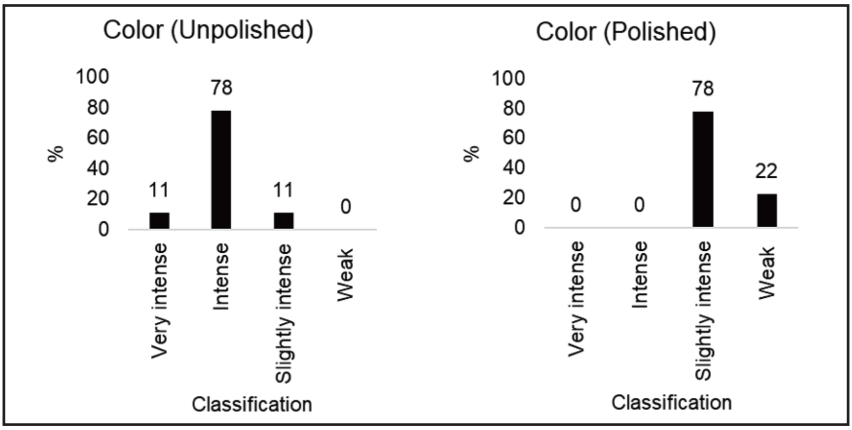


**Figure 9.22.** Percentage distribution of black rice in terms of color classifications in raw form.

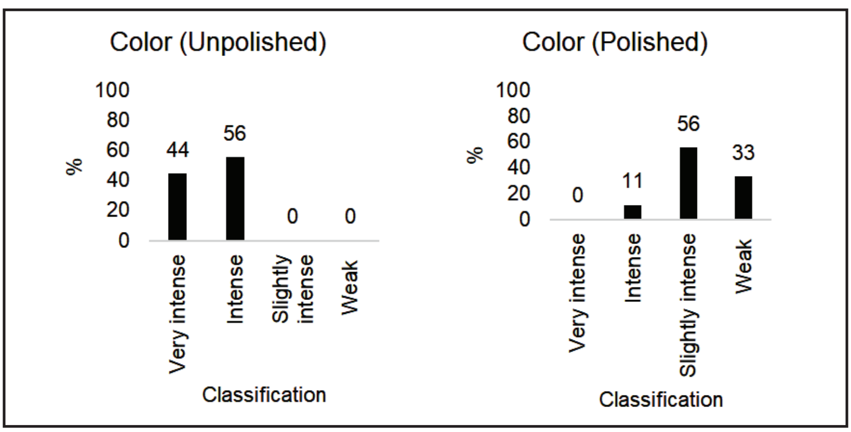


**Figure 9.23.** Percentage distribution of black rice in terms of color classifications in cooked form.

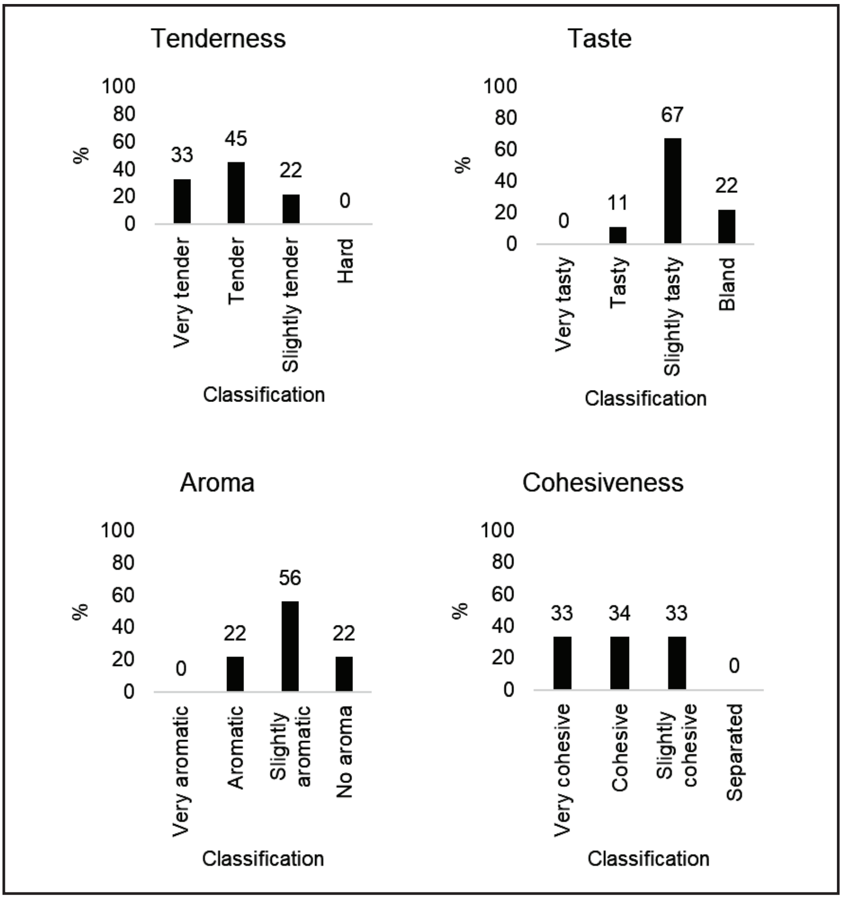


**Figure 9.24.** Percentage distribution of black rice in terms of sensory characteristic classifications in cooked form.

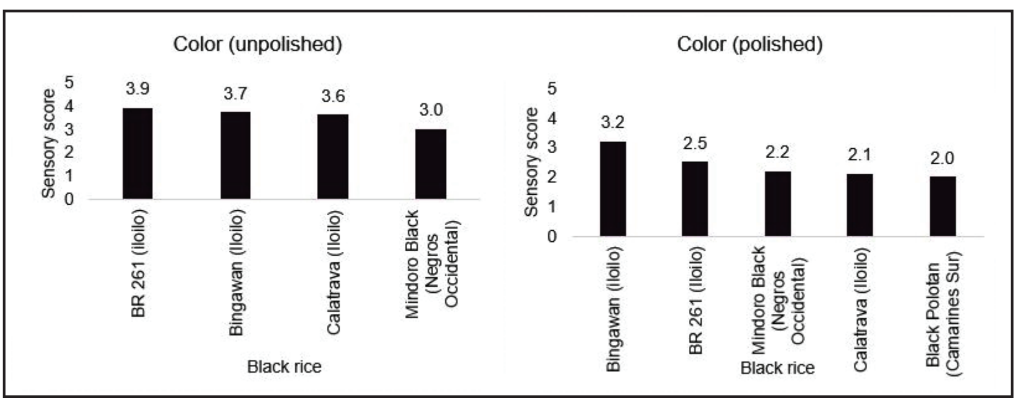


**Figure 9.25.** Sensory scores for color of top black rice varieties.

**Table 9.11.** Top black rice varieties in terms of their important grain quality characteristics.

| Attribute | Unpolished | Polished |
|---|---|---|
| Color (cooked) | BR 261 (Iloilo), *Bingawan* (Iloilo), *Calatrava* (Iloilo), Mindoro Black (Negros Occidental) | *Bingawan* (Iloilo), BR 261 (Iloilo), Mindoro Black (Negros Occidental), *Calatrava* (Iloilo), Black *Polotan* (Camarines Sur) |
| Tenderness (Instron cooked rice hardness) | Black *Polotan* (Glutinous, Camarines Sur), *Balatinaw* A (Abra), *Balatinaw* B (Abra), *Sinelat* (Apayao), *Calatrava* (Iloilo) | *Sinelat* (Apayao), *Balatinaw* A (Abra), Black *Polotan* (Camarines Sur), *Balatinaw* B (Abra), Mindoro Black (Negros Occidental) |
| Aroma (cooked) | *Sinelat* (Apayao) | *Sinelat* (Apayao), Black Rice (Bukidnon), *Bingawan* (Iloilo), Mindoro Black (Negros Occidental), Black *Polotan* (Camarines Sur) |
| Taste | *Sinelat* (Apayao), Black *Polotan* (Camarines Sur), *Balatinaw* A (Abra), *Balatinaw* B (Abra) | *Sinelat* (Apayao), Black *Polotan* (Camarines Sur), *Balatinaw* A (Abra), Mindoro Black (Negros Occidental), *Calatrava* (Iloilo), *Bingawan* (Iloilo) |
| Brown rice | *Sinelat* (Apayao), Mindoro Black (Negros Occidental), *Balatinaw* A (Abra), Black Rice (Bukidnon) | |


**Figure 9.26.** Best black rice varieties based on overall grain quality.

<u>Red rice</u>

These are rice with red bran layer. Though the color is confined in the bran, a tinge of red remains even after a high degree of milling. The color of the bran ranges from light to dark red. The bran layer contains polyphenols and anthocyanins that possess antioxidant properties. The innermost portion of red and white rice is similar in terms of its white color.

A total of 29 red rice varieties were collected and analyzed for their grain quality (Table 9.12). The ranges of values obtained for milling recoveries, physical attributes, physicochemical properties, and sensory characteristics in both raw and cooked forms are enumerated in Table 9.13.

Among the SR types, red rice achieved the best milling recovery. The percentages out of 29 samples that passed the recommended classifications were 80% for BR recovery, 86% for TMR recovery, and 76% for HR recovery (Figure 9.27). Red rice with the highest TMR recovery was *Dikit* from Bukidnon.

In terms of physical attributes (Figure 9.28), most of the red rice (66%) displayed medium grain length with intermediate (79%) shape. Their grains were shorter and bolder than the common long and slender grain length and shape, respectively.

Although 10% of the red rice obtained high AC, the remaining samples had lower amylose (Figure 9.29). Most of the red rice (59%) registered intermediate AC and only a few were waxy. For GT, 86% of the samples were intermediate, which require relatively shorter cooking time. Consistent with the majority of intermediate AC red rice in the samples, most of them correspondingly manifested medium cooked rice texture based on Instron hardness (52%). Based on this parameter, the top performing red rice varieties are Super *Pilit* from North Cotabato, Red Rice from Abra, *Awot* B from North Cotabato, and *Dekat* and Red from Apayao (Table 9.14). Meanwhile, the protein content of the red rice ranged from 6.1 to 9.7% (Table 9.13).

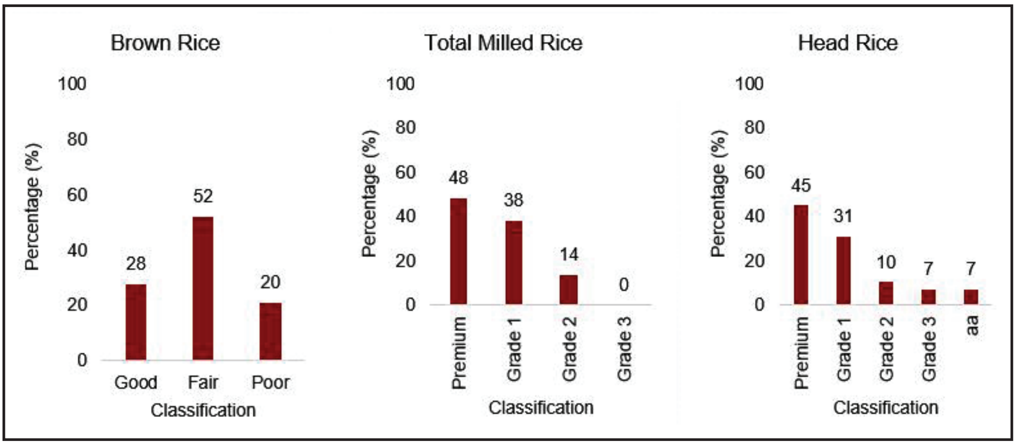


**Figure 9.27.** Percentage distribution of red rice in terms of milling recovery classifications.

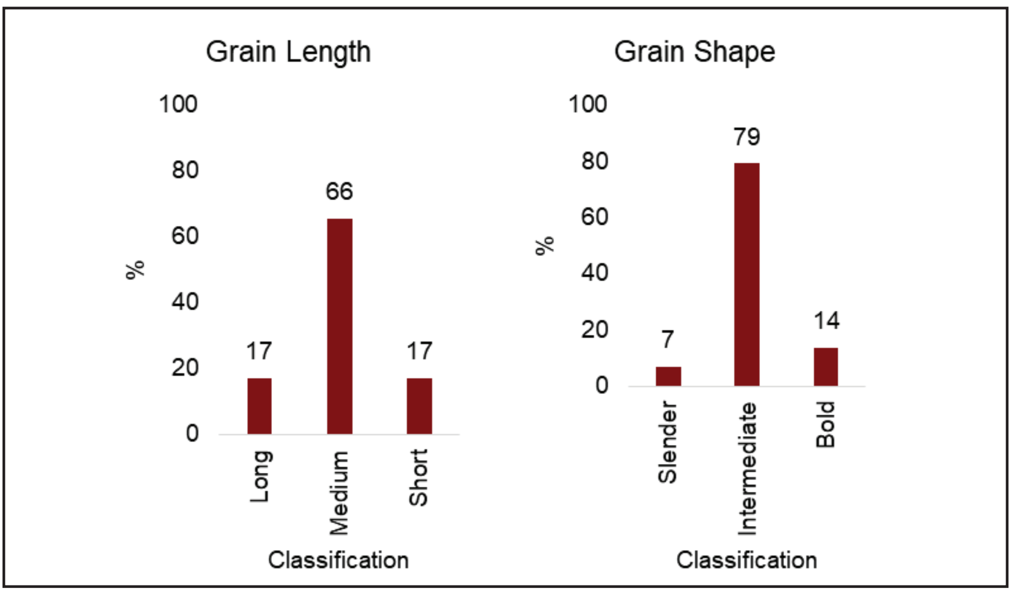


**Figure 9.28.** Percentage distribution of red rice in terms of physical attribute classifications.

**Table 9.12.** Red rice samples and sources.

| Variety | Source |
|---|---|
| *Dekat* | Apayao |
| Red Rice | Apayao |
| Red | Apayao |
| Mixture (*Mungat* and *Liyao*) | Apayao |
| *Dekat - Iyuan* | Apayao |
| Red Rice | Abra |
| Red 64 | Iloilo |
| *Pilit* Red | Iloilo |
| Red Rice | Iloilo |
| Red *Dinorado* | Iloilo |
| Red *Malagkit* | Negros Occidental |
| *Dalagang bukid* | Negros Occidental |
| *Diamante* | Samar |
| *Kalinayan* | Samar |
| *Dikit* (Mix with *Dinorado*) | Bukidnon |
| *Denorado* | Bukidnon |
| *Kapukaw* | Bukidnon |
| *Dikit* | Bukidnon |
| *Dinorado* | Bukidnon |
| *Intramis* | Bukidnon |
| Red *Kabaro* | Bukidnon |
| *Pulot* | North Cotabato |
| *Awot* A | North Cotabato |
| *Kanune* | North Cotabato |
| *Hinumay* | North Cotabato |
| *Dinorado* A | North Cotabato |
| *Awot* B | North Cotabato |
| Super *Pilit* | North Cotabato |
| *Dinorado* B | North Cotabato |

**Table 9.13.** Grain quality characteristics of red rice.

| Parameter | Range | Classification |
|---|---|---|
| ***Milling recoveries*** | | |
| Brown rice (%) | 73.4 – 82.3 | Poor to good |
| Total milled rice (%) | 61.5 – 76.7 | Grade 2 to premium |
| Head rice (%) | 18.8 – 74.8 | Below classification to premium |
| ***Physical attributes*** | | |
| Grain length (mm) | 4.4 – 7.2 | Short to long |
| Grain shape | 1.7 – 3.2 | Bold to slender |
| ***Physicochemical properties*** | | |
| Amylose content (%) | 1.6 – 24.3 | Waxy to high |
| Gelatinization temperature | <70.0 to 74.0°C | Low to high-intermediate |
| Crude protein (%) | 6.1 – 9.7 (unpolished)<br>4.9 – 8.4 (polished) | |
| Instron cooked rice hardness ($kg/cm^2$) | 1.50 – 3.84 (unpolished)<br>0.95 – 2.34 (polished) | Soft to hard<br>Very soft to medium |
| ***Sensory characteristics (polished)*** | | |
| *Raw* | | |
| Aroma | 1 – 2 | No aroma to slightly aromatic |
| Color | 1 – 2 | Weak to slightly intense |
| Gloss | 1 | Dull |
| Translucency | 1 – 4 | Opaque to translucent |
| Hardness | 2 – 3 | Slightly hard to hard |
| *Cooked* | | |
| Aroma (freshly cooked) | 1 – 3 | No aroma to aromatic |
| Aroma (staled) | 1 – 3 | No aroma to aromatic |
| Color | 1 – 2 | Weak to slightly intense |
| Gloss | 2 – 4 | Slightly glossy to very glossy |
| Cohesiveness | 1 – 4 | Separated to very cohesive |
| Tenderness (cooked) | 2 – 4 | Slightly tender to very tender |
| Smoothness | 2 – 4 | Slightly smooth to very smooth |
| Taste | 1 – 3 | Bland to tasty |

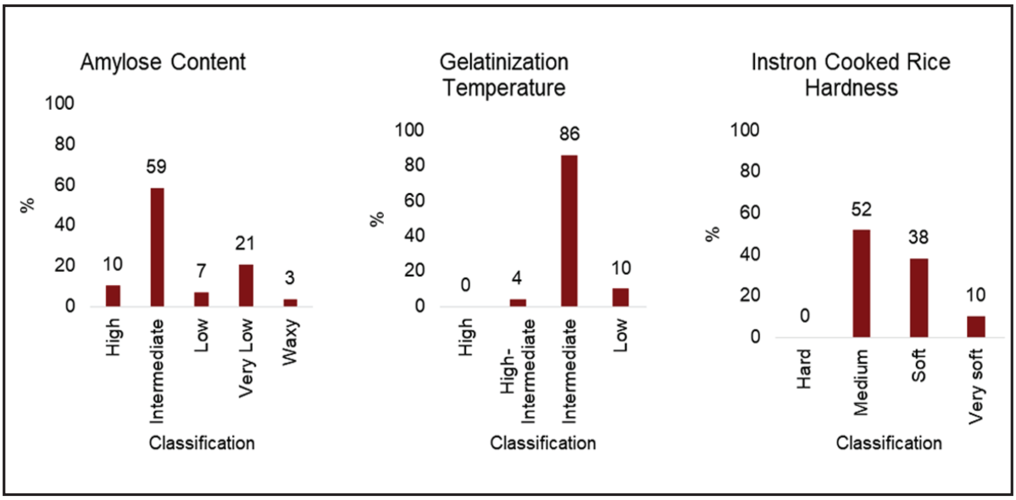


**Figure 9.29.** Percentage distribution of red rice in terms of physicochemical property classifications.

Among the raw milled red rice, majority had no aroma (97%), while a handful produced slightly aromatic *pandan*-like scent (Figure 9.30). They were all dull.

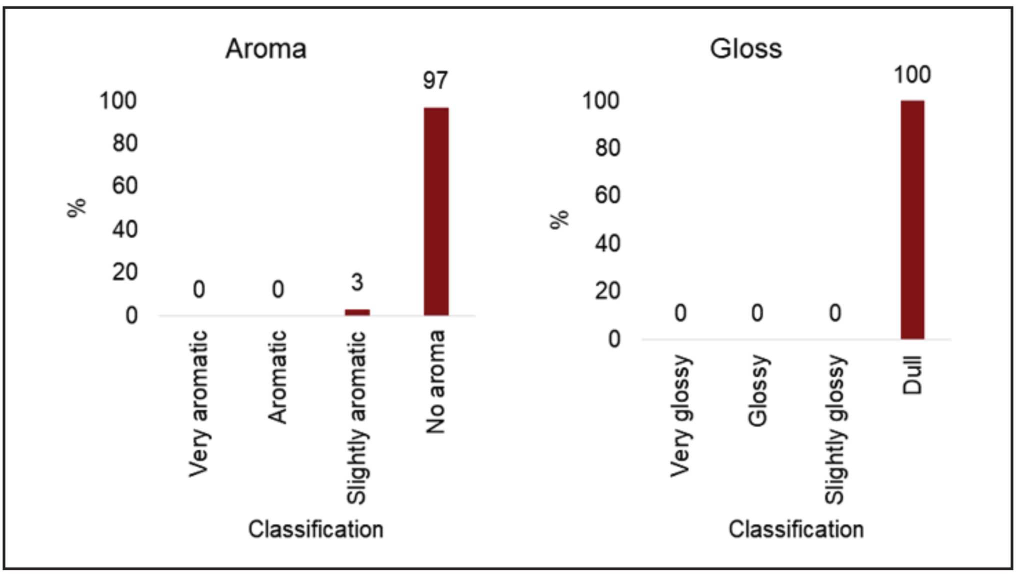


**Figure 9.30.** Percentage distribution of red rice in terms of aroma and gloss classifications in raw form.

Color of the unpolished red rice was distributed across slightly intense (41%) and intense (55%) color (Figure 9.31). However, significant reduction in the intensity occurred upon polishing. This confirms that most of the pigments responsible for color are concentrated in the bran. The same was observed in the color of the cooked form of the red rice varieties (Figure 9.32). The samples with the most intense red color were Red *Malagkit* from Negros Occidental, *Diamante* from Samar, Super *Pilit* and *Dinorado* B from North Cotabato, and Red from Apayao (Table 9.14).

A total of 38% of the freshly cooked red rice produced slightly aromatic *pandan*-like scent while 7% were aromatic (Figure 9.33). The best red rice in terms of aroma are *Intramis* and Red *Kabaro* both from Bukidnon (Table 9.14). Majority of them were slightly cohesive (55%), while in terms of tenderness, most scored slightly tender (45%) and tender (41%). In terms of taste, majority of the freshly cooked red rice had bland taste (52%) while 41% were slightly tasty and very tasty (7%). The best tasting red rice varieties are Red *Malagkit* from Negros Occidental, Super *Pilit* from North Cotabato, Red Rice from Abra, *Dekat* from Apayao, and *Intramis* from Bukidnon (Table 9.14).

Table 9.14 summarizes the top red rice varieties in terms of the important grain quality attributes: color, cooked rice hardness, aroma, taste, and BR recovery. Figure 9.34 shows the best red rice varieties that obtained the highest scores in color based on sensory evaluation.

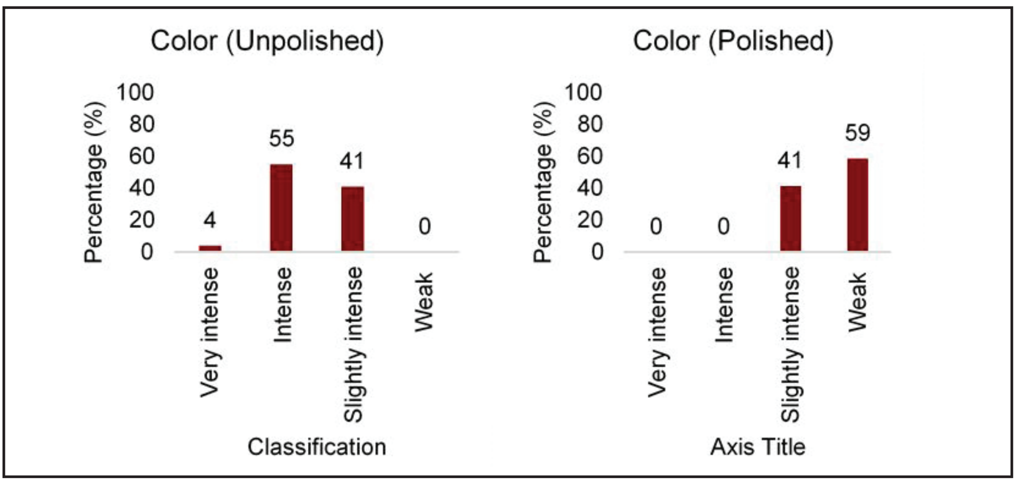


**Figure 9.31.** Percentage distribution of red rice in terms of color classifications in raw form.

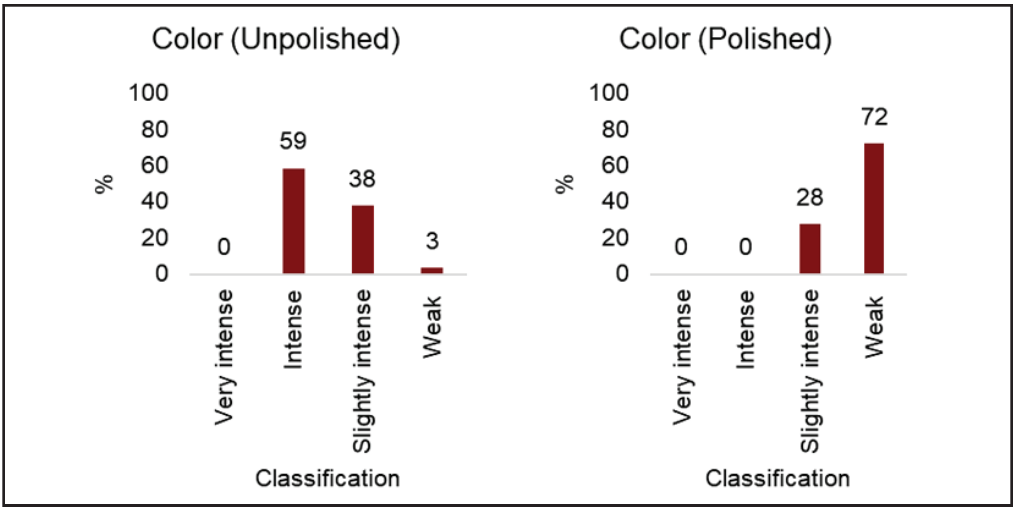


**Figure 9.32.** Percentage distribution of red rice in terms of color classifications in cooked form.

**Table 9.14.** Top red rice varieties in terms of their important grain quality characteristics.

| Attribute | Unpolished | Polished |
|---|---|---|
| Color (cooked) | Red *Malagkit* (Negros Occidental), *Diamante* (Samar), Super *Pilit* (North Cotabato), *Dinorado* B (North Cotabato), Red (Apayao) | *Pulot* (North Cotabato), *Diamante* (Samar), *Kalinayan* (Samar), Red Rice (Iloilo), Mixture (*Mungat* and *Liyao*) (Apayao), *Dalagang Bukid* (Negros Occidental) |
| Tenderness<br><br>(Instron cooked rice hardness) | Super *Pilit* (North Cotabato), Red Rice (Abra), *Awot* B (North Cotabato), *Dekat* (Apayao), Red (Apayao) | *Dekat* (Apayao), Red (Apayao), *Pilit* red (Iloilo), *Dekat-Iyuan* (Apayao), Red Rice (Apayao) |
| Aroma (cooked) | *Intramis* (Bukidnon), Red *Kabaro* (Bukidnon) | *Pulot* (North Cotabato). *Kalinayan* (Samar), Red Rice (Apayao), *Intramis* (Bukidnon), Red Rice (Iloilo) |
| Taste | Red *Malagkit* (Negros Occidental), Super *Pilit* (North Cotabato), Red Rice (Abra), *Dekat* (Apayao), *Intramis* (Bukidnon), | Red Rice (Abra), *Intramis* (Bukidnon), Super *Pilit* (North Cotabato), *Dekat-Iyuan* (Apayao), *Dekat* (Apayao) |
| Brown rice recovery | *Dikit* (Bukidnon), *Dikit* (Mixed with *Dinorado*) (Bukidnon), *Dinorado* B (North Cotababto), *Intramis* (Bukidnon), *Diamante* (Samar) | |

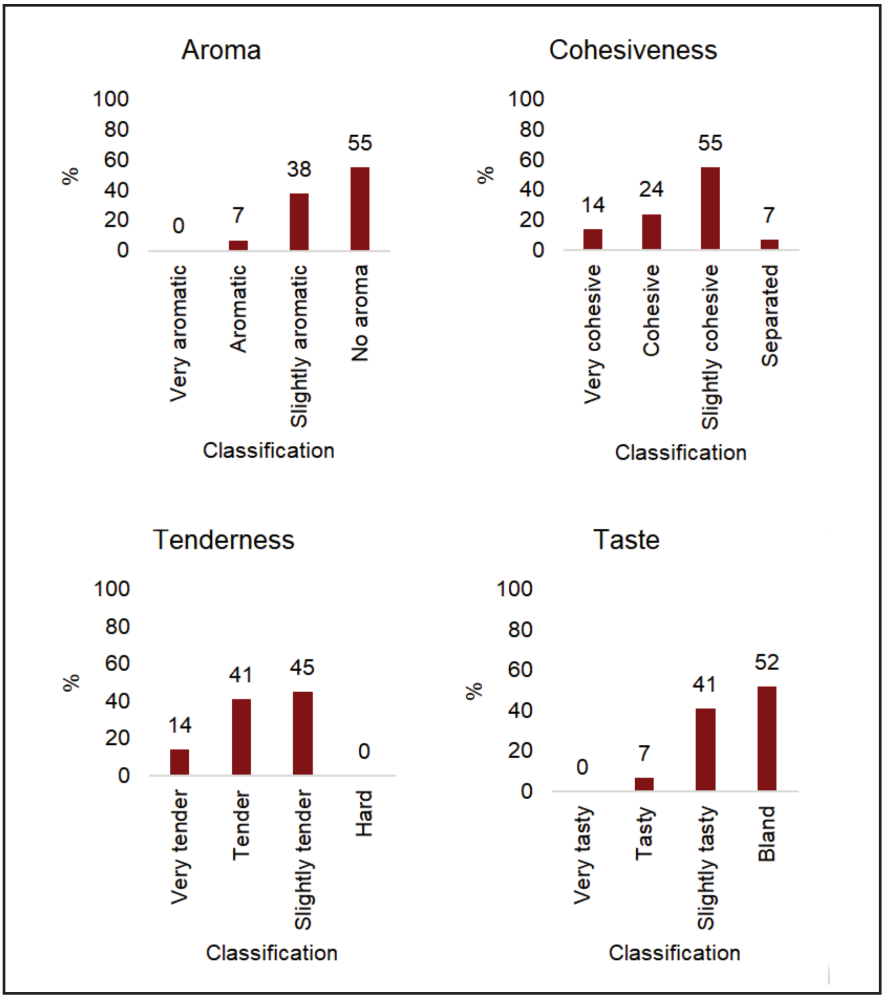


**Figure 9.33.** Percentage distribution of red rice in terms of sensory characteristic classifications in cooked form.

**Table 9.15.** Summary of the top varieties per SR type in terms of grain quality.

| SR type | Top varieties |
|---|---|
| Aromatic rice | *Gobyerno* (Apayao), *Azucena* (Apayao), NSIC Rc 218 A (Oriental Mindoro) |
| Glutinous rice | *Waray* (Abra), *Sinongsong-Malagkit* (Oriental Mindoro), Miracle (Oriental Mindoro) |
| Black rice (unpolished) | *Calatrava* (Iloilo), Mindoro Black (Negros Occidental) |
| Red rice (unpolished) | Super *Pilit* (North Cotabato), Red (Apayao) |

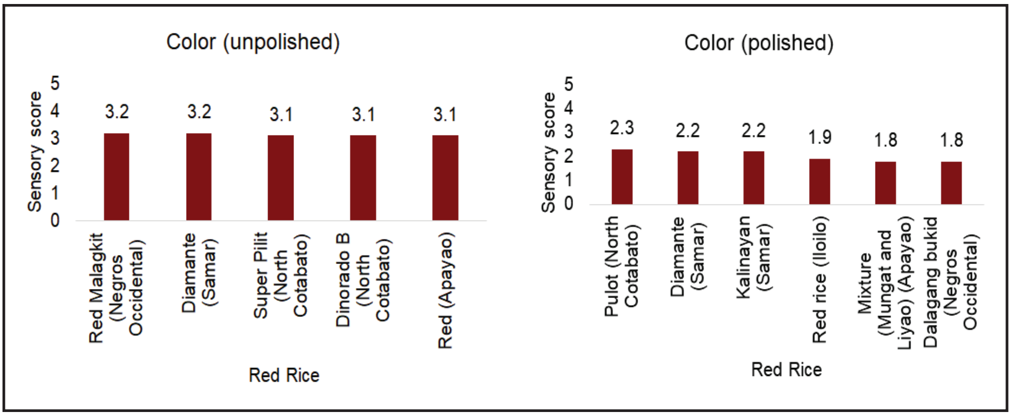


**Figure 9.34.** Sensory scores for color of top red rice varieties.

Considering the important quality attributes of red rice above, the top two identified were Super *Pilit* from North Cotabato and Red from Apayao (Figure 9.35). This was based on the intensity of color (red) and tenderness (Instron cooked rice hardness).

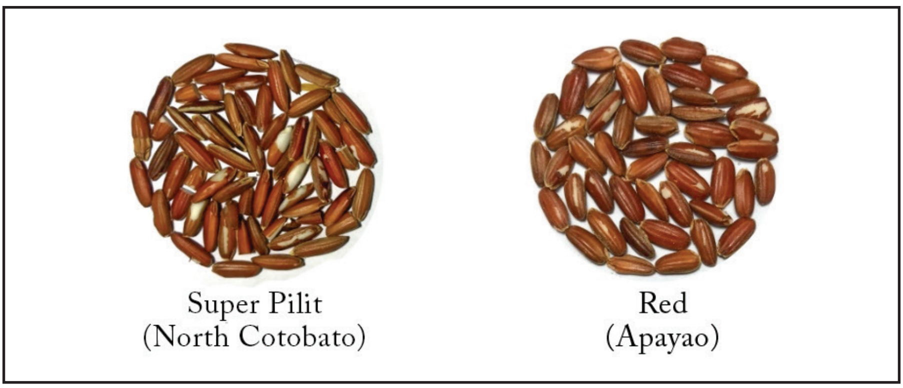


**Figure 9.35.** Best red rice varieties based on overall grain quality.

Table 9.15 summarizes the best performing varieties per SR type based on their important grain quality attributes. These varieties exemplified other superior quality aside from the most important grain quality parameter for each type, i.e., aroma for aromatic rice, AC for glutinous rice, and color for both black and red rice.

## Health-promoting properties of pigmented rice

### *Pigmented rice samples and sources*

Among the SR samples collected and evaluated, a total of 38 were pigmented rice with 9 black and 29 red. They were obtained from six provinces in the Philippines as listed above. Aside from the various grain quality parameters evaluated, their unpolished forms were further analyzed for health-promoting properties, including total anthocyanin content (TAC), total phenolic content (TPC), and total antioxidant activity (TAA).

The TAC of SR samples was evaluated using the method developed by Abdel-Aal and Hucl (1999) with minor modifications. Successive extraction of powdered sample was employed using 85% acidified ethanol. For TPC and TAA, rice sample was extracted and supernatant was then collected and analyzed. The TPC was determined following the Folin-Ciocalteu method developed by Singleton et al. (1999) with minor modifications. Lastly, the TAA was determined using the DPPH radical-scavenging assay developed by Brand-Williams et al. (1995), also with slight modifications.

<u>Black rice</u>

Since anthocyanins are the major pigments responsible for the color of pigmented rice, it is clear that the darker their color, the higher the amounts of anthocyanins. This is the primary reason higher TAC values were observed in black rice compared with red rice with relatively less intense pigmentation. Thus, the TAC ranging from 352.62 to 1438.57 mg C3GE/kg obtained from the black rice evaluated was significantly higher than those from red rice (Table 9.16). Black *Polotan* from Camarines Sur, *Calatrava* and *Bingawan* from Iloilo, *Balatinaw* from Abra, and *Sinelat* from Apayao registered the highest TAC among all pigmented samples, with 804.3 to 1438.6 mg C3GE/kg (Figure 9.36). The TPC of black rice ranged from 0.9 to 3.2 mg GAE/g. Interestingly, the abovementioned rice varieties (except *Balatinaw*) also achieved the highest TPC (1.7 – 3.2 mg GAE/g) among the black rice (Figure 9.37). Included in the top five for TPC was BR 261 from Iloilo. Meanwhile, the TAA ranged from 1.1 to 6.0 mg TE/g. Incidentally, the five black rice with the highest TAC were also the top performers in terms of TAA, with 1.9 – 6.0 mg TE/g (Figure 9.38).

**Table 9.16.** Health-promoting properties of black rice.

| Parameter | Range |
|---|---|
| Total anthocyanin content (mg C3GE/kg) | 352.6 – 1438.6 |
| Total phenolic content (mg GAE/g) | 0.9 – 3.2 |
| Total antioxidant activity (mg TE/g) | 1.1 – 6.0 |

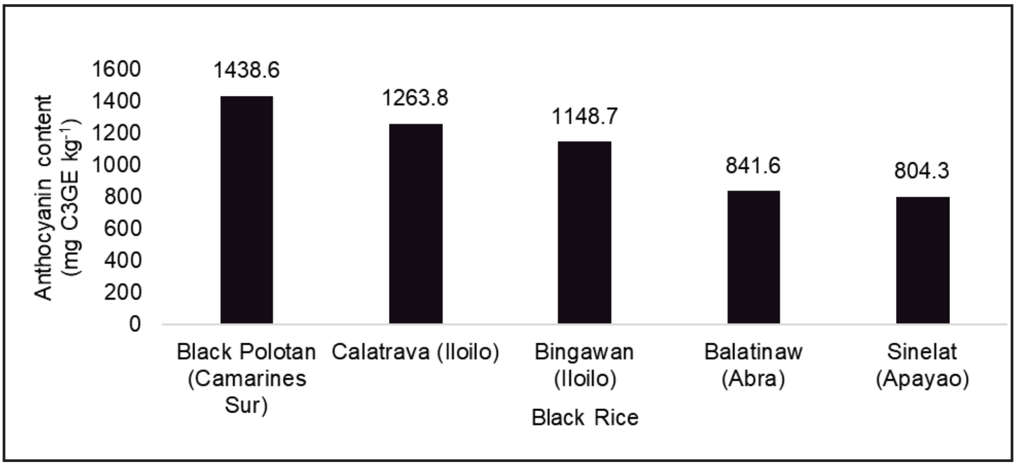


**Figure 9.36.** Black rice with the highest total anthocyanin content.

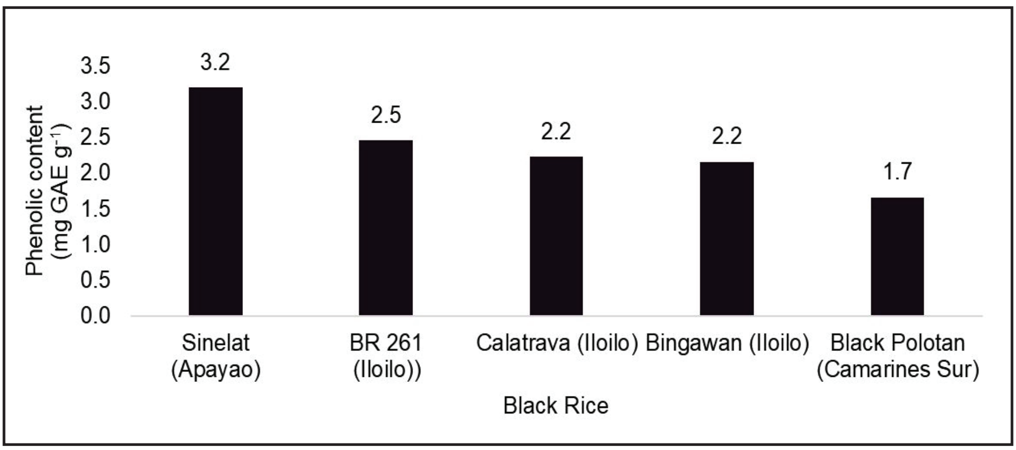


**Figure 9.37.** Black rice with the highest total phenolic content.

With their remarkably high health-promoting properties, Black *Polotan* (Camarines Sur), and *Calatrava* and *Sinelat* (Iloilo) were considered the top black rice varieties (Figure 9.39). Black *Polotan* produced the highest anthocyanin content, while *Sinelat* exhibited the highest phenolic content and antioxidant activity among samples. Meanwhile, *Calatrava* was consistently in the top three for the three parameters.

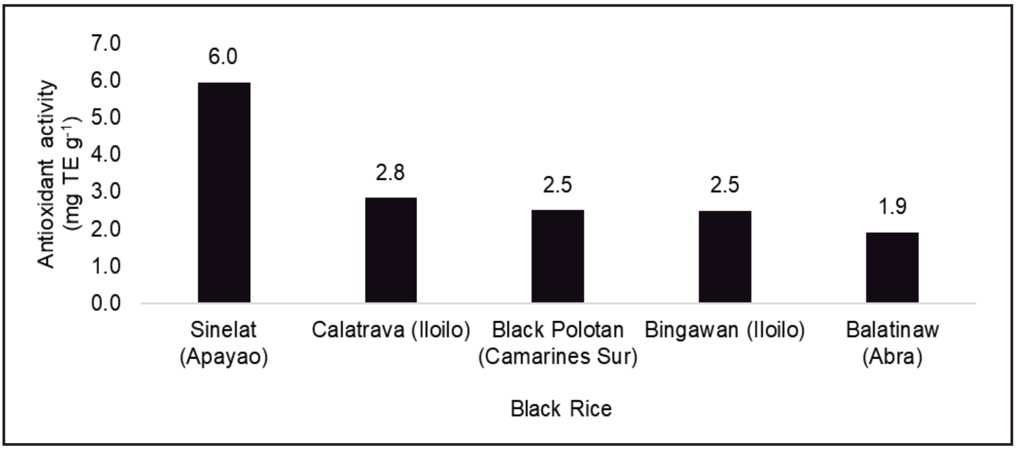


**Figure 9.38.** Black rice with the highest total antioxidant activity.


**Figure 9.39.** Best black rice varieties based on health-promoting properties.

<u>Red rice</u>

The red rice samples recorded TAC of 11.6 to 194.1 mg C3GE/kg (Table 9.17). As expected, these values were lower than those in black rice because of their lighter pigment color. Surprisingly, *Pulot* from North Cotabato yielded 194.2 mg C3GE/kg, which is quite high for red rice (Figure 9.40). The other top red rice varieties in terms of TAC included *Denorado*, *Intramis*, and *Dinorado* (Bukidnon) and *Dinorado* B (North Cotabato). Meanwhile, the TPC ranged from 0.5 to 4.7 mg GAE/g. Three red rice varieties from Bukidnon (*Dinorado*, *Denorado,* and *Kapukaw*) and two from North Cotabato (*Dinorado* A and B) registered the highest values of 3.8 - 4.7 mg GAE/g (Figure 9.41). These are much higher than the TPC of the best black rice varieties. Finally, the red rice samples had TAA from 0.5 to 10.6 mg TE/g. Four of the top red rice in terms of TPC were also the best in TAA (Figure 9.42). *Intramis* from Bukidnon also obtained high TAA. It is noteworthy to mention that most of the red rice samples had higher TAA than the black rice evaluated.

**Table 9.17.** Health-promoting properties of red rice.

| Parameter | Range |
|---|---|
| Total anthocyanin content (mg C3GE/kg) | 11.6 – 194.1 |
| Total phenolic content (mg GAE/g) | 0.5 – 4.7 |
| Total antioxidant activity (mg TE/g) | 0.5 – 10.6 |

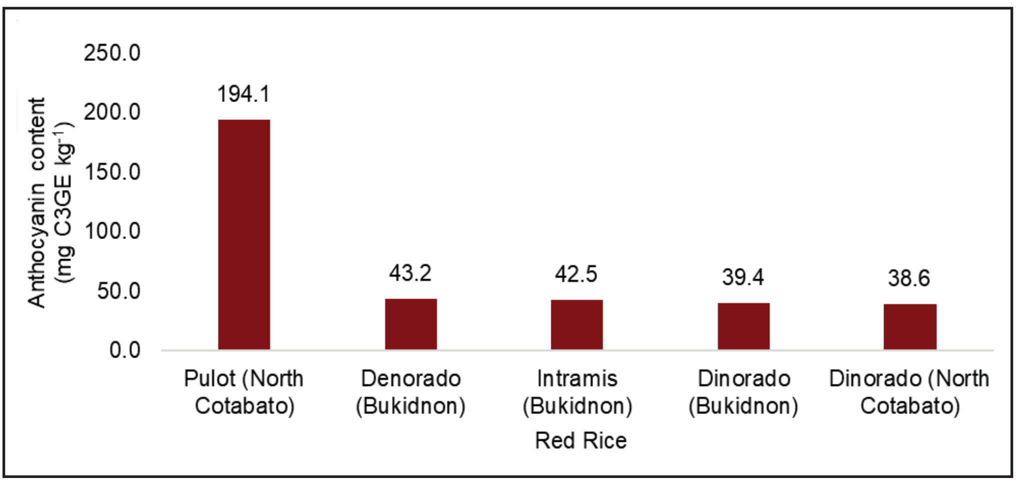


**Figure 9.40.** Red rice with the highest total anthocyanin content.

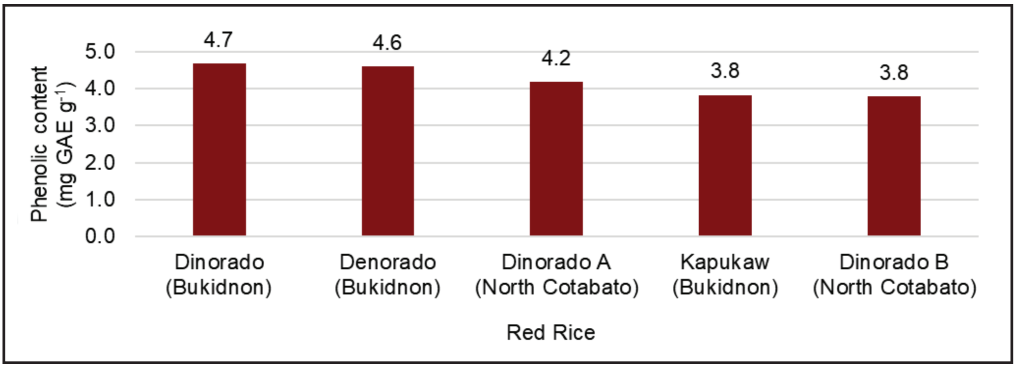


**Figure 9.41.** Red rice with the highest total phenolic content.

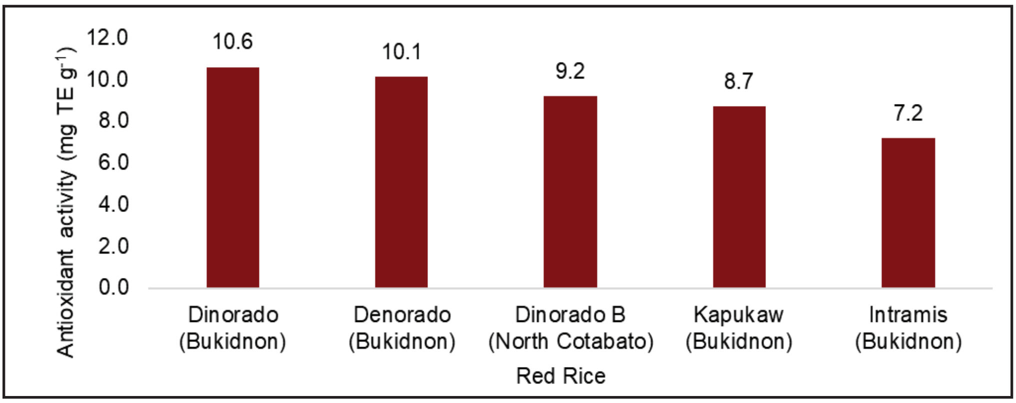


**Figure 9.42.** Red rice with the highest total antioxidant activity.

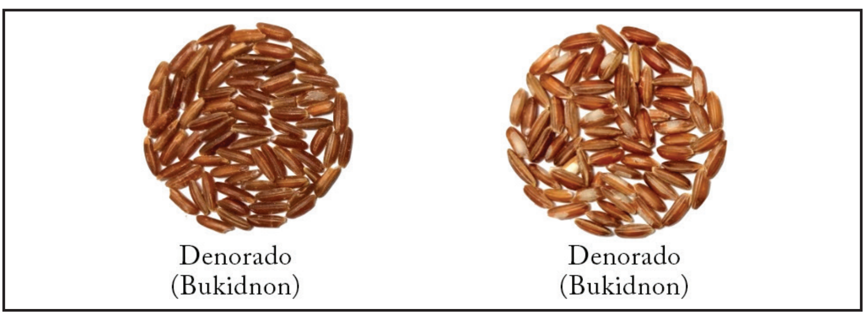


**Figure 9.43.** Best red rice varieties based on health-promoting properties.

Among the top red rice varieties, both *Denorado* and *Dinorado* from Bukidnon were recognized as the best performing varieties based on their health-promoting properties (Figure 9.43). The two varieties consistently exhibited the two highest phenolic content and antioxidant activity, while producing substantial amount of anthocyanin content.

Through careful evaluation of TAC, TPC, and TAA, the overall top varieties with the highest antioxidants are summarized in Table 9.18. Consumption of these red rice varieties with significant amounts of health-promoting properties is beneficial to consumers.

**Table 9.18.** Summary of the top pigmented rice varieties in terms of health-promoting properties.

| SR type (pigmented) | Top varieties |
|---|---|
| Black rice (unpolished) | Black *Polotan* (Camarines Sur), *Calatrava* (Iloilo), *Sinelat* (Iloilo) |
| Red rice (unpolished) | *Denorado* (Bukidnon), *Dinorado* (Bukidnon) |

## Summary and implications

Specialty rice varieties are valued for their unique quality traits. Aromatic, waxy or glutinous, and pigmented are just some of the important traits that make them premium. The Philippine government recognizes that the increased production of SR is a good strategy to address its growing demand in local and international markets. This chapter describes the grain quality characteristics and health-promoting properties of 63 local SR varieties collected from the farmers in nine project sites. The collection comprises 13 aromatic, 12 glutinous, 9 black, and 29 red rice varieties.

In aromatic rice, aroma is obviously the most important attribute. Among the samples, *Gobyerno* and *Azucena* (Apayao) and NSIC Rc 218 A (Oriental Mindoro) were identified as the top aromatic varieties for their strong *pandan* scent and tasty and tender cooked rice. For glutinous rice, AC plays a key indicator of cooking and eating quality of rice. *Waray* (Abra) and *Sinongsong-Malagkit* and Miracle (Oriental Mindoro) were named the best performing glutinous varieties due to their true-to-type amylose classification. These SR also produced 100% opaque grains, cohesive to very cohesive, and very tender cooked rice grains, which are also important traits of glutinous varieties.

In pigmented rice, color is the major contributing factor for grain quality. The varieties that exhibited very intense black grains were *Calatrava* (Iloilo) and Mindoro Black (Negros Occidental). Aside from this, Mindoro Black yielded considerably high amount of BR, while *Calatrava* produced good cooked rice texture (Instron cooked rice hardness). Having a high BR recovery and softer texture would be advantageous since pigmented rice are better consumed in unpolished form, especially for their nutritional and health-promoting properties loaded in the bran layer. Black rice varieties are an excellent source of antioxidants due to their anthocyanin and phenolic content. Among the black rice, Black *Polotan* (Camarines Sur) produced the highest TAC, while *Sinelat* (Apayao) exhibited the highest TPC and TAA. In addition to its good grain quality characteristics, *Calatrava* (Iloilo) is also loaded with health-promoting properties as shown by its high TAC, TPC, and TAA.

Similar to black rice, color is also the main grain quality trait for red rice. Among the varieties, Super *Pilit* (North Cotabato) and Red (Apayao) performed the best in terms of intensity of color (red) and tenderness (Instron cooked rice hardness). Considering the health-promoting properties, *Denorado* and *Dinorado*, both from Bukidnon, were named the top red rice varieties for their remarkably high TPC and TAA.

These research outputs showed that the country still has SR varieties that possess excellent grain quality characteristics and health-promoting properties despite the popularity of modern rice varieties over the years. For one, the pigmented SR varieties are potential source of additional health-promoting properties aside from the carbohydrates and proteins. However, additional efforts are needed to maximize the full potential of Philippine SR as healthy food and a viable enterprise. First, community seed banking (CSB) must be established to ensure availability of pure and good quality seeds all year round. Seed mixtures and impurities lead to inferior grain quality and subsequently lower market price. Also, postharvest practices, particularly drying, must also be improved to obtain good-quality grains and high milling recovery. Development of processing technologies to produce high-value food and non-food products from SR must also be considered to increase its utilization. Strong promotion, linkages, and marketing strategies will also boost the demand for SR. Lastly, improvement of existing varieties to produce high-yielding SR varieties with excellent characteristics will offer more choices and supply to farmers and end-users.

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10

# QUALITY MATCHING OF SPECIALTY RICE COLLECTED FROM FARMERS WITH CONSUMER PREFERENCES

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Rice has a wide diversity of traits that give rise to its utilization as a staple food and food- and non-food products to most people around the world. Through these traits, rice consumer preferences are expressed (Lancaster, 1966; Custodio et al., 2019), logically varying from one country to another. Preference is usually based on demographic factors, urbanization level, accessibility to market outlets, packaging, and branding (Musa et al., 2011; Custodio et al., 2019). In Japan, consumers often choose well-milled, newly processed, and short-grained Japonica rice, whereas well-milled and long-grained *Indica* rice is preferred in Thailand (Galawat and Yabe, 2010). In the Philippines, most consumers prefer long and slender rice grains with *pandan*-like scent or pleasant aroma. Nowadays, an essential criterion that affects consumers' purchasing decision is superior rice quality attributes. This is evident as many people are developing more fondness for good appearance, eating quality, and health benefits of rice (Tuaño et al., 2015; Cuevas et al., 2016). According to Galawat and Yabe (2010), although preferences in visual characteristics such as length and shape vary, consumers generally prefer varieties with tender cooked rice as expressed by intermediate amylose content (AC).

Despite ubiquitous cultivation of certified seeds of modern rice varieties for commercial production, some farmers set aside part of their land for planting premium quality specialty rice (SR) varieties that are popular in their areas. Aromatic, glutinous, black, and red rice are cultivated for personal consumption, as gift to their guests, or for selling at a higher price to generate additional income. In their efforts to preserve the cultural significance of SR, principally the indigenous varieties, some Filipino farmers continually plant traditional SR to be used in special occasions such as weddings, baptisms, and birthdays as well as in rituals or activities that are part of their tradition.

The increasing demand for premium quality rice and the willingness of consumers to pay for a higher price for certain quality attributes (Spiller, 2012; Cuevas et.al., 2016) provide an opportunity for marginalized farmers to raise their income by expanding the production of SR. With the excellent characteristics of SR, evaluation of their grain quality and consumer preference are of great significance in varietal improvement programs. Therefore, the available SR in the country must be assessed lengthily and verified to see if they meet the quality demanded or preferred by household consumers or institutional buyers. In this manner, production of available SR can be enhanced.

In this study, locally available SR samples were obtained and subjected to comprehensive grain quality evaluation. A household consumer survey was also conducted among 147 respondents from nine project sites in the Philippines and the preferences of respondents toward SR were assessed. Although the quality preferences of institutional buyers were also determined through key informant interviews as described in Chapter 7, this was only limited to small business entities, including rice-based product manufacturers, fast-food establishments, and restaurants. The bigger and more established food companies were not included as they refused to be interviewed.

This chapter focused mainly on the selected grain quality attributes of SR obtained, the household consumer quality preferences for the corresponding quality parameters, and lastly, matching the quality of the actual SR varieties cultivated by local farmers with household consumer preferences, particularly for table rice.

## SR samples and sources

The collection of SR samples was done during the different surveys performed in the course of implementation of the entire research project. Sixty-three SR varieties were obtained in paddy form from farmers in the different project sites in the Philippines: Apayao (9), Abra (4), Camarines Sur (2), Negros Occidental (7), Oriental Mindoro (6), Iloilo (12), Samar (5), North Cotabato (10), and Bukidnon (8). These are described in detail in the succeeding sections for each SR type. They were cleaned and processed in the Rice Chemistry and Food Science Division (RCFSD) laboratory and stored properly prior to analyses. These are the same SR varieties discussed in Chapter 9.

## Grain quality evaluation of SR samples

The SR samples were comprehensively characterized for various grain quality parameters using standard protocols detailed in Chapter 9. However, this chapter only highlights the selected parameters evaluated in the laboratory that were also considered in the household consumer survey.

### *Percent head rice*

Rough rice was dehulled to obtain brown rice and polished to remove the bran and embryo. The resulting milled rice was graded to separate head rice (HR) from the broken grains. The percent HR was calculated based on total milled rice (TMR).

### *Length and shape*

The length and width of the rice samples were measured using a calibrated caliper. The shape was determined by dividing grain length by its width. Grain length and shape were calculated using an average of 10 grains.

### *Percent chalky grains/translucency*

About 10 g of milled rice grains in triplicate were randomly selected. A grain with more than 50% chalky area was considered chalky.

### *Laboratory sensory evaluation*

Eleven trained panelists from RCFSD were employed to evaluate the sensory properties of raw and cooked SR. Raw rice samples were assessed in terms of the following parameters: color, % HR, grain length and shape, translucency, and gloss. On the other hand, cooked rice was evaluated for aroma, color, tenderness, and taste. Staled cooked rice was also evaluated for aroma and tenderness. Each attribute was assessed on the basis of the rating and sensory description described in Table 10.1.

**Table 10.1.** Standard rating of quality attributes used in the laboratory grain quality evaluation and consumer survey of SR.

| Attribute | Rating | Description |
|---|---|---|
| **Raw** | | |
| Color | 4 | Very white |
| (polished aromatic and glutinous) | 3 | White |
| | 2 | Creamish white |
| | 1 | Grayish white |
| Color | 4 | Very intense |
| (unpolished and polished black and red) | 3 | Intense |
| | 2 | Slightly intense |
| | 1 | Weak |
| % Head rice | 4 | 76 – 100 |
| (based on total milled rice) | 3 | 51 – 75 |
| | 2 | 26 – 50 |
| | 1 | 0 – 25 |
| Grain length (mm) | 4 | Extra long |
| | 3 | Long |
| | 2 | Medium |
| | 1 | Short |
| Grain shape | 3 | Slender |
| | 2 | Intermediate |
| | 1 | Bold |
| Translucency | 4 | Translucent |
| | 3 | White belly |
| | 2 | Chalky |
| | 1 | Opaque |
| Gloss | 4 | Very glossy |
| | 3 | Glossy |
| | 2 | Slightly glossy |
| | 1 | Dull |

*Table 10.1. Continuation.*

| Attribute | Rating | Rating |
|---|---|---|
| **Cooked** | | |
| Aroma (freshly cooked) | 4 | Very aromatic |
| | 3 | Aromatic |
| | 2 | Slightly aromatic |
| | 1 | No aroma |
| Cohesiveness | 4 | Very cohesive |
| | 3 | Cohesive |
| | 2 | Slightly cohesive |
| | 1 | Separated |
| Tenderness (freshly cooked) | 4 | Very tender |
| | 3 | Tender |
| | 2 | Slightly tender |
| | 1 | Hard |
| Tenderness (upon staling) | 4 | Very tender |
| | 3 | Tender |
| | 2 | Slightly tender |
| | 1 | Hard |
| Taste | 4 | Very tasty |
| | 3 | Tasty |
| | 2 | Slightly tasty |
| | 1 | Bland |

## Household consumer survey

Prior to the survey proper, the researchers coordinated with the Provincial Agriculture Office (PAO) and requested a list of municipalities with relatively high production of SR. When the municipalities were short-listed, they sought assistance from the Municipal Agriculture Office (MAO) in identifying possible respondents. The MAO also assisted in the actual conduct of the household consumer survey among 147 rice consumers in the provinces of Abra, Apayao, Camarines Sur, Oriental Mindoro, Iloilo, Negros Occidental, Samar, North Cotabato, and Bukidnon. For each sample province in Luzon and Visayas, 15 respondents were interviewed; 20 consumers came from each province in Mindanao. The selection criteria used in screening respondents were the following: must not be SR farm operator and must also be consuming any of the four types of SR for at least twice a month. When they meet both requirements, they were selected as respondents through snowball sampling.


**Figure 10.1.** Raw rice standards with corresponding rating and description.

The survey lasted for about 15 to 20 minutes per consumer, depending on the number of SR types that they consume as there were instances that one consumer uses two types of SR in their household (e.g., red and black rice). The sociodemographic profiles of respondents, which include the number of all household members who are consuming SR, household quantity requirement per year, as well as source and amount of SR consumed, were recorded. Raw rice standards with corresponding rating and description were shown to respondents and used as reference in choosing the appropriate rating for each raw rice attribute (e.g., color – 1 grayish white, 2 creamish white, 3 white, 4 very white). The complete set of standards was composed of different rice samples representing different degrees of color, % HR, grain length and shape, translucency, and gloss (Figure 10.1). Meanwhile, for cooked rice, respondents were asked for their preferred characteristics in terms of aroma, cohesiveness, tenderness (both freshly cooked and upon staling), and taste, which was limited only to the personal perception of the respondents because no cooked rice standards were shown to them. Unfortunately, personal perception may likely lead to exaggerated preference, which may affect the overall consumer liking of SR. This is another limitation of this study.

Finally, data from actual laboratory analyses and those from the survey were compared to determine if consumer preference for each quality attribute matches and if this can be satisfied by using locally available SR.

## Aromatic rice

One of the most important value-added characteristics of rice is aroma since it is a preferred trait by most consumers, not only in the Philippines but also across South and Southeast Asia (Custodio et al., 2019). There is great interest in aromatic varieties in the market as they command a higher price than non-aromatic rice (Calingacion et al., 2014). The *pandan*-like scent is mainly associated with the volatile compound 2AP that is present in relatively high concentrations in aromatic rice varieties (Laksanalamai and Ilangantileke, 1993). The intensity of aroma brought by 2AP is greatly affected by genetic background of the variety and agronomic and postharvest conditions and management (Wakte et al., 2017). The detection of 2AP on routine basis is usually conducted using gas chromatography. Interestingly, this compound can be easily detected by humans, hence, it is one of the parameters looked at in laboratory sensory evaluation of raw and cooked rice.

The percentage distribution of collected aromatic rice in the different provinces is indicated in Figure 10.2 and some of the samples are shown in Figure 10.3. The grain quality characteristics of the samples evaluated in the laboratory are given in Table 10.2. The % HR of raw aromatic SR samples varied from as low as 34% to as high as 96%. *Kalapdos* from Samar had the highest HR recovery (96%) among other aromatic rice samples. According to Singh et al. (2000), milling yield is very important from a marketing standpoint since a variety that possesses high HR and TMR recoveries can command a higher price. However, HR recovery varies, depending on the rice variety, drying and milling time, as well as degree of polishing.

For grain length, shape, and chalkiness/translucency, the samples were classified as short to long, intermediate to slender, and opaque to translucent, respectively. The results showed that aromatic rice available in the Philippines varied in length, shape, and chalkiness/translucency. Based on a study conducted by Villanueva et al. (2018), one of the most commonly known aromatic rice, Jasmine rice, is medium, slender, and translucent. This study shows one of the samples having almost the same characteristics as Jasmine rice, NSIC Rc 218 B from Oriental Mindoro, which was found to be slender and translucent. Most of the samples were perceived to be creamish white in color, except for *Biganti* Plus from Negros Occidental with white grains. All aromatic SR collected had dull grains, except for *Azucena* from Negros Occidental, which was slightly glossy.

In terms of cooked aromatic SR, the samples collected either had no aroma or were slightly aromatic only. Cooked samples were also evaluated as bland to slightly tasty. No sample was evaluated as aromatic and tasty contrary to what farmers claim for their aromatic SR. The cooked grains collected were also

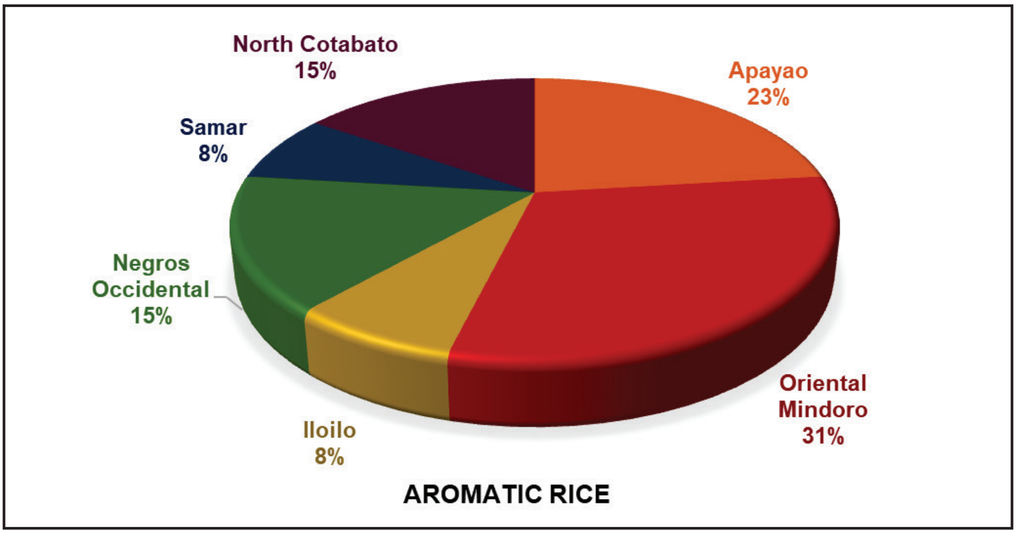


**Figure 10.2.** Percentage distribution of collected aromatic rice in the project sites.

observed to be either separated, slightly cohesive, or cohesive. The tenderness of cooked rice was also assessed in freshly cooked and staled forms. Results show that freshly cooked rice had slightly tender to tender grains while staled cooked rice grains were hard to tender.


**Figure 10.3.** Some aromatic rice varieties collected from farmers.

Consumer preference data on raw and cooked aromatic SR are presented in Table 10.3. Based on the results, majority of the consumers surveyed preferred white to very white raw aromatic SR. They perceived whiteness as premium quality, an anticipated finding inasmuch as most Filipinos in the country prefer white rice and they tend to classify those with off-color or yellowish grains as low-quality rice (Velasco et al., 2015; Custodio et al., 2019). In terms of HR, most of the consumers preferred aromatic rice with 76 – 100%. Wholeness of the rice grain or higher HR recovery has been consistently emphasized as a priority trait by consumers in the Philippines since the 1980s (Unnevehr, 1986; Juliano and Villareal, 1993). Strangely enough, some of the respondents still chose very low HR recovery as a preferred trait. It is possible that their choice is greatly affected by their purchasing power, especially in rural areas as HR is known to be associated with higher market price (Rachmat et al., 2006; Cuevas et al., 2016). In addition, based on a previous study of Cuevas et al., 2016, respondents were willing to pay for milled rice that falls below the premium standard set by the National Food Authority (NFA), especially those in rural areas where availability of premium quality rice is possibly limited. Meanwhile, the grain length and shape preference of the respondents also appeared to differ from one another from short to extra-long and from intermediate to slender, respectively. Based on previous data, most consumers in the Philippines prefer long and slender grains (Juliano et al., 1992; Cuevas et al., 2016). Similarly, consumers showed a wide range of preference in terms of translucency and gloss of raw SR aromatic varieties. This suggests that having opaque spots on rice grains is not a big deal for some consumers. According to Ikehashi and Khush (1979), chalkiness does not directly affect the cooking and eating experience of rice.

For the cooked aromatic SR varieties, consumer preferences in terms of aroma, cohesiveness, tenderness (freshly cooked and staled), and taste were assessed. Results showed a broad degree of preferences on all traits, except for the taste and tenderness of rice upon staling. The consumers wanted slightly tasty to very tasty cooked aromatic SR. In terms of tenderness, consumers preferred tender to very tender staled rice, which was opposite that of freshly cooked where a few consumers selected hardness as their preferred trait. Even though majority of the respondents wished to consume rice with aroma, some of them still selected rice with no aroma. Again, this may be attributed to the fact that they still consider the price they have to pay in their selection even if the question is merely about quality.

**Table 10.2.** Grain quality characteristics of aromatic rice collected from farmers.

| Attribute | Laboratory result | Description |
|---|---|---|
| **Raw** | | |
| Color | 1 – 3 | Grayish white to white |
| % Head rice | 34 – 96 | |
| Grain length (mm) | 4.6 – 7.4 | Short to long |
| Grain shape | 2.1 – 3.1 | Intermediate to slender |
| Translucency | 2 – 4 | Chalky to translucent |
| Gloss | 1 – 2 | Dull to slightly glossy |
| **Cooked** | | |
| Aroma | 1 – 2 | No aroma to slightly aromatic |
| Cohesiveness | 1 – 3 | Separated to cohesive |
| Tenderness (freshly cooked) | 2 – 3 | Slightly tender to tender |
| Tenderness (upon staling) | 1 – 3 | Hard to tender |
| Taste | 1 – 2 | Bland to slightly tasty |

Table 10.4 compares the results from actual laboratory analysis with consumer preference toward aromatic SR collected from farmers. Actual quality was computed as the percentage of samples falling under the specific description of each rice attribute, while consumer preference was the percentage of consumers who preferred the specific rice description. Although consumer preference was already discussed in the consumer survey in Chapter 7, laboratory evaluation of the collected SR is

elaborated in this chapter in order to emphasize the matching between the quality of supply and quality requirements of consumers.

For raw polished aromatic rice, most of the quality parameters evaluated differed significantly between the farmer samples analyzed and consumer preference, except for grain length (long) and shape (intermediate). Consumers desired white (41%) to very white (59%) grains, but the actual samples were mostly creamish white (62%). This preference of Filipinos for whiter rice is expected. Since the color of the grains is largely influenced by postharvest management, farmers should ensure that drying and storage are employed properly to prevent color deterioration. In terms of percent HR, the samples obtained were mostly 51 – 75%, whereas the consumers (77%) preferred a higher percentage at 76 – 100%. To cater to the preference of consumers for whole grains, appropriate postharvest practices should also be conducted to minimize fissuring or cracking of the grains that result in lower HR recovery. Again, discrepancies were detected in terms of translucency and gloss. Majority of the consumers favored more translucent (50%) and glossy grains (52%); in contrast, the samples were chalky (77%) and dull (92%).

**Table 10.3.** Consumer preference for aromatic rice.

| Attribute | Response range | Description |
|---|---|---|
| **Raw** | | |
| Color | 3 – 4 | White to very white |
| % Head rice | 1 – 4 | 0 – 25 to 76 – 100 |
| Grain length (mm) | 1 – 4 | Short to extra long |
| Grain shape | 2 – 3 | Intermediate to slender |
| Translucency | 1 – 4 | Opaque to translucent |
| Gloss | 1 – 3 | Dull to glossy |
| **Cooked** | | |
| Aroma | 1 – 4 | No aroma to very aromatic |
| Cohesiveness | 1 – 4 | Separated to very cohesive |
| Tenderness (freshly cooked) | 1 – 4 | Hard to very tender |
| Tenderness (upon staling) | 3 – 4 | Tender to very tender |
| Taste | 2 – 4 | Slightly tasty to very tasty |

When it comes to cooked polished aromatic rice, significant differences were observed for aroma, tenderness, and taste but none for cohesiveness (both slightly cohesive to cohesive). Consumers preferred more aromatic, tender, and tasty rice, but the samples recorded lower scales. A total of 77% of the SR aromatic samples produced no aroma as compared with the consumer preference of aromatic (57%) to very aromatic (23%). Nevertheless, there were three SR aromatic varieties that exhibited slight *pandan*-like scent when freshly cooked: *Gobyerno* and *Azucena* (Apayao) and NSIC Rc 218 A (Oriental Mindoro). In terms of tenderness, SR aromatic samples, when freshly cooked, scored slightly tender (46%) to tender (54%), while consumer preference was tender (83%). Upon staling, 90% of consumers still preferred tender SR samples, far from slightly tender (54%) of the collected samples. Most of the samples collected from farmers and evaluated in the laboratory as bland (77%) significantly differed from the desired tasty of 80% of consumers.

**Table 10.4.** Comparative quality between actual laboratory analysis and consumer preference of aromatic rice collected from farmers.

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| **Raw** | | | |
| Color (polished) | Very white | 0 | 59 |
| | White | 8 | 41 |
| | Creamish white | 62 | 0 |
| | Grayish white | 30 | 0 |
| % Head rice | 76 – 100 | 31 | 77 |
| | 51 – 75 | 54 | 10 |
| | 26 – 50 | 15 | 0 |
| | 0 – 25 | 0 | 13 |
| Grain length (mm) | Extra long | 0 | 27 |
| | Long | 54 | 47 |
| | Medium | 38 | 23 |
| | Short | 8 | 3 |
| Grain shape | Slender | 15 | 30 |
| | Intermediate | 85 | 70 |
| | Bold | 0 | 0 |
| Translucency | Translucent | 23 | 50 |
| | White belly | 0 | 17 |
| | Chalky | 77 | 27 |
| | Opaque | 0 | 6 |

*Table 10.4. Continuation.*

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| Gloss | Very glossy | 0 | 0 |
| | Glossy | 0 | 52 |
| | Slightly glossy | 8 | 34 |
| | Dull | 92 | 14 |
| **Cooked** | | | |
| Aroma | Very aromatic | 0 | 23 |
| | Aromatic | 0 | 57 |
| | Slightly aromatic | 23 | 17 |
| | No aroma | 77 | 3 |
| Cohesiveness | Very cohesive | 0 | 3 |
| | Cohesive | 46 | 40 |
| | Slightly cohesive | 46 | 50 |
| | Separated | 8 | 7 |
| Tenderness (freshly cooked) | Very tender | 0 | 7 |
| | Tender | 54 | 83 |
| | Slightly tender | 46 | 7 |
| | Hard | 0 | 3 |
| Tenderness (upon staling) | Very tender | 0 | 10 |
| | Tender | 38 | 90 |
| | Slightly tender | 54 | 0 |
| | Hard | 8 | 0 |
| Taste | Very tasty | 0 | 13 |
| | Tasty | 0 | 80 |
| | Slightly tasty | 23 | 7 |
| | Bland | 77 | 0 |

## Glutinous rice

Glutinous rice differs from ordinary rice mainly because of the very low or almost negligible AC in its starch. It is basically composed of high amounts of amylopectin (Chung et al., 2010). Amylose is considered a key determinant of rice eating quality as it has been found to be positively correlated with hardness of rice (Oko et al., 2012). Glutinous rice, being very low in AC, tends to be very sticky when cooked. This is the reason most Filipino consumers prefer this type of rice, especially for special gatherings and occasions as it is commonly utilized in the preparation of rice-based snacks and delicacies such as *kakanin*, champorado, and the like. Meanwhile, other countries in Southeast Asia such as Thailand and Laos prefer glutinous rice as their staple food (Takamura, 1967).

Twelve glutinous rice samples were collected from six different provinces in the Philippines and Figure 10.4 displays the percentage distribution in Abra, Camarines Sur, Oriental Mindoro, Iloilo, Negros Occidental, and Samar. Some of the collected glutinous rice are shown in Figure 10.5. Raw grains were grayish white to white in color (Table 10.5). Generally, whiteness of grain for non-waxy rice is relatively higher than in glutinous rice. Grain length and shape varied from short to long and bold to intermediate, respectively. Based on a study conducted by Juliano et al. (1989), non-pigmented glutinous rice typically has short and bold grains. Among all samples, *Waray* from Abra had short and intermediate grains. All samples had dull and mostly opaque grains.

For cooked glutinous SR, no aroma was perceived among 58% of the samples while 33% were bland. The rest were observed to have a slightly pleasant aroma and taste. Pleasant aroma and taste of the samples were described as "glutinous-like," not as *pandan*. Cooked glutinous rice are known to have cohesive texture due to its waxy amylose. Most of the collected samples were found to be cohesive to very cohesive. In addition, 83% of the samples were evaluated as very tender in freshly cooked form but this was reduced to 33% upon staling. Tenderness of the samples may also be affected by the variety itself, AC, gelatinization temperature, and cooking method (Zhou et al., 2002).

Table 10.6 gives the results of the survey on the preferences of consumers for glutinous SR varieties. For raw polished glutinous rice, a wide range of consumer preference was observed in all the traits. Consumers preferred very white glutinous rice grains, whereas a few still selected creamish or grayish white. Most of the respondents preferred high HR percentage. The few consumers who selected low HR recovery or those with broken grains were probably not after whole rice grains because they most likely use glutinous rice flour as raw material in the preparation of rice-based food products. The consumer preference ranged from short to extra long for grain length and bold to slender for grain shape where preference was mostly bold. This grain shape is typical of local glutinous rice (e.g., *Señorita* and *Sungsong*). For translucency, majority of consumers favored opaque grains. Lastly, glossiness does not seem to be an important parameter for the respondents as most of them preferred dull grains.

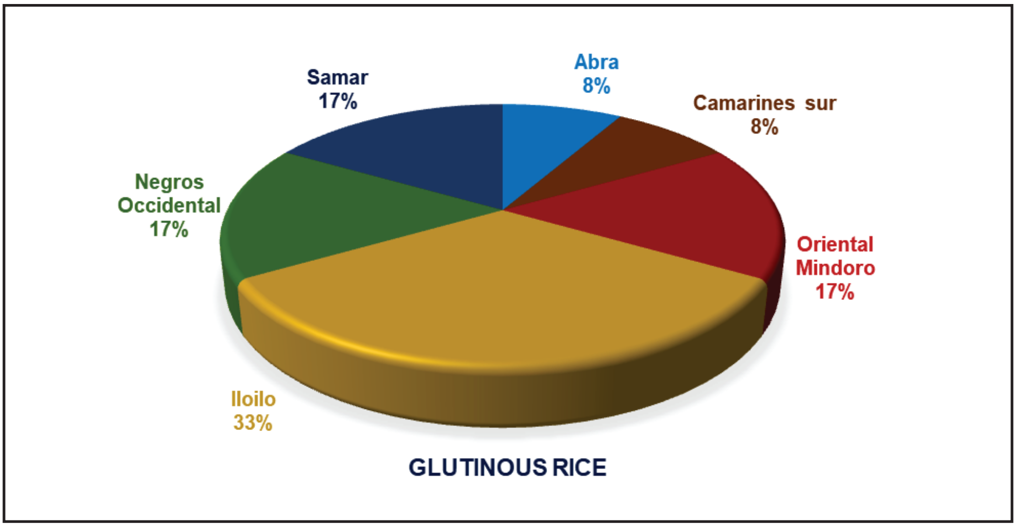


**Figure 10.4.** Percentage distribution of collected glutinous rice in the project sites.


**Figure 10.5.** Some glutinous rice varieties collected from farmers.

In terms of cooked glutinous SR, a wide range of preference was also observed in each parameter, except for cohesiveness and tenderness of the freshly cooked form. The consumers preferred the slightly to very cohesive trait. Similarly, slightly tender to very tender was preferred by consumers of freshly cooked glutinous rice. However, majority of the respondents showed preference for very cohesive and very tender glutinous rice, in keeping with the actual properties of glutinous rice. Upon staling, some consumers preferred hard glutinous rice,

**Table 10.5.** Grain quality characteristics of glutinous rice collected from farmers.

| Attribute | Scale/rating | Description |
|---|---|---|
| **Raw** | | |
| Color | 1 – 3 | Grayish white to white |
| % Head rice | 37 – 92 | |
| Grain length (mm) | 4.9 – 6.7 | Short to long |
| Grain shape | 1.8 – 2.9 | Bold to intermediate |
| Translucency | 1 – 3 | Opaque to white belly |
| Gloss | 1 | Dull |
| **Cooked** | | |
| Aroma | 1 – 2 | No aroma to slightly aromatic |
| Cohesiveness | 2 – 4 | Slightly cohesive to very cohesive |
| Tenderness (freshly cooked) | 2 – 4 | Slightly tender to very tender |
| Tenderness (upon staling) | 2 – 4 | Slightly tender to very tender |
| Taste | 1 – 2 | Bland to slightly tasty |

**Table 10.6.** Consumer preference for glutinous rice.

| Attribute | Response range | Description |
|---|---|---|
| **Raw** | | |
| Color | 1 – 4 | Grayish white to very white |
| % head rice | 1 – 4 | 0 – 25 to 76 – 100 |
| Grain length (mm) | 1 – 4 | Short to extra long |
| Grain shape | 1 – 3 | Bold to slender |
| Translucency | 1 – 4 | Opaque to translucent |
| Gloss | 1 – 3 | Dull to glossy |
| **Cooked** | | |
| Aroma | 1 – 4 | No aroma to very aromatic |
| Cohesiveness | 2 – 4 | Slightly cohesive to very cohesive |
| Tenderness (freshly cooked) | 2 – 4 | Slightly tender to very tender |
| Tenderness (upon staling) | 1 – 4 | Hard to very tender |
| Taste | 1 – 4 | Bland to very tasty |

**Table 10.7.** Comparative quality between actual laboratory analysis and consumer preference of glutinous rice collected from farmers.

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| **Raw** | | | |
| Color (polished) | Very white | 0 | 63 |
| | White | 17 | 28 |
| | Creamish white | 25 | 3 |
| | Grayish white | 58 | 6 |
| % Head rice | 76 – 100 | 17 | 64 |
| | 51 – 75 | 75 | 26 |
| | 26 – 50 | 8 | 3 |
| | 0 – 25 | 0 | 7 |
| Grain length (mm) | Extra long | 0 | 12 |
| | Long | 33 | 36 |
| | Medium | 50 | 29 |
| | Short | 17 | 23 |
| Grain shape | Slender | 0 | 17 |
| | Intermediate | 92 | 38 |
| | Bold | 8 | 45 |
| Translucency | Translucent | 0 | 3 |
| | White belly | 8 | 3 |
| | Chalky | 8 | 1 |
| | Opaque | 84 | 93 |
| Gloss | Very glossy | 0 | 0 |
| | Glossy | 0 | 14 |
| | Slightly glossy | 0 | 19 |
| | Dull | 100 | 67 |
| **Cooked** | | | |
| Aroma | Very aromatic | 0 | 1 |
| | Aromatic | 0 | 33 |
| | Slightly aromatic | 42 | 32 |
| | No aroma | 58 | 34 |

*Table 10.7. Continuation.*

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| Cohesiveness | Very cohesive | 50 | 63 |
| | Cohesive | 42 | 25 |
| | Slightly cohesive | 8 | 12 |
| | Separated | 0 | 0 |
| Tenderness (freshly cooked) | Very tender | 84 | 51 |
| | Tender | 8 | 42 |
| | Slightly tender | 8 | 7 |
| | Hard | 0 | 0 |
| Tenderness (upon staling) | Very tender | 33 | 42 |
| | Tender | 50 | 46 |
| | Slightly tender | 17 | 10 |
| | Hard | 0 | 2 |
| Taste | Very tasty | 0 | 5 |
| | Tasty | 0 | 62 |
| | Slightly tasty | 67 | 26 |
| | Bland | 33 | 7 |

although majority still wanted a tender texture. In terms of aroma, consumers liked no aroma to very aromatic glutinous rice, but surprisingly, a higher percentage of respondents chose the no-aroma characteristic of glutinous rice. Lastly, a wide range of preference was also observed for taste: majority was in favor of glutinous rice that is tasty.

Except for color, HR recovery, and grain shape, all parameters for raw polished glutinous rice were similar between the collected samples and consumer preference (Table 10.7). Majority of the samples were evaluated in the laboratory as grayish (58%) and creamish white (25%), which were significantly different from what the consumers liked (white at 28% to very white at 63%). The 76 – 100% HR recovery preferred by 64% of the consumers also significantly differed from the 75% of the collected samples from farmers with 51 – 75% recovery only. Grain shape was intermediate (92%) in the laboratory as opposed to bold (45%) by the consumers.

For cooked polished glutinous rice, sensory evaluation revealed that the farmers' samples were attuned to consumer preference in being mostly very cohesive and mostly very tender when fresh or mostly tender upon staling. These traits were displayed by *Waray* (Abra), Miracle and *Sinongsong-Malagkit* (Oriental Mindoro), *Pilit* (Negros Occidental), and *Pilit* White D (Iloilo). However, majority of the consumers favored more aromatic glutinous rice (65%), while the samples profiled with no aroma (58%) to slightly aromatic (42%) as perceived by the sensory panelists. Furthermore, 62% of the consumers preferred tasty rice, which was significantly different from the laboratory results showing that samples were slightly tasty (67%) and bland (33%).

## Black rice

In Southeast Asian countries, premium quality rice is perceived to feature properties that are beneficial to human health such as the presence of vitamins, minerals, high fiber, and others (Custodio et. al, 2019). Such traits are interestingly present in pigmented rice varieties.

Black rice is well-known for its high amount of anthocyanin, a group of reddish to purple water-soluble flavonoids mainly responsible for the numerous health benefits (Deng et al., 2013). Although pigmented rice, in general, is often perceived as less palatable, mainly because of its hardness and coarse texture, the health benefits affect consumer preference, increasing its demand in the market (Napasintuwong, 2020).

Black rice samples were obtained from six provinces in the Philippines; these were sourced particularly in Apayao, Abra, Camarines Sur, Iloilo, Negros Occidental, and Bukidnon (Figure 10.6). Some of the collected black rice are shown in Figure 10.7. The grains had slightly intense to very intense black color (Table 10.8). HR recovery is one of the parameters that affect the price of black rice in the market, reaching as high as 84%. Grain length and shape of samples ranged from short to long and bold to intermediate, respectively. In India, black rice has long and slender grains (Ponnappan et al., 2017). They were also perceived to be chalky to translucent. Meanwhile, all raw black rice grains were described as dull in general.

In terms of aroma, cooked black rice were perceived by sensory panelists to range from no aroma to aromatic. All samples had no aroma, except for *Sinelat* from Apayao, which exhibited *pandan*-like scent. In general, black rice has a relatively intense flavor that is typically different from other types of rice. Its aroma and taste are most commonly described as nutty (Saha, 2016). In terms of cohesiveness and tenderness, the samples were evaluated to be slightly cohesive to very cohesive and slightly tender to very tender, respectively.

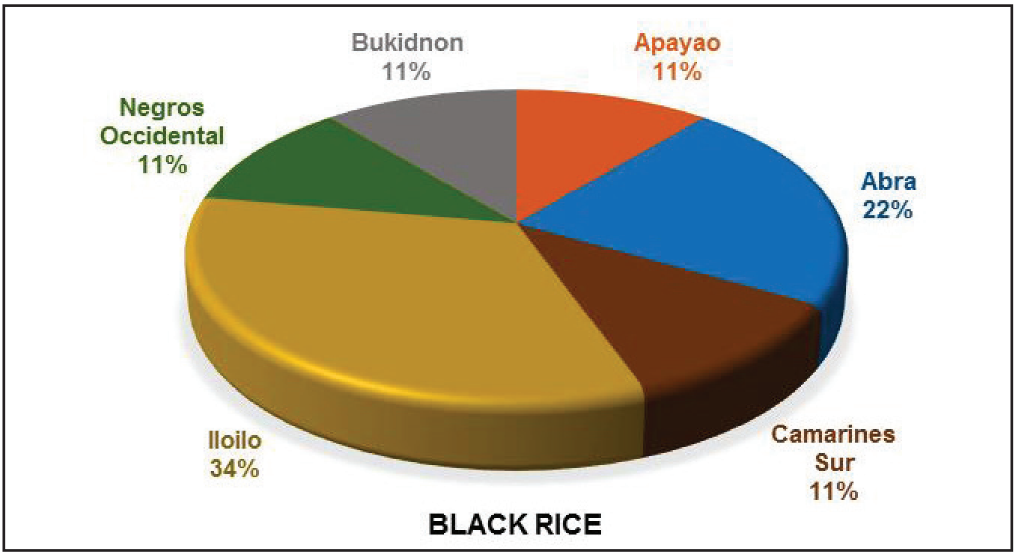


**Figure 10.6.** Percentage distribution of collected black rice in the project sites.


**Figure 10.7.** Some black rice varieties collected from farmers.

The data gathered from the consumer preference survey on black rice varieties are presented in Table 10.9. In the raw samples, a broad range of preference was noted in all attributes. For color, consumers preferred weak to very intense black rice. Higher consumer preference was recorded as color intensity increased in the samples. Majority of the respondents preferred very intense black rice varieties. This choice may be attributed to the belief that the more intense the color of the rice pericarp, the healthier it is (Walter and Marchesan et al., 2011). As in other SR types, majority of the consumers wanted a high percentage of HR, 76 – 100%. Consumer preference for grain length and shape ranged from short to extra long and bold to slender, respectively. Most of them liked long and intermediate size and shape for black rice varieties. For translucency, preference varied from opaque to translucent; most of them preferred black rice with opaque attributes. Results also showed that dull black rice was mostly preferred by the consumers.

In terms of cooked black rice, a wide range of preference was also noted in all the attributes. For aroma, consumer preference ranged from no aroma to aromatic; most of them favored aromatic black rice. For cohesiveness, consumers chose separated to very cohesive cooked black rice. For tenderness, the range was from slightly tender to very tender and slightly tender to very tender for freshly cooked and staled black rice, respectively. Likewise, a wide range of preference was noted in taste from bland to very tasty, where tasty black rice was the most preferred.

**Table 10.8.** Grain quality characteristics of black rice collected from farmers.

| Attribute | Scale/rating | Description |
|---|---|---|
| **Raw** | | |
| Color | 2 – 4 | Slightly intense to very intense |
| % Head rice | 38 – 84 | |
| Grain length (mm) | 5.4 – 6.9 | Short to long |
| Grain shape | 1.7 – 2.8 | Bold to intermediate |
| Translucency | 2 – 4 | Chalky to translucent |
| Gloss | 1 | Dull |
| **Cooked** | | |
| Aroma | 1 – 3 | No aroma to aromatic |
| Cohesiveness | 2 – 4 | Slightly cohesive to very cohesive |
| Tenderness (freshly cooked) | 2 – 4 | Slightly tender to very tender |
| Tenderness (upon staling) | 1 – 4 | Hard to very tender |
| Taste | 1 – 3 | Bland to tasty |

**Table 10.9.** Consumer preference for black rice.

| Attribute | Response range | Description |
|---|---|---|
| **Raw** | | |
| Color | 1 – 4 | Weak to very intense |
| % head rice | 1 – 4 | 0 – 25 to 76 – 100 |
| Grain length (mm) | 1 – 4 | Short to extra long |
| Grain shape | 1 – 3 | Bold to slender |
| Translucency | 1 – 4 | Opaque to translucent |
| Gloss | 1 – 3 | Dull to glossy |
| **Cooked** | | |
| Aroma | 1 – 3 | No aroma to aromatic |
| Cohesiveness | 1 – 4 | Separated to very cohesive |
| Tenderness (freshly cooked) | 2 – 4 | Slightly tender to very tender |
| Tenderness (upon staling) | 2 – 4 | Slightly tender to very tender |
| Taste | 1 – 4 | Bland to very tasty |

In raw black rice samples, the collected samples were found to have intense black color, which was aligned with consumer preference (Table 10.10). However, the percent HR recorded a significant difference: majority of the black rice samples had only 26 – 50% in the laboratory, while consumers desired higher values at 76 – 100%. A similar case was observed for translucency, 89% of black rice samples were evaluated as chalky, whereas consumer preference was either translucent (35%) or opaque (41%).

Based on perception, consumer preference did not differ significantly from laboratory analysis for all cooked rice parameters, except for aroma and taste. Aromatic black rice was favored by 52% of the consumers while only 22% of the samples were aromatic. Sixty-three percent of the consumers preferred cooked black rice to be tasty compared with actual laboratory analysis where samples were rated slightly tasty (67%). For color, the varieties with very intense black color were BR 261, *Bingawan*, and *Calatrava* from Iloilo, and Mindoro Black from Negros Occidental.

## Red rice

The health-promoting properties of pigmented rice can significantly influence the preference of rice consumers. Consumers buy pigmented rice mainly because of their nutritional value and potential defense against several diseases. In fact, the Philippines and its neighboring countries have been utilizing colored rice as functional food. Red rice, in particular, contains a promising amount of bioactive compounds such as proanthocyanidin and phenolic acids that are associated with excellent antioxidant activity (Gunaratne et al., 2013).

Red rice samples were collected from seven provinces in the Philippines (Figure 10.8), most of which were collected from North Cotabato (28%) and Bukidnon (24%). Figure 10.9 shows some of these samples. Red color was distinctively perceived in the grains, which ranged from slightly intense to very intense red (Table 10.11). Two samples (i.e., *Dikit* and *Dinorado* mixed with *Dikit*), both from Bukidnon, had a high HR recovery of 98%. Grain length and shape were observed to be short to long and bold to slender, respectively. Ponnappan et al. (2017) discovered two varieties of red rice in India to have medium and slender grain length and shape. Red rice, therefore, has a wide range of grain length and shape not only in the Philippines but also in other countries. On the other hand, grains of red SR were observed to range from being opaque to translucent. Red *Malagkit* from Negros Occidental, *Pulot* and Super *Pilit* from North Cotabato, and *Dekat* and *Dekat-Iyuan* from Apayao are the red rice with opaque grains. Rice with opaque grains were generally considered waxy or glutinous, hence, they have more tender and cohesive texture than varieties with translucent grains. Meanwhile, all red rice samples were evaluated to have dull grains.

In terms of cooked red rice, samples were perceived to have no aroma to aromatic and bland to tasty. According to Saha (2016), most pigmented rice have nutty aroma and taste compared with non-pigmented rice. For texture, cohesiveness and tenderness varied from separated to very cohesive and slightly tender to very tender. In a study conducted by Mardiah, et al. (2017), milling degree greatly affects the texture of rice, including cohesiveness, smoothness, and tenderness. In the case of red rice, many of the samples were described as slightly tender and slightly cohesive.

**Table 10.10.** Comparative quality between actual laboratory analysis and consumer preference of black rice collected from farmers.

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| **Raw** | | | |
| Color (unpolished) | Very intense | 11 | 42 |
| | Intense | 78 | 38 |
| | Slightly intense | 11 | 17 |
| | Weak | 0 | 4 |
| % Head rice | 76 – 100 | 22 | 76 |
| | 51 – 75 | 22 | 12 |
| | 26 – 50 | 56 | 0 |
| | 0 – 25 | 0 | 12 |
| Grain length (mm) | Extra long | 0 | 16 |
| | Long | 56 | 48 |
| | Medium | 33 | 20 |
| | Short | 11 | 16 |
| Grain shape | Slender | 0 | 24 |
| | Intermediate | 89 | 52 |
| | Bold | 11 | 24 |
| Translucency | Translucent | 11 | 35 |
| | White belly | 0 | 6 |
| | Chalky | 89 | 18 |
| | Opaque | 0 | 41 |
| Gloss | Very glossy | 0 | 0 |
| | Glossy | 0 | 39 |
| | Slightly glossy | 0 | 15 |
| | Dull | 100 | 46 |
| **Cooked** | | | |
| Aroma | Very aromatic | 0 | 0 |
| | Aromatic | 22 | 52 |
| | Slightly aromatic | 56 | 30 |
| | No aroma | 22 | 18 |

*Table 10.10. Continuation.*

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| Cohesiveness | Very cohesive | 33 | 19 |
| | Cohesive | 34 | 35 |
| | Slightly cohesive | 33 | 38 |
| | Separated | 0 | 8 |
| Tenderness (freshly cooked) | Very tender | 33 | 22 |
| | Tender | 45 | 45 |
| | Slightly tender | 22 | 33 |
| | Hard | 0 | 0 |
| Tenderness (upon staling) | Very tender | 33 | 15 |
| | Tender | 45 | 52 |
| | Slightly tender | 11 | 33 |
| | Hard | 11 | 0 |
| Taste | Very tasty | 0 | 7 |
| | Tasty | 11 | 63 |
| | Slightly tasty | 67 | 26 |
| | Bland | 22 | 4 |

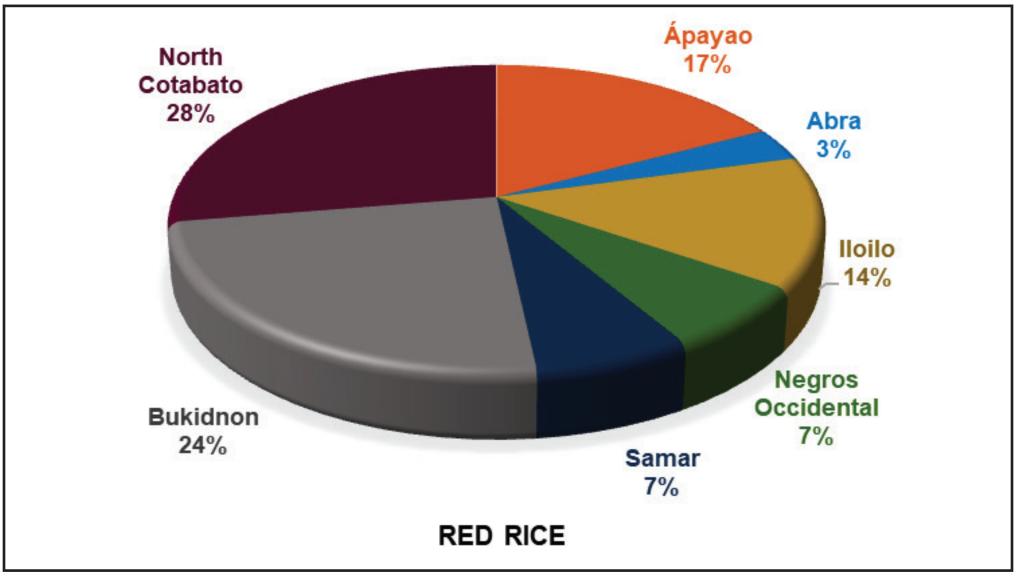


**Figure 10.8.** Percentage distribution of collected red rice in the project sites.

Based on the data presented in Table 10.12, wide variations in consumer preference were noted in all attributes for both raw and cooked red rice. In raw red rice, the color preference of the consumers ranged from weak to very intense, where most consumers wanted intense red. Similar to all other SR types, the HR preference of consumers was mostly high, 76 – 100%. As to grain length and shape, consumer preference varied from short to extra long and bold to slender, respectively, although most liked long and intermediate red rice. In contrast to the previously discussed preference on black rice, most of the consumers preferred translucent grains for red rice. This may be the reason more red rice is consumed as table rice than black rice. In terms of gloss, consumer preference ranged from dull to glossy; majority of consumers liked glossy red rice.

Red *Malagkit* (Negros Occidental) | *Dalagang Bukid* (Negros Occidental) | *Pulot* (North Cotobato)

**Figure 10.9.** Some red rice varieties collected from farmers.

The results of the consumer preference survey for cooked red rice were almost the same as those for black rice. A broad range of consumer preference was noted in all attributes. For aroma, preference ranged from no aroma to very aromatic red rice. Most of the consumers were likely to consume aromatic red rice. Cohesive red rice was also preferred by the majority of the consumers. In terms of tenderness, consumers' preference varied from slightly tender to very tender for freshly cooked and from hard to tender for staled red rice. Most of the respondents chose tender as their preferred characteristic for both freshly cooked and staled red rice. As expected, consumers preferred tasty red rice.

The importance of color intensity of raw red rice was revealed in both farmers' samples and consumer preference (Table 10.13). A similar observation was obtained in terms of higher percent HR. Notable discrepancies were, however, observed in grain length and translucency. Consumers desired long grains, but the samples

**Table 10.11.** Grain quality characteristics of red rice collected from farmers.

| Attribute | Scale/rating | Description |
|---|---|---|
| **Raw** | | |
| Color | 2 – 4 | Slightly intense to very intense |
| % Head rice | 28 – 98 | |
| Grain length (mm) | 4.4 – 7.2 | Short to long |
| Grain shape | 1.7 – 3.2 | Bold to slender |
| Translucency | 1 – 4 | Opaque to translucent |
| Gloss | 1 | Dull |
| **Cooked** | | |
| Aroma | 1 – 3 | No aroma to aromatic |
| Cohesiveness | 1 – 4 | Separated to very cohesive |
| Tenderness (freshly cooked) | 2 – 4 | Slightly tender to very tender |
| Tenderness (upon staling) | 1 – 3 | Hard to tender |
| Taste | 1 – 3 | Bland to tasty |

displayed only medium length. While 57% of consumers preferred translucent grains, the samples were mostly chalky (41%). Consumers also preferred glossy grains (51%), but the samples were all dull.

As in other SR types, consumers favored more aroma in cooked red rice but no aroma was detected in most of the samples based on sensory evaluation. For freshly cooked rice, laboratory panelists evaluated most of the red rice to be slightly tender (45%), which was significantly different from consumer preference (tender, 95%). Upon staling, 78% of consumers preferred tender SR samples, which significantly differed from the collected samples that were mostly slightly tender. Tasty was preferred by 74% of the consumers, but the farmers' samples were mostly bland (52%).

**Table 10.12.** Consumer preference for red rice.

| Attribute | Response range | Description |
|---|---|---|
| **Raw** | | |
| Color | 1 – 4 | Weak to very intense |
| % Head rice | 1 – 4 | 0 – 25 to 76 – 100 |
| Grain length (mm) | 1 – 4 | Short to extra long |
| Grain shape | 1 – 3 | Bold to slender |
| Translucency | 1 – 4 | Opaque to translucent |
| Gloss | 1 – 3 | Dull to glossy |
| **Cooked** | | |
| Aroma | 1 – 4 | No aroma to very aromatic |
| Cohesiveness | 1 – 4 | Separated to very cohesive |
| Tenderness (freshly cooked) | 2 – 4 | Slightly tender to very tender |
| Tenderness (upon staling) | 1 – 3 | Hard to tender |
| Taste | 1 – 4 | Bland to very tasty |

**Table 10.13.** Comparative quality between actual laboratory analysis and consumer preference of red rice collected from farmers.

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| **Raw** | | | |
| Color (unpolished) | Very intense | 4 | 17 |
| | Intense | 55 | 48 |
| | Slightly intense | 41 | 34 |
| | Weak | 0 | 1 |
| % Head rice | 76 – 100 | 66 | 71 |
| | 51 – 75 | 24 | 7 |
| | 26 – 50 | 10 | 6 |
| | 0 – 25 | 0 | 16 |
| Grain length (mm) | Extra long | 0 | 19 |
| | Long | 17 | 40 |
| | Medium | 66 | 18 |
| | Short | 17 | 23 |

*Table 10.13. Continuation.*

| Parameter | Description | Actual quality (%) | Preferred (%) |
|---|---|---|---|
| Grain shape | Slender | 7 | 32 |
| | Intermediate | 79 | 42 |
| | Bold | 14 | 26 |
| Translucency | Translucent | 24 | 57 |
| | White belly | 18 | 16 |
| | Chalky | 41 | 21 |
| | Opaque | 17 | 6 |
| Gloss | Very glossy | 0 | 0 |
| | Glossy | 0 | 51 |
| | Slightly glossy | 0 | 13 |
| | Dull | 100 | 36 |
| **Cooked** | | | |
| Aroma | Very aromatic | 0 | 13 |
| | Aromatic | 7 | 62 |
| | Slightly aromatic | 38 | 18 |
| | No aroma | 55 | 7 |
| Cohesiveness | Very cohesive | 14 | 1 |
| | Cohesive | 24 | 57 |
| | Slightly cohesive | 55 | 34 |
| | Separated | 7 | 8 |
| Tenderness (freshly cooked) | Very tender | 14 | 1 |
| | Tender | 41 | 95 |
| | Slightly tender | 45 | 4 |
| | Hard | 0 | 0 |
| Tenderness (upon staling) | Very tender | 0 | 0 |
| | Tender | 34 | 78 |
| | Slightly tender | 52 | 19 |
| | Hard | 14 | 3 |
| Taste | Very tasty | 0 | 8 |
| | Tasty | 7 | 74 |
| | Slightly tasty | 41 | 15 |
| | Bland | 52 | 3 |

## Summary and implications

After comparing the quality of SR from farmers with the preference of household consumers, it was found that some actual quality characteristics of collected SR did not meet the choice of consumers. However, it is most likely that the consumers' responses were based predominantly on their perception of the description of each quality parameter. This may be more particularly true for cooked rice where no actual standard samples were provided. As such, the consumers' quality preferences tend to have higher ratings than the sensory scores of the laboratory panelists. For instance, majority of the consumers prefer "very tender" rice, but in reality, the corresponding rice sample is only "tender" under laboratory analysis.

For aromatic rice, translucent and glossy raw rice as well as aromatic and tasty cooked rice were preferred by consumers, but these were not matched by the qualities of most of the collected samples. In the laboratory analysis, only three aromatic rice varieties exhibited slight *pandan*-like scent – *Gobyerno* and *Azucena* (Apayao) and NSIC Rc 218 A (Oriental Mindoro).

For glutinous rice, the consumer-preferred traits of very white color and bold shape did not emerge in the laboratory analysis. Moreover, high HR recovery, a consistent consumer preference, was not observed in the laboratory analysis of aromatic, glutinous, and black SR. One reason for the unexpected less intense aroma in aromatic rice, the grayish color of glutinous SR, and the low HR recovery is probably the unfavorable conditions present when samples were harvested and stored, which may have affected the quality. It is therefore suggested that careful postharvest management, especially proper drying and storage of aromatic samples, be practiced to minimize fissuring or cracking of grains. This is to maintain high HR recovery, glossy raw rice, and preserve the *pandan*-like/pleasant scent and taste of the SR samples. Moreover, continuous research and development is needed to further improve the quality of SR varieties.

Meanwhile, it is a known fact that no single SR possesses all the qualities that consumers prefer. Nevertheless, there are grain quality characteristics validated by laboratory analysis that matched the preferred qualities of consumers for SR. For aromatic rice, the preferred long grain, intermediate shape, and slightly cohesive to cohesive cooked rice attributes were found in specific aromatic varieties. Likewise, the preferred very cohesive and very tender glutinous rice traits were displayed by the glutinous *Waray* (Abra), Miracle and *Sinong-song-Malagkit* (Oriental Mindoro), *Pilit* (Negros Occidental), and *Pilit* White D (Iloilo). The darker color of pigmented rice preferred by consumers was remarkably observed in black BR 261, *Bingawan*, and *Calatrava* (Iloilo), and Mindoro Black (Negros Occidental) as well as in Red *Malagkit* (Negros Occidental), Diamante (Samar), Super *Pilit* and *Dinorado* B (North Cotabato), and Red (Apayao). This implies that there are SR samples that can fit the preference of consumers in terms of the abovementioned qualities. Therefore, production and marketing of SR varieties possessing these qualities must be strengthened.

The study proved that the different types of SR are unique in their own way in terms of quality characteristics. The rice varieties for aromatic, glutinous, and pigmented rice also have specific milling, physical, physicochemical, and sensory properties. In addition, pigmented rice have different health-promoting components. With these diverse quality characteristics, it is illuminating to reflect them on the packaging of SR for better and proper appreciation of the product. Thus, truthful labelling is recommended to benefit both farmers and consumers. This will ensure that based on quality, the producers will be paid fairly for their harvest while consumers get the value for their money.

Value addition in terms of creating special or unique menus or product development should be pursued to identify and create new ways of maximizing the utilization of SR varieties and contribute to increased income of farmers. These local rice-based food products from aromatic, glutinous, and pigmented rice can become a vital component of culinary tourism. Providing exciting dining-out experience for tourists and food enthusiasts or as "pasalubong" can be an excellent way of promoting the consumption and consequently increase the demand for SR.

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# IV

# CULTURAL PRACTICES IN GROWING SPECIALTY RICE

11

# FARMERS' PERCEPTIONS AND SOCIO-CULTURAL PRACTICES

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Farmers' perceptions influence their technology adoption patterns (Adesina and Foson, 1995). As perceptions form the farmers' subjective assessment of specialty rice (SR) and its cultivation, these greatly affect their adoption of SR and related technologies at present and understanding such will help research and development (R&D) planners identify key technology characteristics in improving SR production and marketing. The previous chapters present survey results relative to sociodemographic profiles, cost and returns, and economic performance of SR. To complement them, this chapter aims to provide survey results that capture perceptions and related information reported by SR farmers that have implications on technology adoption and SR production. Specifically, the chapter discusses the following: 1) farmers' comparison between SR and non-SR; 2) their perception of SR 5 years ago versus that at present; 3) their intention to plant in the next 5 years; 4) reported uses of SR; 5) farmers' customs and taboos related to SR; and 6) government support that farmers need. All these data were gathered using a two-page questionnaire supplemented to the farm-level survey of all sample farmers from the nine project sites. The supplemental questionnaire included questions on rituals, traditions, beliefs, taboos, and sociocultural changes in farming.

## Farmers' perceptions of specialty vs ordinary rice

Farmers were asked to compare SR with their preferred ordinary rice varieties. The characteristics by which they were compared included input use, yield, and market price, among others. Table 11.1 shows the farmers' perceived comparison between SR and ordinary rice. Data show that SR farmers from the provinces of Apayao (aromatic), North Cotabato (red), and Samar (red) primarily cultivated SR. Though hybrid rice is seen to be gaining popularity in some of the provinces, inbred rice varieties still dominated.

Delving into farmers' perceptions of SR in comparison to the ordinary rice that they have cultivated, the general perception of SR requiring greater fertilizer use was only seen in the province of North Cotabato for red rice. For pesticide and water use, none of the SR-producing provinces expressed more usage for SR relative to ordinary rice. Notably, higher labor use for SR cultivation was only observed in the province of Apayao for aromatic rice. This can be explained by the fact that SR in the area is cultivated in upland ecosystems as opposed to ordinary rice, which is cultivated in irrigated fields. For the other provinces, labor use was generally perceived to be just the same, except for Samar, where farmers reported less labor input for SR.

As to perceptions on yield, nutrition, and conservation of the environment, results varied across SR types and provinces. In all provinces and across SR types, farmers perceived SR to command a higher price than ordinary rice; the exception was Bukidnon, where 35% of farmers interviewed reported the price to be the same. Women participation in farming was generally observed to be similar, with the exception of Samar in which female involvement was significantly higher. With regard to government support provided, it is notable that farmers in the sample provinces for glutinous rice unanimously stated that support was less for SR.

## Perceptions of SR at present vs those from 5 years ago

The study also seeks to investigate how the dynamics of SR has changed in recent years from the perspectives and experiences of SR farmers. To clarify, a 'less' response for household consumption, for example, would mean that people have come to consume fewer amounts of SR at present compared with 5 years ago. Table 11.2 shows the results of this comparison. Only 24% of the farmers in Negros Occidental reported planting SR in the last 5 years compared with the other sites where majority of the farmers did so. One explanation is that Negros Occidental farmers are newcomers to SR production.

Similar levels of fertilizer and pesticide use were reported by sample provinces for aromatic and glutinous SR. Less fertilizer use was observed by

71% of black rice farmers. In red rice sample provinces, fertilizer use increased as reported by 47% of the farmers. Additionally, 60% of the farmers in North Cotabato perceived less pesticide use at present, and 54% of Bukidnon farmers reported no change at all. Interestingly, in Samar, the same percentage of farmers (42%) reported higher or the same level of use for pesticides.

In terms of area planted to SR, only Negros Occidental (43%) and North Cotabato (67%) farmers mentioned dedicating more land to SR production. There was otherwise generally no change in area allocation for the other provinces. As to land productivity, farmers reported that it generally decreased for aromatic rice and increased for red rice. The results varied among glutinous rice provinces: more productive for Iloilo (43%), the same for Camarines Sur (55%), and less for Abra (48%).

It is remarkable that all farmers in Negros Occidental perceived increased market demand (as did other SR farmers). This is consistent with their market-oriented production of SR (later expounded in Chapter 12 case studies). Bukidnon was also off-trend in this regard as 43% of the farmers said SR demand did not change over the 5-year period. This is probably because of the fact that, Bukidnon, being a food basket province, has more options regarding agricultural products other than rice for livelihood. Examples of these are sugarcane, corn, and coffee (see Chapter 12). Lastly, results for household consumption varied, but no province reported less usage at present. Specifically, the glutinous rice provinces (Iloilo and Camarines Sur) and the red rice provinces (North Cotabato and Samar) showed a significant increase in SR household consumption at present versus that 5 years ago.

## Intention to plant in the next 5 years

About 94-100% of the farmers in all sample provinces said they intend to plant SR in the next 5 years (Table 11.3). Good eating quality was the main reason for planting by majority of the aromatic (79%), black (69%), and red (89%) rice producers. The glutinous rice farmers' primary reason was generally connected to the high market price. In Iloilo, 50% of the farmers stated that SR is for their use in observing traditions and celebrations. Overall, good eating quality and its premium price are the two driving factors that motivate farmers to plant SR in the next 5 years.

**Table 11.1.** Farmers' perceptions of SR vs. ordinary rice.

| Item | Aromatic | | | Glutinous | | | | Black | Red | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oriental Mindoro | Apayao | All | Iloilo | Camarines Sur | Abra | All | Negros Occidental | North Cotabato | Samar | Bukidnon | All |
| | n=45 | n=42 | n=87 | n=28 | n=48 | n=34 | n=110 | n=29 | n=45 | n=47 | n=39 | n=131 |
| Farmers who planted non-SR within the last 5 years (%) | 62 | 24 | 44 | 100 | 60 | 85 | 78 | 97 | 22 | 28 | 67 | 37 |
| Type of non-SR planted (%) | | | | | | | | | | | | |
| Hybrid | 26 | 50 | 31 | - | 11 | 14 | 8 | 4 | 60 | 23 | 46 | 43 |
| Inbred | 52 | 33 | 48 | 50 | 71 | 86 | 69 | 71 | 40 | 77 | 46 | 53 |
| Both | 22 | 17 | 21 | 50 | 18 | - | 22 | 25 | - | - | 8 | 4 |
| Comparison of SR with planted non-SR (%) | | | | | | | | | | | | |
| Fertilizer use | | | | | | | | | | | | |
| More | 7 | 10 | 8 | 4 | 14 | 3 | 7 | 4 | 60 | 8 | 12 | 20 |
| Less | 32 | 70 | 42 | 75 | 28 | 66 | 56 | 61 | 20 | 85 | 50 | 53 |
| Same | 61 | 20 | 50 | 21 | 59 | 31 | 37 | 36 | 20 | 8 | 38 | 27 |
| Don't know | - | - | - | - | - | - | - | - | - | - | - | - |
| Pesticide use | | | | | | | | | | | | |
| More | 36 | - | 26 | 7 | 17 | 21 | 15 | 4 | 30 | - | 4 | 8 |
| Less | 14 | 80 | 32 | 50 | 45 | 28 | 41 | 64 | 50 | 85 | 58 | 63 |
| Same | 50 | 20 | 42 | 43 | 38 | 52 | 44 | 25 | 20 | 15 | 38 | 29 |
| Don't know | - | - | - | - | - | - | - | 7 | - | - | - | - |
| Water use | | | | | | | | | | | | |
| More | 4 | - | 3 | 4 | 14 | 24 | 14 | 7 | - | - | 8 | 4 |
| Less | 36 | 90 | 50 | 46 | 21 | 14 | 27 | 7 | 10 | 92 | 8 | 31 |
| Same | 61 | 10 | 47 | 50 | 66 | 62 | 59 | 82 | 90 | 8 | 68 | 56 |
| Don't know | - | - | - | - | - | - | - | 4 | - | - | 16 | 8 |
| Labor use | | | | | | | | | | | | |
| More | 15 | 70 | 30 | 4 | 7 | 10 | 7 | 4 | 30 | 23 | 8 | 17 |
| Less | 19 | 20 | 19 | 39 | 3 | 21 | 21 | 11 | 30 | 69 | 13 | 32 |
| Same | 67 | 10 | 51 | 57 | 90 | 66 | 71 | 86 | 40 | 8 | 71 | 47 |
| Don't know | - | - | - | - | - | 3 | 1 | - | - | - | 8 | 4 |
| Yield | | | | | | | | | | | | |
| More | 11 | - | 8 | 36 | 90 | 24 | 50 | 14 | 90 | 62 | 17 | 45 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Less | 32 | 80 | 45 | 50 | 7 | 66 | 41 | 61 | 10 | 38 | 17 | 21 |
| Same | 57 | 20 | 47 | 14 | 3 | 10 | 9 | 25 | - | - | 46 | 23 |
| Don't know | - | - | - | - | - | - | - | - | - | - | 21 | 11 |
| Price | | | | | | | | | | | | |
| More | 82 | 60 | 76 | 89 | 90 | 79 | 86 | 96 | 90 | 100 | 35 | 63 |
| Less | 14 | 30 | 18 | 4 | - | 3 | 2 | - | - | - | 15 | 8 |
| Same | 4 | 10 | 5 | 7 | 3 | 17 | 9 | 4 | 10 | - | 35 | 20 |
| Don't know | - | - | - | - | 7 | - | 2 | - | - | - | 15 | 8 |
| Sociocultural uses | | | | | | | | | | | | |
| More | 39 | 30 | 37 | 43 | 59 | 54 | 52 | 46 | 20 | 85 | 8 | 32 |
| Less | 4 | 50 | 16 | 29 | 28 | 32 | 29 | 14 | 20 | 8 | 17 | 15 |
| Same | 54 | 20 | 45 | 14 | 10 | 7 | 11 | 32 | 60 | 8 | 46 | 38 |
| Don't know | 4 | - | 3 | 14 | 3 | 7 | 8 | 7 | - | - | 29 | 15 |
| Nutrition | | | | | | | | | | | | |
| More | 36 | 60 | 42 | 64 | 3 | 31 | 33 | 96 | 60 | 92 | 36 | 56 |
| Less | 7 | 10 | 8 | 7 | 69 | 28 | 35 | - | 20 | 8 | 4 | 8 |
| Same | 46 | 30 | 42 | 21 | 17 | 24 | 21 | 4 | 20 | - | 48 | 29 |
| Don't know | 11 | - | 8 | 7 | 10 | 17 | 12 | - | - | - | 12 | 6 |
| Environment | | | | | | | | | | | | |
| More | 25 | 40 | 29 | 46 | 10 | 14 | 23 | 71 | 20 | 92 | 19 | 39 |
| Less | 7 | 50 | 18 | 11 | 21 | 14 | 15 | - | 30 | - | 8 | 10 |
| Same | 61 | - | 45 | 36 | 48 | 45 | 43 | 29 | 50 | 8 | 42 | 35 |
| Don't know | 7 | 10 | 8 | 7 | 21 | 28 | 19 | - | - | - | 31 | 16 |
| Women participation | | | | | | | | | | | | |
| More | 4 | 40 | 13 | 14 | 3 | 14 | 10 | 14 | 10 | 85 | 4 | 27 |
| Less | 14 | - | 11 | 32 | 3 | 7 | 14 | 4 | 10 | 8 | 35 | 22 |
| Same | 82 | 60 | 76 | 54 | 79 | 69 | 67 | 82 | - | 8 | 42 | 24 |
| Don't know | - | - | - | - | 14 | 10 | 8 | - | 80 | - | 19 | 27 |
| Government support | | | | | | | | | | | | |
| More | 14 | 10 | 13 | 14 | - | 3 | 6 | 11 | 30 | 54 | - | 20 |
| Less | 11 | 20 | 13 | 64 | 55 | 62 | 60 | 36 | 10 | 31 | 27 | 24 |
| Same | 75 | 50 | 68 | 18 | 31 | 7 | 19 | 39 | 60 | 15 | 50 | 43 |
| Don't know | - | 20 | 5 | 4 | 14 | 28 | 15 | 14 | - | - | 23 | 12 |

**Table 11.2.** Farmers' perceptions of SR planted 5 years ago and those at present.

| Item | Aromatic | | | Glutinous | | | | Black | Red | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oriental Mindoro | Apayao | All | Iloilo | Camarines Sur | Abra | All | Negros Occidental (All) | North Cotabato | Samar | Bukidnon | All |
| | n=45 | n=42 | n=87 | n=28 | n=48 | n=34 | n=110 | n=29 | n=45 | n=47 | n=39 | n=131 |
| Planted 5 years ago (%) | 84 | 100 | 92 | 82 | 79 | 62 | 75 | 24 | 100 | 96 | 72 | 90 |
| Fertilizer use | | | | | | | | | | | | |
| More | 18 | 31 | 25 | 26 | 18 | 24 | 22 | 29 | 58 | 40 | 43 | 47 |
| Less | 13 | 7 | 10 | 17 | 8 | 14 | 12 | 71 | 29 | 18 | 14 | 21 |
| Same | 68 | 60 | 64 | 57 | 74 | 62 | 66 | - | 13 | 42 | 39 | 31 |
| Don't know | - | 2 | 1 | - | - | - | - | - | - | - | 4 | 1 |
| Pesticide use | | | | | | | | | | | | |
| More | 26 | 48 | 38 | 9 | 21 | 29 | 20 | 29 | 27 | 42 | 29 | 33 |
| Less | 21 | 5 | 13 | 35 | 3 | 19 | 16 | 43 | 60 | 16 | 14 | 32 |
| Same | 53 | 45 | 49 | 52 | 74 | 52 | 62 | 14 | 13 | 42 | 54 | 34 |
| Don't know | - | 2 | 1 | 4 | 3 | - | 2 | 14 | - | - | 4 | 1 |
| Water use | | | | | | | | | | | | |
| More | 21 | 2 | 11 | 17 | 11 | 14 | 13 | 29 | 4 | 20 | - | 9 |
| Less | 13 | 2 | 8 | 26 | 5 | 5 | 11 | 14 | 18 | 13 | 8 | 14 |
| Same | 63 | 93 | 79 | 57 | 79 | 81 | 73 | 57 | 78 | 67 | 81 | 74 |
| Don't know | 3 | 2 | 3 | - | 5 | - | 2 | - | - | - | 12 | 3 |
| Land planted to SR | | | | | | | | | | | | |
| More | 16 | 26 | 21 | 30 | 11 | 14 | 17 | 43 | 67 | 36 | 21 | 44 |
| Less | 18 | 17 | 18 | 13 | 5 | 19 | 11 | 14 | 20 | 20 | 4 | 16 |
| Same | 66 | 57 | 61 | 57 | 84 | 67 | 72 | 43 | 13 | 44 | 64 | 37 |
| Don't know | - | - | - | - | - | - | - | - | - | - | 11 | 3 |
| Land productivity of SR | | | | | | | | | | | | |
| More | 34 | 36 | 35 | 43 | 18 | 14 | 24 | 29 | 73 | 53 | 21 | 53 |
| Less | 37 | 48 | 43 | 22 | 26 | 48 | 30 | 29 | 22 | 29 | 21 | 25 |
| Same | 29 | 17 | 23 | 30 | 55 | 33 | 43 | 43 | 4 | 18 | 54 | 21 |
| Don't know | - | - | - | 4 | - | 5 | 2 | - | - | - | 4 | 1 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Market demand | | | | | | | | | | | | |
| More | 47 | 57 | 53 | 74 | 55 | 52 | 60 | 100 | 82 | 76 | 32 | 68 |
| Less | 26 | 19 | 23 | 4 | 13 | 33 | 16 | - | 11 | 11 | 11 | 11 |
| Same | 24 | 24 | 24 | 22 | 24 | 14 | 21 | - | 7 | 13 | 43 | 18 |
| Don't know | 3 | - | 1 | - | 8 | - | 4 | - | - | - | 14 | 3 |
| Household consumption | | | | | | | | | | | | |
| More | 39 | 43 | 41 | 70 | 84 | 29 | 66 | 43 | 73 | 64 | 26 | 59 |
| Less | 29 | 24 | 26 | 13 | 11 | 19 | 13 | 29 | 13 | 9 | 11 | 11 |
| Same | 32 | 33 | 33 | 17 | 5 | 48 | 20 | 29 | 13 | 27 | 56 | 28 |
| Don't know | - | - | - | - | - | 5 | 1 | - | - | - | 7 | 2 |

**Table 11.3.** Intention of farmers to plant SR in the next 5 years.

| Item | Aromatic | | | Glutinous | | | | Black | Red | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oriental Mindoro | Apayao | All | Iloilo | Camarines Sur | Abra | All | Negros Occidental (All) | North Cotabato | Samar | Bukidnon | All |
| | n=45 | n=42 | n=87 | n=28 | n=48 | n=34 | n=110 | n=29 | n=45 | n=47 | n=39 | n=131 |
| Intends to plant (%) | 96 | 100 | 98 | 100 | 100 | 94 | 98 | 100 | 100 | 100 | 100 | 100 |
| Reasons for planting | | | | | | | | | | | | |
| Good eating quality | 63 | 95 | 79 | 36 | 13 | 34 | 25 | 69 | 91 | 96 | 79 | 89 |
| Use in traditions and celebrations | - | 2 | 1 | 50 | 6 | 22 | 22 | 7 | 7 | 28 | 3 | 13 |
| High yield | 19 | 7 | 13 | 4 | 48 | 3 | 23 | 3 | 33 | 13 | 15 | 21 |
| Resistance to pests | 2 | 5 | 4 | 4 | 2 | - | 2 | 7 | 36 | 2 | 5 | 15 |
| Commands premium price | 70 | 10 | 40 | 32 | 60 | 63 | 54 | 55 | 22 | 55 | 10 | 31 |
| Suitable in the area | 5 | 29 | 16 | 11 | 6 | - | 6 | - | 40 | 28 | 3 | 24 |

## Uses of specialty rice

The observed sociocultural uses of SR primary revolved around its function as food (Table 11.4). Except for glutinous rice, nearly all farmers who grow other SR types utilized SR for daily consumption. It was only in Iloilo that 50% of the farmers used glutinous rice for daily consumption. Since glutinous rice is generally deemed to be not for daily consumption, glutinous rice farmers exhibited a high usage of SR as food for individual special occasions, such as birthdays or weddings. The same trend was seen among red rice farmers (91%) in Samar. The use of SR in community celebrations was noticeably lower than that for individual occasions. Yet, the majority of farmers in Iloilo and Samar used SR for this purpose.

Non-food or symbolic use of SR in rituals and special events was sparse, even for the indigenous people-inhabited provinces of Apayao and Abra. This is perhaps a sign of the dwindling practice of tradition and customs. In addition, around one-fourth of glutinous rice farmers from Iloilo and black rice farmers from Negros Occidental utilized SR for health purposes. Interestingly, no aromatic rice farmer expressed any health-related use of SR.

There are other uses of SR not explored here but are reported in other studies. For example, pigmented rice are used as supplement and medicine in China, India, Malaysia, and other rice-producing countries (Limtraktul et al., 2019; Harun et al., 2018; Deng et al., 2013; MSSRF, 2005). Modern studies proved that this practice is scientifically possible because of the health-promoting properties of pigmented rice. Moreover, black rice also served as a social status symbol during the Chinese empire era, when only the royals are allowed to consume this specific SR type (Kushwaha, 2016).

Nowadays, modern uses of SR have also been developed. Mataia et al. (2018) reported that pigmented rice bran, which contains compounds that promote shiny hair and healthy skin, is being utilized by local and Italian cosmetic product manufacturers. In addition, pigmented rice are also used as natural colorant by the textile industry or food manufacturers (Hong, 2015; Nontasan et al., 2012). Likewise, some artists also use SR as colorant in their art works or as material for mosaics.

**Table 11.4.** Sociocultural uses of SR across the nine provinces.

| Item | Aromatic | | | Glutinous | | | | Black | Red | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oriental Mindoro | Apayao | All | Iloilo | Camarines Sur | Abra | All | Negros Occidental (All) | North Cotabato | Samar | Bukidnon | All |
| | n=45 | n=42 | n=87 | n=28 | n=48 | n=34 | n=110 | n=29 | n=45 | n=47 | n=39 | n=131 |
| Uses (%) | | | | | | | | | | | | |
| Food for daily cosumption | 93 | 98 | 95 | 50 | 4 | 18 | 20 | 100 | 100 | 98 | 98 | 98 |
| Food for individual special occasions (e.g., birthdays and weddings) | 16 | 26 | 20 | 89 | 73 | 85 | 81 | - | - | 91 | 15 | 37 |
| Food for communty celebrations (e.g., offerings in rituals and festivals) | 2 | 21 | 11 | 64 | 33 | 24 | 39 | 3 | 2 | 57 | 3 | 22 |
| Non-food use in rituals and special occasions | - | 9 | 5 | 4 | - | 18 | 6 | - | - | - | 3 | 1 |
| Health purposes (e.g., medicine) | - | - | - | 25 | - | - | 6 | 28 | 7 | 13 | 3 | 8 |
| Aesthetics/decorations | - | - | - | - | - | - | - | 3 | - | 6 | 3 | 3 |
| For personal hygiene (e.g., facial wash) | - | - | - | - | - | - | - | - | - | - | - | - |
| Snacks | - | - | - | - | 8 | - | 4 | - | - | - | - | - |
| As payment for other commodities | 2 | - | 1 | - | - | - | - | - | - | - | - | - |

**Table 11.5** Customs and taboos observed by farmers in SR production.

| Item | Aromatic | | | Glutinous | | | | Black | Red | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oriental Mindoro | Apayao | All | Iloilo | Camarines Sur | Abra | All | Negros Occidental (All) | North Cotaba-to | Samar | Bukidnon | All |
| | n=45 | n=42 | n=87 | n=28 | n=48 | n=34 | n=110 | n=29 | n=45 | n=47 | n=39 | n=131 |
| Customs (%) | | | | | | | | | | | | |
| Pray | 24 | 71 | 47 | 79 | 33 | 35 | 45 | 52 | 87 | 81 | 90 | 85 |
| Offer SR | - | 29 | 14 | 32 | 13 | 6 | 15 | 10 | 18 | 36 | 8 | 21 |
| Hang rice bundles in kitchen hearth | 18 | 19 | 18 | 21 | 10 | - | 10 | 3 | 16 | 40 | 10 | 23 |
| Sacrifice livestock | - | 12 | 6 | 29 | 4 | 15 | 14 | 10 | 24 | 32 | 26 | 27 |
| Place plants in rice fields | - | 17 | 8 | 36 | 2 | - | 10 | 21 | 2 | 57 | 3 | 22 |
| Prepare seedbeds during new moon | 11 | 17 | 14 | 11 | 2 | - | 4 | 21 | 7 | 30 | 31 | 22 |
| Stars should appear before farm activity | 11 | 14 | 13 | 7 | - | - | 2 | 10 | 33 | 13 | 26 | 24 |
| Hang dead animals | - | 5 | 2 | 14 | 2 | - | 5 | 14 | 16 | 6 | 18 | 13 |
| Burn herbal leaves in field | - | 2 | 1 | 18 | 4 | - | 6 | 3 | 2 | 47 | - | 18 |
| Community leader dictates seeds to plant | 4 | - | 2 | 4 | 2 | - | 2 | 7 | 33 | 6 | 8 | 16 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Store paddy rice in designated areas | 7 | 5 | 6 | 4 | - | - | 1 | 14 | 4 | 19 | - | 8 |
| Farm implements left in field | - | 10 | 5 | - | - | - | - | - | - | 32 | 3 | 12 |
| Sing songs | 2 | 2 | 2 | 18 | - | - | 5 | 3 | 9 | 4 | - | 5 |
| Perform dance | - | 2 | 1 | 4 | - | - | 1 | - | - | 2 | 3 | 2 |
| Taboos (%) | | | | | | | | | | | | |
| No menstruating women allowed to work | 18 | 10 | 14 | 29 | 4 | 3 | 10 | 38 | 78 | 53 | 59 | 63 |
| No work when someone has died | 2 | 38 | 20 | 25 | 2 | 9 | 10 | 10 | 29 | 60 | 26 | 39 |
| No haircut until germination of seeds | 13 | 5 | 9 | 21 | 2 | 3 | 7 | 14 | 22 | 51 | 21 | 32 |
| No urinating and defecating in the field | 4 | 7 | 6 | 11 | - | - | 3 | 7 | 38 | 49 | 26 | 38 |
| Cannot get rice directly from pot | 2 | 14 | 8 | 21 | 4 | - | 7 | 17 | 22 | 28 | - | 18 |
| No sexual contact | 2 | 12 | 7 | 14 | 2 | - | 5 | 3 | 38 | 15 | - | 18 |
| No planting if cetain birds are present | - | 10 | 5 | 4 | - | - | 1 | 3 | 22 | 21 | 21 | 21 |
| No hexed people allowed to work in farm | - | 7 | 3 | 11 | 2 | - | 4 | 7 | 13 | 9 | 5 | 9 |
| No visitors allowed to enter houses | - | 10 | 5 | - | - | 3 | 1 | 3 | 2 | 4 | 3 | 3 |

**Table 11.6.** Government support needed.

| Item | Aromatic | | | Glutinous | | | | Black | Red | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oriental Mindoro | Apayao | All | Iloilo | Camarines Sur | Abra | All | Negros Occidental (All) | North Cotabato | Samar | Bukidnon | All |
| | n=45 | n=42 | n=87 | n=28 | n=48 | n=34 | n=110 | n=29 | n=45 | n=47 | n=39 | n=131 |
| **Production support (%)** | | | | | | | | | | | | |
| Free seeds | 36 | 24 | 30 | 54 | 19 | 21 | 28 | 52 | 91 | 81 | 64 | 79 |
| New varieties | 20 | 21 | 21 | 75 | 21 | 12 | 32 | 28 | 9 | 4 | 33 | 15 |
| Fertilizer subsidy | 51 | 60 | 55 | 54 | 67 | 82 | 68 | 21 | 51 | 57 | 72 | 60 |
| Training programs | 7 | 2 | 5 | 18 | 10 | 3 | 10 | 14 | 31 | 17 | 13 | 21 |
| Irrigation facilities | 20 | 14 | 17 | 11 | 15 | 9 | 12 | 10 | - | - | 3 | 1 |
| Production machinery | 18 | 36 | 26 | 25 | 10 | 18 | 16 | 21 | 9 | 6 | 10 | 8 |
| Drying facilities | 2 | 2 | 2 | 18 | 6 | 3 | 8 | 3 | 7 | 19 | 10 | 12 |
| Storage facilities | - | 5 | 2 | - | - | - | - | 3 | 13 | - | 5 | 6 |
| Milling facilities | 2 | 5 | 3 | - | 2 | - | 1 | 10 | - | 13 | - | 5 |
| Technical support | 7 | 7 | 7 | 4 | 2 | 6 | 4 | 7 | - | - | 5 | 2 |
| Financial support | 18 | 7 | 13 | 18 | 35 | 9 | 23 | 38 | 18 | 17 | 8 | 15 |
| Pesticide subsidy | 16 | 38 | 26 | 18 | 6 | 24 | 15 | 3 | 2 | 6 | 3 | 4 |
| Organic inputs | 11 | - | 6 | - | - | - | - | 10 | - | 2 | - | 1 |
| Draft animals | 2 | - | 1 | - | - | - | - | - | - | 9 | - | 3 |
| Farm implements | 2 | 5 | 3 | - | - | - | - | 3 | - | 2 | - | 1 |
| Trichogramma laboratory | - | - | - | - | - | - | - | - | - | - | - | - |
| Additional laborer | - | - | - | - | - | - | - | 3 | - | - | - | - |
| Livelihood | - | - | - | - | - | - | - | - | 2 | - | - | 1 |
| Cultural management | - | - | - | - | - | 3 | 1 | - | - | - | - | - |
| Crop insurance | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| Water supply | - | - | - | - | - | - | - | 3 | - | - | - | - |
| Soil analysis | - | - | - | - | 2 | - | 1 | | - | - | - | - |
| Diesel subsidy | - | - | - | - | 2 | - | 1 | | - | - | - | - |
| None | - | - | - | 4 | 2 | 3 | 3 | 3 | 4 | - | 3 | 2 |
| **Marketing support (%)** | | | | | | | | | - | - | - | - |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Link to big buyers | 13 | 26 | 20 | 61 | 48 | 41 | 49 | 59 | 4 | 64 | 26 | 32 |
| Farm-to-market roads | 2 | 24 | 13 | 25 | 6 | 18 | 15 | 17 | 7 | 40 | 51 | 32 |
| Price support | 71 | 64 | 68 | 71 | 56 | 74 | 65 | 28 | 87 | 21 | 41 | 50 |
| Training | 7 | 2 | 5 | - | - | - | - | - | 7 | 17 | 5 | 10 |
| Value-adding/ processing facilities | - | - | - | - | 2 | - | 1 | | - | - | 3 | 1 |
| Local buying station | 13 | - | 7 | - | 4 | - | 2 | 3 | - | 2 | - | 1 |
| Transportation | 2 | 10 | 6 | 4 | 4 | - | 3 | 3 | - | - | - | - |
| Export opportunities | | | | 4 | - | - | 1 | - | - | - | - | - |
| Coop insurance | - | 2 | 1 | - | - | - | - | - | - | - | - | - |
| Less strict grading scheme | - | 2 | 1 | - | - | - | - | - | - | - | - | - |
| Proper weighing system | 2 | - | 1 | - | - | - | - | - | - | - | - | - |
| Agent | 2 | - | 1 | - | - | - | - | - | - | - | - | - |
| No imports | - | - | - | - | 2 | - | 1 | 14 | - | - | - | - |
| None | 2 | - | 1 | - | 4 | 3 | 3 | - | 9 | - | 5 | 5 |
| **Training needs from private sector (%)** | | | | | | | | | | | | |
| General information on SR production | 9 | 26 | 17 | 29 | 15 | 24 | 21 | 24 | 36 | 38 | 26 | 34 |
| Information on new SR varieties | 4 | 2 | 3 | 7 | 10 | - | 6 | 10 | - | 4 | - | 2 |
| Nutrient management | 36 | 7 | 22 | - | 23 | 9 | 13 | 7 | 29 | - | 3 | 11 |
| Disease and pest management | 18 | 14 | 16 | 14 | 10 | 12 | 12 | 31 | 49 | 19 | 41 | 36 |
| Information on latest farming technologies | 18 | 36 | 26 | 18 | 27 | 26 | 25 | 21 | 2 | 9 | 18 | 9 |
| How to increase yield | 11 | 14 | 13 | 11 | 13 | 12 | 12 | - | 2 | 9 | 5 | 5 |
| PalayCheck for specialty rice | - | - | - | 4 | - | - | 1 | - | 11 | - | - | 4 |
| Organic production | 2 | - | 1 | - | 2 | 3 | 2 | 3 | - | 9 | 3 | 4 |
| Value-adding | - | - | - | 4 | - | - | 1 | - | - | 2 | - | 1 |
| Marketing | - | - | - | - | - | - | - | - | - | 2 | - | 2 |
| Land preparation | 2 | - | 1 | - | 2 | - | 1 | - | - | - | - | - |
| Crop establishment | - | - | - | - | 2 | - | 1 | - | - | - | - | - |
| Climate change | 2 | - | 1 | - | - | - | - | - | - | - | - | - |
| Soil suitability | 2 | - | 1 | - | 4 | - | 2 | - | - | - | - | - |
| None | 9 | - | 5 | 4 | 10 | - | 5 | - | - | - | 3 | 1 |

## Customs and taboos

The respondents reported varied customs and taboos, but observance of these was seldom (Table 11.5). The most common practice by a significant percentage of SR farmers was praying. Praying, in this particular context, does not pertain to praying as a general life activity. But, it is praying, in whatever form, during farm activities (specifically pre-planting, crop establishment, crop management, and harvest). Among the SR groups, only red rice farmers (more than 80%) practiced this custom. Further, they were also generally particular about not allowing women to work in rice fields during their menstruation cycles (63%).

Aside from this, it was only in Samar where farmers were more inclined toward the performance of customs. Specifically, the other customs considerably practiced in the province were the placing of plants in the rice field (57%), burning of herbal leaves in the field (47%), hanging of rice bundles in kitchen hearths (40%), and offering of SR (36%). Majority of them also followed the practices of not getting a haircut until the seeds have germinated (51%) and of not doing any farm work when someone has died (60%).

## Summary and implications

Farmers' perceptions and reported practices were outlined and presented in this chapter. Generally, farmers found SR to require less or just the same input use but to have greater market value than ordinary rice. Labor use was predominantly found to be the same, whereas yield perceptions varied across the provinces. Farmers recognized an increasing demand for SR, coupled with rising household SR consumption. Negros Occidental, in particular, records all SR farmers who perceive increased market demand for SR. Moreover, two primary factors that could propel farmers to continue engaging in SR production revolve around SR's good eating quality and premium price, given that SR is used as food for daily consumption of the interviewed households and a concurrent source of income. One can capitalize on these attributes to encourage ordinary rice farmers to cultivate SR or to encourage existing SR farmers to further increase their investment in SR production.

When it comes to customs and taboos, the cultural landscape has changed, resulting in fewer practices performed by farmers over the years. Practices varied across the nine provinces, but "praying" remained to be the foremost customary behavior of farmers. Except for the provinces of Samar and North Cotabato, the number of SR farmers who practice superstitious customs and taboos was very limited. Even then, farmers who practiced them in these two provinces did not comprise the majority. One of the aspects that this study wanted to investigate was whether SR cultivation is sacred and surrounded by superstitions, thereby being more sensitive to intervention as opposed to ordinary rice. The results go against this notion and suggest that SR cultivation in the country may not differ substantially from ordinary rice production and is more or less open to intervention from a cultural point of view. The meager practice of customs and taboos is also reflected in the IP-inhabited areas of Apayao and Abra, in contrast to the idea of an IP stereotype still being very traditional (see Chapter 12).

With regard to sociocultural use of SR, aromatic and pigmented SR farmers primarily used SR for daily consumption. Glutinous rice farmers, on the other hand, used SR for individual special occasions and, though at a lower rate, for community celebrations. The red rice farmers' use of SR for health purposes was lower than expected. Aside from food, SR have also been used in various ways. Although not explored in this study, it would be interesting to see how SR is used in the context of ethnopharmacology. No significant results for non-food use of SR was found, except for around one-fourth of farmers from the provinces of Iloilo (glutinous) and Negros Occidental (black) who used SR for health purposes. Traditionally, SR is also used as ritual objects during festivities to either ask or thank the gods for a bountiful harvest. In the country, the use of SR during celebrations is still being practiced by some IPs that continue the tradition of SR production.

Almost all farmer respondents expressed their intention to cultivate SR in the next 5 years. Hence, it can be surmised that current SR production is stable and not likely to decline in the near future. As for government support, free seeds and fertilizer subsidy are on top of the list. These do not differ from those reported by most of farmers in the Philippines. Additionally, increasing support for glutinous rice production should be considered, given that majority of glutinous rice farmers expressed the sentiment that support for SR cultivation is wanting less in comparison to ordinary rice.

Considering these findings, farmers' perceptions should be addressed accordingly in development interventions. First, as farmers give importance to SR varieties with good eating quality, new or alternative varieties that are at par or surpass the quality of what they presently use can be introduced. In doing so, not only should good eating quality of SR be considered but also other relevant characteristics such as higher yields and greater resistance to pest and diseases. Second, regarding the premium price that contributes to higher income derived from SR, government policies and programs should create a conducive environment for SR farmers; this may not be necessarily and directly a price support but a system that guarantees the same level of assistance for SR and non-SR farmers. Lastly, throughout the chapter, key results that were common or reported by the majority of all SR farmers are given emphasis. However, still much more can be gleaned from the data and information for each province, which warrants location-specific development programs. Identifying and addressing these location-specific needs and SR-type dependent support would lead to adoption of yield-enhancing and cost-reducing technologies, growth in SR production, and prosperity for Filipino farmers.

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# ETHNORYZA CASE STUDIES

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In previous sections, pertinent aspects of specialty rice (SR) production, grain quality, and consumer and institutional preferences were discussed. To complement that information, which centered on the economic and rice chemistry profiling of SR, this chapter aims to present case studies that look at the ethnographic and sociological dimensions of SR farming. This chapter likewise recognizes that SR production is commonly associated with traditional rice varieties, which, in turn, are usually grown by indigenous people (IPs). Thus, weaving the complementation of quantitative and qualitative perspectives, SR farmers and their production ecosystems can be understood and depicted with pliability and nuances.

## Methodology

To achieve the chapter objectives, a combination of methodologies was used in gathering primary and secondary data. For primary data, the methods employed were formal and informal interviews, key informant interviews (KII), focus group discussions (FGD), and community immersion through participant observation (PO) (see Chapter 2). The consent of individuals who willingly gave information was secured. Secondary data, on the other hand, were collected through review of related literature, web data, and useful documents requested from agricultural offices such as but not limited to municipal agricultural profiles, economic profiles, and comprehensive land use programs.

Preliminary research through literature review and scheduled informal over-the-phone interviews with municipal agricultural officers (MAOs) were necessary in constructing guide questions for the KII and FGD, which were tailored to the specific contexts of the case studies. The initial interviews with the MAO were also pivotal in the identification and selection of barangays and areas that would best represent SR production in the chosen municipalities. Their expert opinions and recommendations were the bases for the solicited assistance in gathering farmers for the interviews and also in making arrangements with willing host farming households for the community immersion in IP areas. As such, the main method of selecting study participants was purposive sampling.

These were imperative precursors to PO, which was necessary in order to witness and document the IP's indigenous knowledge systems and practices (IKSP) and customary laws (CL) related to rice production. Four case studies were considered: IP producing SR for subsistence (Apayao in Luzon), IP producing SR for market (Abra in Luzon), non-IP producing SR for subsistence (Bukidnon in Mindanao), and organic production of SR for market (Negros Occidental in Visayas). This segmentation was done for the following reasons: 1) most of the SR varieties are heirloom and are therefore cultural property of the IPs, 2) organic farmers have unique niche considerations, and 3) technological options may encourage the shift from subsistence to market-oriented farming. Geographically, the three major islands of the Philippines, Luzon, Visayas, and Mindanao, were fittingly represented. In contrast with the previous chapters, where major interest lies in discussing and understanding each SR type, the key focus of this chapter is describing people, places, practices, and economic performance relative to SR.

In the context of PO and by doing with them what they have shared they do, rapport is built, trust is gained, ideas are shared, and new levels of safe spaces for comfortable discourse and honest openness or bleakness to the ideas of mechanization and agricultural development are unlocked. In anthropological terms, PO is indispensable in getting "the native's point of view," which would allow project stakeholders and implementers to understand the farmers' real needs and not just their deemed needs. The researchers thus lived the daily lives of the SR farmers with them–living in their actual houses and field houses, doing domestic and farming activities, participating in their moments of recreation, and attending their community affairs–finding meaning and tracing patterns in the mundane to make sense of "that complex whole" which is culture; constantly zooming out and plunging back in to discern the implicit, the explicit, and what is not said as much as what is said.

The immersion process was conducted twice in Abra. The first was during their planting season in late July 2018 and the second during their harvest season in late November of the same season. The duration for each was 2 weeks, covering barangays Sabnangan and Luzong in the municipality of Luba, and almost the entire municipality of Manabo, given its conglomerated barangay system. Some activities participated in were levelling the land using the traditional method, setting up of bunds, transplanting, and harvesting. Interviews with the local shaman *(baglan)*, traditional leaders *(lallakay)*, and IP representatives were also scheduled through the help of the agricultural technicians. These cultural authorities were consulted mainly for their insights on what could possibly be culture-preserving and culture-destroying in the proposed plans to enhance and develop their SR production.

In Apayao, fieldwork was conducted during harvest time in October 2018. The duration was also 2 weeks, covering barangay Nabuangan in the municipality of Conner, barangay Lenneng in the municipality of Kabugao, and barangay Lydia in the municipality of Pudtol. Here, the researchers joined the Isneg farmers in their *magtaw* practice or their temporary residence at their farms up in the mountains. This is a common practice during the harvest period so as to make efficient use of time and also watch over the harvest. The Isneg farmers also granted the researchers the opportunity to take part in their harvest *abuyug* or *bayanihan* commitments to their co-farmers.

For the sections on costs and returns, KIIs were conducted to get an idea of the different inputs and subsequent costs that go into specific cases of SR production and the produce or income that farmers generate from them. It should be noted that, whereas the rest of the data in this chapter were acquired from multiple persons or communities, this portion took into account the situation of only one typical farmer to represent his or her particular case.

The information gathered from these methodologies were organized into case studies, which present a rich and textured understanding of the SR cultivators, considering their farming ecosystems and sociocultural contexts. The succeeding sections containing the case studies and for consistency purposes would adhere to this discussion flow: 1) depiction of places; 2) description of people; 3) demystification of SR practices; and 4) documentation of SR economic performance. The economic performance is basically cost and returns of a specific type of SR produced by the key informant, which is interspersed in the particular context in focus.

At a glance, Table 12.1 shows the summary of methodologies employed in this chapter.

**Table 12.1.** Summary of methods employed in the case studies.

| Method | Section used for |
|---|---|
| FGDs | People, production |
| Formal/informal interviews, KIIs | People, production, costs and returns |
| Community immersion | Place, people, production |
| Secondary data, review of related literature | Place, people |

## Case 1: Subsistence IP cultivation of SR in Apayao

The first case focuses on SR cultivation by IP in Apayao. The province was chosen given its distinctive features in producing SR, which highlight cultivation done by IP coupled with a subsistence nature. Moreover, Apayao is one of the famous provinces known for producing traditional SR varieties. From this case, the study seeks to learn about the sensitivities of IPs and what forms of intervention are acceptable to them. Aside from this, it also hopes to determine what factors come into play in SR production that remains only at subsistence levels and how this characteristic is correlated with indigenous culture and tradition.

### *The Place*

Apayao is characterized by densely forested mountains, valleys, plains, springs, and rivers. Seven municipalities make up the province. Conner, Kabugao, and Pudtol are the areas identified as part of the study. In the case of Apayao, SR production is only found in the upland ecosystems where slash-and-burn farming and shifting cultivation are common methods of rice cultivation. The swiddens (Figure 12.1) where SR is cultivated are at a distance from the nearest paved road. They are only accessible by foot, and some take an hour or more of hiking to reach the nearest settlement. Due to the narrow and obstacle-filled terrain, the farmers' only way of hauling harvests is by manually carrying them either through the use of sacks or the traditional implement called an *isiw* (Figure 12.6).

**Figure 12.1.** Swidden area and field house in Lenneng, Kabugao.

**Figure 12.2.** An offering of glutinous delicacy to *anitos*.

### *The Isneg*

The Isneg (or alternatively, Isnag) are the IP of Apayao. In earlier times, they were known throughout the Cordillera as fierce headhunters who defended their territory against invaders from rival tribes. Status and leadership in their tribes were based on the merits of warriors or *mengal*—that is, the number of heads one has taken (Keesing, 1962). Today, the Isneg have abandoned their headhunting ways, have formed *podong* or peace pacts with their neighboring tribes, and the *mengal* political system is no longer practiced.

Rice cultivation has always been central to the lives of the Isneg. Their main rice production does not come from irrigated and terraced fields but from upland swiddens *(koman)* wherein the practices of slash-and-burn farming *(kaingin)* and shifting cultivation are employed (Cordillera Schools Group, 2003). Based on discussions with local residents, sometime around the early 2000s, the Department of Environment and Natural Resources (DENR) has banned the clearing of virgin forests in the interest of conservation. Yet, the Isneg continued to rely on traditional rice farming practices within the existing koman that they have already established.

Isneg belief revolves around a profusion of spirits or *anito* that have existed ever since. These spirits dwell in and govern nature, thereby influencing the daily lives and affairs of humans. Moreover, each *anito* has a particular specialization or aspect of nature that it has power over. Based on this view of the world, the Isneg have customs and rituals intended to appease, petition to, communicate with, and give thanks to the superior beings. For this purpose, their societal structure consists of shamans *(maganito)* who are essential in the performance of these practices and the perpetuation of their cultural identity. Because they do not have written documentation of their culture, the shamans are, in essence, their living libraries. Today, almost the entire Isneg population has been Christianized. Majority are Roman Catholics, yet a substantial number also belong to Protestant sects. However, this does not mean that they have abandoned their indigenous beliefs altogether. Most have formed a syncretism of the two religions. Yet it was observed that, for many, indigenous belief has taken on a passive quality. These people say that they still believe in the *anito* but do not necessarily carry out the associated practices thoroughly anymore. They refer to these practices as *kanyaw/ kannaw/ kankannaw/ annaw*, depending on the Isneg dialect spoken. Some sample customs are presented in Table 12.2.

**Table 12.2.** Sample customs and rituals in Apayao still in practice today.

| |
|---|
| • (Pudtol) A farmer must begin first harvesting in the afternoon. Also, he/she should be alone without anyone seeing him/her. If done in the morning, or if seen by anyone, the *Danag* (a collective term for bad spirits) will be displeased and might cause harm to the farmer and his/her family.<br>• (Pudtol) Reciting a prayer at the offering of sweets, similar to what Morice Vanoverbergh wrote in *Religion and Magic among the Isneg: Part I: The Spirits I* (1953). *"Ne ma-uwamo balangobang ad-addayyowanannaami. Ne uwamo anito ta dinaami tattahonongan."* (Here, this is yours, balangobang, keep away from us. Here, this is yours, spirit, so that you do not accompany us.)<br>• (Kabugao) *Magpakayab and Magtuna* are a series of rituals done so that the rice to be planted will be blessed by the anitos and thereby grow vigorously. |

**Figure 12.3.** *Aliwa* used by farmers in cutting trees.

***Rice production practices***

Associated with the practice of slash-and-burn farming *(kaingin)* is shifting cultivation, where the total farm area is divided into several portions (how many is dependent on the extensiveness of land area and personal strategy of the farmer), and farmers shift to a different portion every year. This ensures that the crop is given sufficient nutrition. Upon rotating and returning to a previouslycultivated portion, vegetation would have already regrown, and performing slash-and-burn farming would provide new nutrients for the soil. Table 12.3 shows the practices in SR production employed in Apayao.

SR production in Apayao is almost entirely manual and labor intensive. The rugged, steep, and obstacle-filled terrain of their farms further adds to the difficulty and inefficiency in performing these tasks. Mechanical intervention would certainly be of great help, yet, determining or developing technologies that would be suitable in the place warrants research and exploration, given the challenging characteristics of their farm landscape.

With respect to openness to new technology, it was found that there are *Isneg* farmers who believe that veering away from their traditional implements and practices would not please the *anitos*, who they believe have been adequately sustaining them. These farmers worry that using new equipment and techniques would lead to poor yield or that their harvest would somehow run out quickly. An approximation of how many these farmers are is beyond the scope of this research. However, impressions from discussions and immersion in communities suggest that they are only, by far, the minority. Most are open-minded and eager to know about new technologies that could increase production and reduce the laboriousness of their processes. They choose to keep a progressive mindset rather than be stuck with tradition. As one informant said, *"Dapat nga mapalitan na eh. We want to advance. Kung ganito lang sa tradition ng Isneg, we will remain depressed. We must be uplifted."* (The practices ought to be replaced. We want to advance. If we remain traditional, we will remain depressed. We must be uplifted.) Furthermore, the Isneg also expressed that it is fine if people from other places would consume and cultivate their traditional varieties. However, they wish that the origin of the rice be acknowledged as these traditional varieties were inherited from and taken care of by their ancestors.

**Table 12.3.** Summary of SR production practices in Apayao.

| Stage of production | | APAYAO | |
|---|---|---|---|
| | | Activity/farm implement | Description |
| **Seedbed Preparation** | | N/A | |
| **Land Preparation** | | Brushing | Weeding using the *pallo/lasseb*, a hoe-like traditional tool |
| | | *Tadaw* | Cutting of small trees using the *aliwa* (Figure 12.3) |
| | | *Tadaw - Baliyad* | Cutting of relatively big and tall trees |
| | | *Si-dog* | Burning |
| | | *Karamkam/Dudo* | Clearing of debris |
| **Crop Establishment** | | *Tugno* | Planting using the *gadang* (a type of dibble with a semi-pointed metal attached at the end of a wooden handle) and *tupang* (receptacle of seeds strapped on to the hip) (Figure 12.4) |
| **Management** | **Nutrient** | *Kaingin* | Soil is nourished by ashes from burned vegetation |
| | **Weed** | *Alasyang* | Cleaning of *koman* edges and boundaries |
| | | *Ballat/Gait* | First post-planting weeding |
| | **Pest** | - | - |
| | **Disease** | - | - |
| **Harvesting** | | *Rakem* | Harvesting using the *rakem* (Figure 12.5), a handheld panicle harvester that has a crescent-shaped blade impaled to a cylindrically shaped piece of wood |
| **Threshing** | | *Magaggi/ Agirik* | Threshing by foot (Figure 12.7) |
| | | *Taltag* | Threshing using the *taltag* (Figure 12.9), a wooden rectangular block with a handle (a hammer of sorts) |
| | | *Chako* | Threshing using the *chako* (Figure 12.8), a farm implement that looks like nunchucks and is used to pick up bundled rice |
| **Drying** | | Solar drying | Paddy drying on-farm using nets or tarpaulin |
| **Hauling** | | Hauling of sacks | For rungus type (no panicle handles) |
| | | *Mag-ishiw* (Figure 12.6) | For *ikkam* type (with panicle handles); transporting bundles of rice hung on a bamboo carried on the shoulder |

*Table 12.3. Continuation.*

| Stage of production | APAYAO | |
|---|---|---|
| | Activity/farm implement | Description |
| **Milling** | Cono | Localized term for milling using mechanical rice mill (Figure 12.10) |
| | *Allo - Alsong* | Dehulling using the traditional *bayu* set that consists of the *allo* (mortar) and the *alsong* (pestle) |

**Figure 12.4.** Left - *Gadang* and *tupang* implements used by farmers in dibbling; middle and right - farmers demonstrating dibbling method in Tugno, Lenneng, Kabugao.

**Figure 12.5.** Harvesting using the *rakem*.

**Figure 12.6.** A farmer from Nabuangan, Conner practicing *mag-ishiw* to transport rice bundles using a bamboo.

**Figure 12.7.** *Magaggi* (foot threshing) demonstrated in Sitio Open Cut, Pudtol.

**Figure 12.8.** *Chako* used by farmers in Nabuang Conner to pick up bundles of rice.

**Figure 12.9.** *Taltag* used by farmers in Lenneng, Kabugao for threshing.

**Figure 12.10.** Cono in Lenneng, Kabugao used for milling.

***Cost and returns of aromatic rice production: subsistence case in Apayao***

The economic performance of one typical farmer was used to analyze the cost and returns of subsistence farming in Apayao (Table 12.4). *Gobyerno* was the variety used in this case. When it comes to cost items, it is noticeable that around 53% of the costs was spent on payment for hired labor. A large portion of this cost was spent for *rakem* (manual panicle harvesting). Other costs, which comprised power cost, food expenses, transportation costs, and other inputs ranked second. OFE labor constituted the next largest share. No costs for fertilizers and chemicals were found in this case. One factor that might explain why the farmer has not substantially adopted fertilizers and chemicals is that the farmer is engaged in subsistence farming and does not aim to maximize production and attain marketable surplus.

Out of these costs, the farmer produced a yield of 1.76 t $ha^{-1}$. On a per-hectare basis, the profit generated was P9,081. The farmer can increase his income up to P16.48 $kg^{-1}$ if he/she becomes market-oriented and sells the produce in milled rice form. But since this typical farmer is into subsistence farming, the produce is custom milled for household consumption.

Yield is equivalent to 877.95 kg $ha^{-1}$ in milled rice form. If the farmer chooses to procure this volume outside his own produce, given the prevailing selling price of milled aromatic rice of P47.06 $kg^{-1}$, he will spend about P41,316. This is much higher compared to the costs in producing his own rice for consumption, which is P24,922 $ha^{-1}$. Thus, a farmer should improve his yield and participate in the market to enable him to obtain higher income from selling his produce in milled rice form.

## Case 2: Market-oriented IP cultivation of SR in Abra

The second case for this chapter sheds light on the situation of SR cultivation in the municipalities of Luba and Manabo, Abra. The province was chosen as a research site because, as in Apayao, it is inhabited by IPs and is known for substantial cultivation of traditional rice varieties many of which are SR. In contrast, however, a considerable portion of SR cultivation in the province is geared for commercial purposes. The features, dynamics, and insights gleaned from this case are distinct from the preceding case of IP subsistence cultivation. Additionally, the study seeks to provide a contrast and discover how this province was able to transition to market production despite being an IP area in the same region.

**Table 12.4.** Costs and imputed milled rice net profit of aromatic rice production of an IP subsistence farmer, Apayao.

| Item | Apayao |
|---|---|
| **Selling price of milled rice*(peso $kg^{-1}$)** | 47.06 |
| **Yield (kg $ha^{-1}$)** | |
| Fresh paddy | 1,760.00 |
| Dry paddy equivalent | 1,596.28 |
| Milled rice equivalent** | 877.95 |
| **Total cost (peso $kg^{-1}$)** | 30.58 |
| Cost of good | 14.16 |
| Seed | 0.34 |
| Fertilizer | - |
| Chemicals | - |
| Hired labor | 7.45 |
| Operator, family, & exchange labor | 2.08 |
| Land rent | 1.24 |
| Interest on capital | 0.15 |
| Other costs | 2.89 |
| Cost per kg (in milled rice equivalent)** | 25.74 |
| Marketing cost* | 4.84 |
| **Net profit (peso $kg^{-1}$)** | 16.48 |

*Taken from market player survey.
**Milling recovery used was 55% (based on market player survey).

### *The Place*

Abra is a landlocked province on the western side of the Cordillera and is composed of 27 municipalities. The towns of Luba and Manabo were chosen as sites of the research. In Luba, the settlements and rice farms are dispersed between high and low areas. The farms at higher locations are only able to cultivate rice once a year, having lower production due to a less sufficient water supply. Majority of the farms in the lowland are able to have two to three rice croppings a year, being irrigated by rivers and their tributaries. Manabo, on the other hand, is a valley municipality with conglomerated settlements and generally lowland farms. Heralded as the "rice granary of Abra," it is capable of substantial rice production. One possible enabling factor here is the clustered arrangement of barangays. An irrigation system in Manabo has been established, maintained, and managed by the Manabo Development Foundation, Inc. through the collection of harvest shares from farmer-users. However, in 2016, the system was damaged by typhoons, which resulted in far-off barangays and sitios not being reached by irrigation water. Farmers therefore had to engage in rainfed rice farming.

***The Tingguian of Abra***

The indigenous inhabitants of the province of Abra are the *Tingguian* or Itneg. Even long before, rice cultivation has been the core of *Tingguian* economic life. Fay Cooper-Cole, an anthropologist who lived with and studied the people during the early 1900s, wrote that "The most important crop raised by the *Tingguian* is rice, and to its cultivation he devotes a considerable portion of his time." He further notes that rice is mainly grown in irrigated rice terraces supplemented by production in mountain or upland fields (through slash-and burn farming) (Cole, 1922). The term *Tingguian* is an exonym used by Spaniards in previous times to refer to all mountain dwellers in the Philippines. Later on, it evolved to being exclusively used for the inhabitants of Abra and Ilocos. The name may have been derived from the ancient Malay word 'tunggi' meaning mountain. On the other hand, Itneg is the term that their ancestors originally used to refer to themselves as a people (Cordillera Schools Group, 2003). Today, both labels are equally acknowledged by them.

Although having their own religious system, the *Tingguian* have indigenous beliefs similar to those of the Isneg. They also believe in anitos and they have shamans *(mannapo, baglan)* who facilitate practices performed to communicate with these superior beings. Likewise, almost all have been Christianized and have formed an amalgamation of Christian and traditional faith, mainly justified by the belief that their indigenous supreme being Kaboniyan and the Christian God are one and the same despite having different names. In Luba, the practice of traditional customs has waned and is very sparse nowadays. The *Tingguian* who reside in Manabo, however, are known to still be steadfast in the performance of rituals to this day. Sample customs and rituals are shown in Table 12.5.

**Table 12.5.** Sample customs and rituals in Abra still in practice today.

| |
|---|
| • (Manabo) *Sidat* is a ritual dance performed for any activity involving land use or land conversion. Examples are when constructing pump wells or turning land into a rice field. This is done so that illness will not befall the person or family that made use of the land.<br>• (Manabo) *Ubaiya* is a traditional ritual done for various reasons such as to ask for rains, to give thanksgiving, to ask for healing, and to fight away sickness in the community. It is conducted for a sitio, specifically where the *pinpinaing* or sacred stones are located. An outsider's entry would cause the ritual to be negated, and he or she must pay the total amount expended in its performance. Abstinence for the entire day follows wherein chili may not be consumed. |

Despite being known as an area of IP population, a significant number of migrants have established themselves and intermarried in Abra in the past few decades. Foremost among these migrants are the Ilocanos, the majority group in northern Luzon. In some municipalities and barangays, the number of Ilocano dwellers even surpasses that of the natives. Yet, the *Tingguian* still comprise a substantial portion of the populace, and their unique ways of life continue to influence religious, economic, and agricultural landscapes to this day.

***Abra: SR farming practices***

Throughout the years, the ratio of traditional SR cultivated to modern white rice cultivated has gotten smaller and smaller. Farmers in Abra have come to prefer the latter due to their faster maturation and greater yield. In certain areas of Manabo and Luba, there is adequate irrigation to potentially have up to three croppings a year, which would not be capitalized on if farmers use traditional varieties that take longer to harvest. Also, even though SR commands a higher premium price in the market, the disparity in yield is still such that planting modern varieties is ultimately more profitable to farmers.

Farmers in the two chosen municipalities continue to practice terrace-style rice cultivation. The practice of upland slash-and burn-farming has been abandoned in these areas due to prohibition set by the DENR. Table 12.6 summarizes the SR production process in Abra (Table 12.6).

**Table 12.6.** Summary of SR production practices in Abra.

| Stage of production | | ABRA | |
|---|---|---|---|
| | | **Activity/farm implement** | **Description** |
| **Seedbed Preparation** | | *Gusad* (Figure 12.13) | Dibbling |
| | | *Pinal* (Figure 12.14) | Planting method where seeds are planted while still attached to the panicles |
| | | Manual broadcasting | Broadcasting of seeds on wet seedbeds |
| **Land Preparation** | | Plowing | Breaking up of soil using the steel plow or hand tractor with disc plow attachment |
| | | *Suyod – Pailid* (Figures 11 and 12) | Harrowing using the *suyod* (a steel harrow) and *pailid,* a traditional Tingguian implement for simultaneous harrowing and levelling |
| | | *Dapnas* | Leveling using *dapnas*, a wooden leveler |
| **Crop Establishment** | | Transplanting | Random method |
| **Management** | **Nutrient** | Synthetic fertilizer application | Broadcasting or spraying of synthetic fertilizer |
| | **Weed** | Herbicide application | Spraying of synthetic herbicide |
| | **Pest** | Synthetic pesticide application | Synthetic pesticide application |
| | | On-field fermentation of small river crabs | Skewering of *agatol* or small river crabs on wooden sticks that are placed in the rice fields to serve as insect-attractants |
| | | Rat poisoning | Mixing arsonate with food (e.g. sardines or dried fish) placed inside bamboos and strategically placed on bunds or in the rice field |
| | | Bird frightening | Driving away of birds using *banbante* which vary in form, e.g. stake of wood covered with a sack, buntings with plastic flaglets or compact discs |
| | **Disease** | Natural pesticide application | Natural pesticide application |

*Table 12.6. Continuation.*

| Stage of production | ABRA | |
|---|---|---|
| | Activity/farm implement | Description |
| **Harvesting** | *Gapas* | Sickle harvesting |
| | *Rakem* | Harvesting using a *rakem*, a hand-held panicle harvester that has a crescent-shaped blade impaled to a cylindrically shaped piece of wood |
| **Threshing** | Threshing | Separating the grains from the panicle by use of head-feed and feed-in mechanical threshers |
| **Drying** | Solar drying | Paddy drying on-farm or on pavement |
| **Hauling** | Transport-hauling | Using motorcycle with sidecar |
| | *Pasagad* (Figure 12.15)/ *Kalison* | Hauling using *pasagad/ kalison*, a wooden sled usually pulled by a carabao |
| **Milling** | Cono | Localized term for milling using mechanical rice mill |

**Figure 12.11.** *Pailid* used by farmers in Luzong, Luba as implement in harrowing.

**Figure 12.12.** Farmer showing the *gusad,* Sabnangan, Luba.

Farmers are evidently open-minded about adopting production-enhancing modern technologies and practices. Though there is the impression that IPs are 'backward' and 'a hindrance to development,' SR farmers in Abra have long before taken their own initiative to acquire and buy machines that would make their rice production more efficient. *Tingguian* and *Itneg* farmers feel the same way with regard to consumption and cultivation of their traditional varieties by other people.

**Figure 12.13.** Seedbed established using *gusad*, Sabnangan, Luba.

**Figure 12.14.** *Pinal* (panicle planting in seedbed), Sabnangan, Luba.

**Figure 12.15.** *Pasagad* or hauling practice using wooden sled pulled by a carabao

***Cost and returns of glutinous rice production: the case in Abra***

The yield achieved by a typical farmer in this case was 2.8 t $ha^{-1}$. With a high paddy price of P22 $kg^{-1}$, the gross revenue obtained was P61,600 $ha^{-1}$. The farmer spent a total of P43,244 for one cropping season in a 1-hectare land or P15.44 $kg^{-1}$ (Table 12.7). Dissecting the cost items, the top three expenses were payment for hired labor (P5.90 $kg^{-1}$), land rent as imputed (P3.07 $kg^{-1}$), and seed (P1.20 $kg^{-1}$). Payment for hired labor accounted for 38% of total cost per hectare. This was followed by imputed land rent cost, which was around 20%. Lastly, seed expense was about 8% of the total cost. Accounting for all costs, the farmer was able to generate a net income of P18,356 $ha^{-1}$ or P6.56 $kg^{-1}$.

Most of the farmers sold their paddy in fresh form. Net income can still increase if the farmer in this case engages in value addition. With a milling recovery of 50%, the milled rice equivalent of yield was 1,270 kg, while the cost of good was P30.88 $kg^{-1}$. Cost of marketing glutinous rice was P5.03 $kg^{-1}$ (see Chapter 8). Considering all these costs, the farmer can generate a profit of P24.09 $kg^{-1}$ inasmuch as the prevailing milled rice price of glutinous rice in Abra is high at P60 $kg^{-1}$.

**Table 12.7.** Cost and returns of glutinous rice production of an IP market-oriented farmer, Abra.

| Item | Abra |
|---|---|
| **Yield (kg ha$^{-1}$)** | **2,800** |
| **Fresh paddy price (peso kg$^{-1}$)** | **22.00** |
| **Production cost (peso kg$^{-1}$)** | **15.44** |
| Seed | 1.20 |
| Fertilizer | 1.19 |
| Chemicals | 1.09 |
| Hired labor | 5.90 |
| Operator, family, & exchange labor | 0.68 |
| Land rent | 3.07 |
| Interest on capital | 0.20 |
| Other costs | 2.12 |
| **Net profit (peso kg$^{-1}$)** | **6.56** |

### Case 3: Non-IP Subsistence Cultivation of SR in Bukidnon

Bukidnon was found to be a suitable location for another of the cases that the study wanted to investigate – that of non-IP subsistence cultivation of SR. in particular, the study wanted to find out what hindrances prevent the subsistence SR cultivators' transition to market production. While it could be speculated that adherence to tradition and having a relatively closed system were potential reasons for the IP case, there was a need for an explanation for a non-IP community. After being designated as the case to represent non-IP subsistence, it was later found during subsequent fieldwork that the municipality is also home to populations of Ivatans and Lumads. Despite this discovery, the case was still retained as representative of non-IP subsistence cultivation because the IPs comprise the minority of the population and the general way of life, farming practices, and dynamics in the chosen municipality are not based on IP traditions (in contrast to the case in Apayao).

*The Place*

Around 77% of the total land area falls within the 8-15% slope range, under moderately undulating and gently rolling land (Municipal Agriculture Office of Kalilangan, nd) (Figure 12.16). The barangays where data gathering was conducted (Malinao, Public, and Ninoy Aquino) have slopes in this category. Climate is Type 4, characterized by evenly distributed rainfall throughout the year (specifically: moderate rainfall during April, heavy rainfall from May to October, end of rainfall towards November to December, and dry season from January to March) (Municipal Agriculture Office of Kalilangan, nd). The local people, however, noticed that climate and rainfall have become quite unpredictable in recent years.

**Figure 12.16.** Rice paddy in the middle of rolling agricultural terrain, Kalilangan, Bukidnon.

Being an agricultural municipality, Kalilangan generally relies on agriculture for local economic movement, and most locals are engaged in agricultural production and agri-support activities. In 2017, rice, corn, sugarcane, coffee, and cacao were the major crops, covering almost 28% of the municipality's total land area. Ninety percent of the population have rice as their staple food while the other 10% consume corn and root crops. Even so, locals are not reliant on rice for everyday consumption and can substitute corn if supply is lacking. In totality, rice production is unstable but local supply still exceeds local demand. Surplus is then sold to neighboring towns (Municipal Agriculture Office of Kalilangan, nd).

Although there are also cultivators of SR (particularly red rice) in the lowland regions of Kalilangan, the focus of this case study is on upland rice farming in the municipality where SR varieties are cultivated mainly for subsistence and personal consumption. While rice is the only main crop planted in the irrigated areas, corn and sugarcane are also heavily cultivated in the uplands. In fact, these are the primary crops over rice. Aside from these, banana and coffee are also extensively grown due to the presence of companies that engage in the trading of these goods.

**Figure 12.17.** *Rastilyo* attachment in four-wheel tractor used by farmers in Kalilangan, Bukidnon for land preparation.

***The People***

Kalilangan, being known as the land of 18 tribes, is a municipality that harbors significant cultural and ethnic diversity. There are Bisayans, Tagalogs, Ilocanos, Ilonggos, Ivatans, and members of various Lumad groups in Mindanao. Although Christianity is the religion of the majority, there is also a substantial Muslim population in the locality. The trend is for people of similar ethnicity or religion to cluster together, thereby forming semi-homogeneous settlements (e.g., Ilocano area, an Ilonggo area, a Muslim area, etc.). Even though several indigenous groups are present within the municipality, there are generally no customs, rituals, taboos, or specific rules observed pertaining to farming.

Farmers think that the multiplicity of people has no bearing on rice farming. In essence, farmers practice the same farming techniques regardless of cultural differences. Preference for labor is not determined by group bias but is based on actual skill. In addition, there is no culture of hostility among the different people.

The SR farmers of Bukidnon, who are, on average, high school graduates, have livelihoods other than rice production (growing corn, sugarcane, coffee, cotton, and banana; employment as laborers). They are also not dependent on rice for consumption, substituting corn as a staple if there is lack in rice supply.

With the increasing presence of many multinational companies in their province, more farmers of Bukidnon are introduced to employment with social security benefits (as opposed to working as ordinary farm labor) and passive income generation by land lease. This can be seen as one of the future challenges for Bukidnon farmers—it is possible that the next-generation farmers would rather get profit from leasing their farm land rather than from their own produce.

***Subsistence practices in SR production in Bukidnon***

As aforementioned, rice is not the main crop planted by upland farmers; it is only cultivated for household consumption. It has been this way in Kalilangan ever since. One of the main factors that hindered the expansion of rice farming is the shortage of available farm labor due to the entry of large companies that employ a considerable number of locals. Further, they practice synchronous planting, thereby inhibiting the distribution of available labor through time. Farmers also admit having little or no knowledge on rice disease and their management. They do not have traditional remedies and training on these topics is yet to be conducted in their area. Hence, they feel that increasing rice production is risky, given their inability to control the spread of diseases if ever they occur. Other factors that limit rice production are the preference for corn, which is the traditional main crop of upland Kalilangan, and the presence of other cash crops.

During occasions where there is surplus, farmers sell their produce in milled rice form within their respective barangays. Other than being more expensive than lowland rice, there was no established price for upland rice since it is not intended for commerce in the first place. Neither do farmers sell ‘first class’ upland rice (*Kapokaw* and *Intramis*) for a premium price. In previous times, it was customary for farmers not to sell rice at all to ensure that family needs are first met.

The farmers’ main source of seeds is their previous harvest. Sometimes they may also exchange seeds with other farmers, in which case, they may need to double the amount of seeds, depending on the agreement. Furthermore, only one rice cropping per year is practiced (planting done in February and March and harvesting takes place in July and August). Table 12.8 summarizes the SR production process in the upland farms of Kalilangan.

After harvesting, the land is plowed or passed by a tractor, and then comb-harrowed to collect the stalks. Sometimes, a second pass is done if stalks are very scattered.

Many upland farmers know how to produce their own compost and organic fertilizer because of their previous training on coffee production. However, they admit not having the time and energy to manually process raw materials since they do not own any organic processing equipment.

***Cost and returns of a subsistence farmer in Bukidnon***

Table 12.9 shows the performance in terms of cost and returns of a typical subsistence farmer in Bukidnon. The top three cost items, accounting for 81% of the total cost, are the imputed land rent cost (39%), payment for hired labor (26%), and seed expense (16%). The seed expense was unexpectedly high: in this case, seeding rate was higher than the recommended. The seeds used were around 200 kg $ha^{-1}$ (4 bags $ha^{-1}$ at 40-50 kg $sack^{-1}$), possibly anticipating damage from rodents and birds. Fertilizer and pesticide costs were minimal.

This typical farmer was able to produce 1.36 t $ha^{-1}$ of aromatic rice. On a per-hectare basis, profit was P3,754. The farmer could double the income if he/she engages into value addition. Processing paddy into milled rice form and selling it at P50 $kg^{-1}$ would generate a net profit of P 9.88 $kg^{-1}$. Using the same assumptions on allocation for rice household consumption (90%) and annual volume requirement for aromatic rice (520 kg $year^{-1}$) as discussed in the Apayao case study, it can be deduced that this farmer’s harvest is just enough for the family’s consumption needs.

**Table 12.8.** Summary of SR production practices in Kalilangan, Bukidnon.

| Stage of production | | Bukidnon | |
|---|---|---|---|
| | | Activity/farm equipment | Description |
| **Seedbed Preparation** | | N/A | |
| **Land Preparation** | | *Plowing* | Breaking up of soil using the steel plow or four-wheel tractor with *rastilyo* (Figure 12.17), disc plow, or rotavator attachments |
| | | *Karas* | Harrowing using the *karas*, a steel comb harrow |
| **Crop Establishment** | | *Tudling* | Sowing of seeds following linear depressions formed through plowing |
| | | Direct seeding | Broadcasting of rice seeds on paddy |
| **Management** | **Nutrient** | Synthetic fertilizer application | Broadcasting or spraying of synthetic fertilizer |
| | **Weed** | Herbicide application | Spraying of synthetic herbicide |
| | | Manual weeding | Weeding by hand |
| | **Pest** | Pesticide application | Spraying of synthetic pesticide or using rodenticide |
| | | *Disease* | - |
| **Harvesting** | | Garab/ Karit | Sickle-harvesting |
| **Threshing** | | Threshing | Separating the grains from the panicle using mechanical threshers |
| **Drying** | | Solar drying | Paddy drying on pavements |
| **Hauling** | | - | |
| **Milling** | | Milling | Use of single-pass mills |

With a milling recovery of 55%, milled rice equivalent of aromatic rice yield is 678.42 kg. If the farmer procures this volume in the market, the cost will be P33,921. This is much higher compared with the cost of producing own rice for consumption, which is P27,350. Thus, a farmer should enhance his yield and participate in the market to take advantage of the higher income obtained from selling his produce in milled rice form.

**Table 12.9.** Costs and imputed milled rice net profit from aromatic rice production of a non-IP subsistence farmer, Bukidnon.

| Item | Bukidnon |
|---|---|
| **Selling price of milled rice (peso $kg^{-1}$)*** | **50.00** |
| **Yield (kg $ha^{-1}$)** | |
| Fresh paddy | 1,360.00 |
| Dry paddy equivalent | 1,233.49 |
| Milled rice equivalent** | 678.42 |
| **Total cost (peso $kg^{-1}$)** | **40.12** |
| Cost of good | 20.11 |
| Seed | 3.24 |
| Fertilizer | 0.73 |
| Chemicals | 0.81 |
| Hired labor | 5.21 |
| Operator, family, & exchange labor | 0.13 |
| Land rent | 7.79 |
| Interest on capital | 0.21 |
| Other costs | 1.98 |
| Cost per kg in milled rice equivalent** | 36.56 |
| Marketing cost* | 3.56 |
| **Net profit (peso $kg^{-1}$)** | **9.88** |

*Taken from market player survey.
**At 55% milling recovery (based on market player survey).

## Case 4: Organic SR cultivation in Negros Occidental

Organic agriculture, as defined in the Philippine National Standards (BAFS, 2016), is a 'holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices over the use of off-farm inputs, and utilizes cultural, biological, and mechanical methods as opposed to synthetic materials, where synthetic is defined as 'substances formulated or manufactured by a chemical process, or by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources.'

Currently, there are two organic certifying bodies in the Philippines—the Negros Island Certification Services (NICERT) and the Organic Certification Center of the Philippines (OCCP), both following international standards and the PNS for organic agriculture. Inspection must be carried out by a certifying body as a prerequisite for a farm to be certified as organic. The time frame of the conversion period is then set based on the initial findings of the inspector. A farm begins to be in conversion once the operator follows the minimum requirements for organic agriculture. Additionally, organic certifications are valid for only a year. Further, organic certifications as producer and as processor are different and separate. In order for a final product to be legally certified as organic, both the producer and the processor must be third-party organic-certified.

***The Place***

Negros Occidental is the northwestern half of the Negros Island in Western Visayas. It has a total land area of around 7,965 $km^2$, with 80% of all arable land cultivated for crops such as palay, corn, sugarcane, coconut, banana, and cassava (DA-SAAD, nd).

Bago City, one of the two representative municipalities for Negros Occidental, has approximately 25,907 ha of land planted to rice, which yields 4.47 t $ha^{-1}$ or around 123,048 t annually. It also produces sugarcane in around 9,690 ha, with 1,272,079 t of annual production (Bago City Municipal Agriculture Profile, 2019). During the Rice Achievers Awards (RAA) in 2019, the municipality was recognized as the top rice-producing city of Region VI with yield surpassing annual production at 119,200 t harvested in 2018 (Monthly Agriculture, 2019). The second representative municipality, Moises Padilla, was chosen following suggestions of local affiliates to represent rainfed organic production. Additionally, it is one of the 12 pilot municipalities for the organic movement. In 2019, the municipality had 1,034 ha devoted to irrigated rice and 271 ha to rainfed rice. In the same year, the average yield of irrigated rice was 4.89 t $ha^{-1}$ and that of rainfed rice was 3.06 t $ha^{-1}$ (Municipal Agriculture Office of Moises Padilla, nd).

Back in 2005, a memorandum of agreement was inked by the governors of Negros Occidental and Negros Oriental, institutionalizing the organic movement in Negros Island. With the declaration of Negros as the 'Organic Food Bowl of Asia,' the goal was to have 10,000 ha planted to organic crops in

10 years. So far, 14,700 ha have been devoted to organic cultivation. However, by and large, farmers in Negros are still engaged in conventional farming.

Springing forth from the organic thrust, Farmer Field Schools (FFS) and training courses on organic cultivation have been conducted around the province throughout the years. Furthermore, in 2017, an organic agriculture division was formed in the provincial government to provide support specifically for organic farming. Its main activities focus on aiding farmer groups acquire certification and on providing technical support to organic cultivation, giving protocols that must be followed in growing and processing crops.

***The People***

Even though Negros Occidental is known for organic farming, organic farmers still comprise the minority of the farmer population. On average, they finished high school. Organic farmers can be divided into two groups: those who consider organic farming their advocacy or to use their own words, 'organic by heart', and those who adopt organic farming mainly for practical reasons. These could be the desire for a premium price in selling their produce or, for some, simply not being able to afford chemicals and synthetic inputs.

Farmers who belong to the former group believe that synthetic inputs and chemicals in food bring about various sicknesses such as asthma, high blood, diabetes, even cancer. Some mentioned that they tend to 'activate' dormant illnesses. More than just for their health and that of their families, they want to promote and propagate organic cultivation to bring about improved well-being for other people, just as they have experienced. Mostly, these farmers learned about the merits of going organic from FFS. Beforehand, they knew little or nothing about organic cultivation.

However, other farmers have different views and require the promise of a premium price in order to shift, especially to offset the cost and hassle of going organic. Because organic markets and linkages are not yet established, they lack the impetus to transition. Also, many are doubtful that they can achieve a good harvest through the use of organic means. Given that farming is their main livelihood, going organic poses too much of a risk for them, although, according to organic farmers, they have been able to approximate and even surpass at times their yields from when they were conventional farmers. However, farmers who have yet to achieve such results are not inclined to believe without evidence. At the same time, there are farmers who are convinced of organic farming and are on the verge of shifting but have not taken the leap. This is due to the lack of purchasable ready-made organic inputs,and their reliance on herbicide usage.

One of the organic farming groups in Negros Occidental is the Negros Island Organic Producers Association (NIOPA). To become a member, a farmer must practice organic farming in his/her own farm, even if protocols are not yet precisely followed as per PNS. Certain fees and requirements must also be complied with.  A farmer-member may reap several benefits. The first is a market for organic crops. Without any affiliation with an association, farmers generally do not have a market for organic produce. Their fresh paddy, even if grown organically, is still being bought by local markets at the same price as inorganic produce. Prior to planting, farmers in NIOPA already have contracts for their organic rice, securing a particular premium amount. NIOPA also provides aid to its members in meeting the standards for organic certification. The association has an internal quality control system (IQCS), which is verified to be consistent with the standards of the certifying bodies. Farms that pass this internal quality control are then endorsed to an organic certifying body. If not, recommendations and technical assistance are provided to correct the deficiencies. Lastly, joining the association gives the farmer the opportunity to apply for certification as a member of a group. Applying individually is very expensive and ultimately unaffordable for a small farm, as fees must be paid annually, given that organic certification is only valid for a year. Currently, majority of the farms owned by members of NIOPA are still undergoing the conversion period. Moreover, NIOPA currently applies for certification as an organic producer only. They have future plans of establishing a processing component, but, as of now, they still have to rely on an external certified processor to whom they sell their produce.

According to organic farmers, the locals do not favor SR mainly because children do not like eating pigmented rice due to their rough and unpalatable quality. Also, there are some who believe that aromatic rice can cause illness. This has hindered the production of SR in the province. Yet, farmers are interested to expand the organic area devoted to SR if external markets are found. From their experience, farmers see pigmented rice varieties as actually more suitable to organic farming. They have found them to be less dependent on supplementary nutrients as opposed to white rice. Also, SR are observed to be more resistant to pests and diseases.

***Organic SR production practices in Negros Occidental***

Organic rice farmers in Negros are not clustered together but are usually positioned amidst inorganic farmers. To avoid contamination, buffer zones are established in strategic portions of their fields. Buffer zones are around 1 to 3 m wide, and buffer crops such as sweet potato, cassava, kakawate, napier, and lemongrass are planted within them. These plants must be taller than rice as they also serve as air filters (Figure 12.18). A type of buffer zone, filter ponds are made on water inlets going into the farm. Different fish and plants such as taro (gabi), water spinach (kangkong), and water lily are grown in them to serve as filters that rid the water of contaminants. Harvest from buffer zones may be sold but may not be considered as organic produce.

**Figure 12.18.** Filter pond to eliminate contaminants, Grace Farm Organic, Tabunan, Bago City.

Organic farmers are able to perform five rice croppings every two years in irrigated areas of Bago City. Those in Moises Padilla, on the other hand, can only have a maximum of two each year. Some organic farmers in rainfed fields can achieve two croppings if water pumps are available. Farmers' seeds come from previous harvests. Furthermore, a one-month fallow period is allotted between croppings as part of the protocol for organic farming. According to the farmers, the results of a mandatory annual soil sampling will reflect their compliance.

Synchronous planting is not employed in areas where the farmer participants come from. This is because irrigation waters are not continuously available and flow according to schedule. Yet, in some places with continuous irrigation, synchronous planting is still not practiced simply because farmers do not collaborate with one another.

Section 5.5.8 of the PNS for organic agriculture states that farm tools and equipment should be used exclusively in organic farms. In cases that these are not dedicated to organic production, these must be properly cleaned and must be free of residues from synthetic pesticides. Organic farmers confirm that they follow certain protocols for cleaning.


**Figure 12.19.** Organic calcium carbonate concoction.


**Figure 12.20.** Vermicomposting facility at Grace Organic Farm, Tabunan, Bago City.

Table 12.10 below summarizes the SR production process in Negros Occidental. The natural farming system concoctions used by organic farmers are fermented plant juice, fermented fruit juice, fish amino acid, kuhol amino acid, lactic acid bacteria serum, and calcium phosphate. For pests, the attractants used are species of colorful plants, frogs, tuba ng niyog mixed with fruit juice, guinamos/hipon, and urine (which farmers find very effective). It is important to note that sources of commercial organic inputs must also be third-party-certified.

**Table 12.10.** Summary of organic SR production practices in Negros Occidental.

| Stage of production | | Negros Occidental | |
|---|---|---|---|
| | | Activity/farm implement | Description |
| **Seedbed Preparation** | | *Dapog* | Growing of seedlings on a concrete floor or raised soil bed covered with polyethylene sheets |
| **Land Preparation** | | Plowing | Breaking up of soil using the steel plow |
| | | Tilling | Tilling of soil using the turtle (*ba-o*) |
| | | Harrowing | Harrowing using the steel harrow |
| | | *Habay* | Leveling using the *habay*, a wooden leveling implement |
| **Crop Establishment** | | Transplanting | Random method |
| **Management** | **Nutrient** | NFS Concoctions | Natural Farming System concoctions include fermented plant/fruit juice, fish amino acid, *kuhol* amino acid, lactic acid bacteria serum, and calcium phosphate |
| | | Organic Fertilizer Application | Vermicompost, carbonized rice hull, commercial organic fertilizers |
| | **Weed** | Weeding | Weeding by hand or by using mechanical weeders |
| | **Pest** | Attractants | Pest attractants used are species of colorful plants, frogs, *tuba ng niyog* mixed with fruit juice, *ginamos* or shrimp, and urine |
| | | Concoctions | Commonly formulated from neem leaves, lemon grass, madre de cacao, *kanyawan*, mahogany seeds, chili, and tobacco leaves |

*Table 12.10. Continuation.*

| Stage of production | | Negros Occidental | |
|---|---|---|---|
| | | Activity/farm implement | Description |
| | | Rat Bait | Made from mixing cement with sardines or dried fish placed in bamboo, or using the cassava or sweet potato planted around the field as natural bait |
| | Disease | Natural and microbial pesticide application | Commonly produced from indigenous microorganisms, microbial inoculants, or madre de cacao and neem extracts |
| **Harvesting** | | Harvesting | Sickle-harvesting or using the combine harvester |
| **Threshing** | | Threshing | Separating the grains from the panicle using mechanical threshers |
| **Drying** | | Solar drying | Palay drying on-farm or on drying pavements |
| **Hauling** | | - | |
| **Milling** | | Milling | Use of single-pass mills |

Many farmers find it hard to comply with the rigorous requirements of the organic certifying bodies. One of the main difficulties has nothing to do with the actual farming process itself but in the meticulous recordkeeping of their farm and farm activities, which is required. While farmers are hard workers some lack the diligence in note taking and documentation. Another challenge for farmers is the establishment of buffer zones (Figure 12.21) that meet the standards. In addition, many farmers are averse to allocating a substantial space for buffer zones, perceiving this to be a waste of valuable land area.

***Cost and returns of an organic SR farm: the case in Negros Occidental***

A group in Bago City headed by a Gawad Saka awardee is one the most active groups in the island. It advocates organic rice production and firmly believes that consuming organic products is highly related to maintaining or achieving healthiness. Thus, aside from having organic SR production as a source of livelihood, it has also become a way of life for the group members. Moreover, most of them also belong to the same religious group.

**Figure 12.21.** Buffer zone in organic rice farm.

To complete the information on this case study, data on cost and returns were collected and analyzed. The major SR produced by the leader of the group was *Black Rice*. Table 12.11 shows the cost and returns for this specific SR production. The reported yield per hectare is 5.78 t. Payment for hired labor occupied the top spot, which was close to 75% of the total cost. This is expected as results of previous studies show labor cost making up the bulk of total expenses in rice farming. The second largest share came from non-chemical materials (P0.63 $kg^{-1}$). This cost item is heavily due to concoctions that can be categorized as biopesticides or biofertilizers. With all these, the cost per kilogram for *Black Rice* was computed to be at P12.3 $kg^{-1}$. On a per-hectare basis, profit generated is about P45,254.

The farmer engaged in value addition and incurred marketing costs. Table 12.11 shows the marketing costs for organic SR. Certification fee made up the largest share, at 75% of total marketing cost. Apart from the fees charged for the production, additional certification fees are paid for the marketing and value adding. Since the farmer has acquired organic certification, it must be ensured that the products are not mixed with conventionally planted rice. One of the major postharvest processes that must be looked out for by the operator is drying, which cost P0.24 $kg^{-1}$. Here, solar drying is practiced using rice hull as bedding. This needs strict supervision since rice must be arranged in the bedding according to color to avoid mixing of pigments.

**Table 12.11.** Cost and returns of milled organic black rice production, Negros Occidental.

| Item | Negros Occidental |
|---|---|
| **Selling price of milled rice (peso kg$^{-1}$)*** | **59.00** |
| Yield (kg ha$^{-1}$) | |
| Fresh paddy | 5,781.00 |
| Dry paddy equivalent | 5,243.23 |
| Milled rice equivalent** | 2,831.34 |
| **Total cost (peso kg$^{-1}$)** | **36.93** |
| Cost of good | 12.30 |
| Seed | 0.19 |
| Non-chemical materials | 0.69 |
| Hired labor | 9.22 |
| Operator, family, & exchange labor | 0.27 |
| Land rent | 1.33 |
| Interest on capital | 0.18 |
| Other costs | 0.42 |
| Cost per kg in milled rice equivalent** | 22.79 |
| Marketing cost* | 14.14 |
| Drying | 0.24 |
| Milling | 1.60 |
| Transportation | 0.88 |
| Packaging | 0.38 |
| Cost of working capital | 0.38 |
| Certification | 10.66 |
| **Net profit (peso kg$^{-1}$)** | **22.07** |

*Taken from market player survey.
**Milling recovery used was 54% (based on market player survey).

Another marketing activity that needs proper management is milling, which comprised 11% of total marketing cost. Dried paddy harvests are stored at milling stations and processed once orders are placed. These are milled in a multi-pass machine with separator and de-stoner. To maintain its pigment, rice is unpolished with an average head rice recovery of 95%. Milling fee is P1.60 kg$^{-1}$, which is higher than the average milling fee of ordinary white rice

(P1.38 $kg^{-1}$) in the Philippines (Beltran et al., 2016). Despite incurring lower electricity costs since output must be unpolished, the machine used must be cleaned at all times, which explains the higher cost per kilogram.

The impact of organic certification is materialized in the selling price as products may be sold at approximately P59 $kg^{-1}$. Organic pigmented rice is usually sold to supermarkets through consignment. Products are also displayed in exhibits at organic markets and training centers. These are also marketed to retailers, establishments, and direct household consumers. There are also cases where products are shipped to Manila through a consolidator.

Accounting for the cost from production to marketing, the farmer can earn P22.07 $kg^{-1}$ for milled rice if he/she ventures into marketing of organic pigmented rice. With the increase in demand from local areas and other provinces, this would be a viable and profitable enterprise for the farmers on top of the net profit per kilogram from production alone. Once expansion of organic black rice production is achieved, it is important to further boost the marketing industry of this SR type in order to sustain the expected surge in demand. Packaging and branding are two important factors that should be looked into to strengthen this industry. Organic certification adds value to pigmented rice, and this must thus be translated in the packaging of organic products.

## Summary of all case studies

Details regarding SR areas, SR producers, management, and cost and returns were discussed to present situations that are not part of the mainstream 'commercial ordinary white rice production'. Table 12.12 presents the summarized SR production and marketing information in all study areas.

Looking at the locations of these farms, except for those used in organic rice production, it can be gleaned that SR production is commonly relegated to areas that have challenging terrains and landscapes. This is highly in contrast with commercial ordinary white rice production. However, it should be noted that these farm locations might have advantages in terms of expression of the SR's highly desirable characteristics.

From an ethical and cultural sensitivity standpoint, attempts to provide support to increase production and encourage the marketing of SR can be made. Majority of the SR farmers are open to yield-enhancing and cost-reducing modern technologies. Save for a small percentage of Isneg farmers, who are into subsistence SR farming and are firmly rooted in traditional practices (even to the extent of harboring fear of consequences should they deviate from it), the rest of the farmers believe otherwise. Specifically for organic rice production, other farmers are yet to be convinced of its advantages given the expensive and rigorous certification process. On one hand, Bukidnon farmers have unique experiences considering certain realities that only in their specific context exist. Thus, as a general observation, the specific context of each case study shaped the production attitudes and practices of the farmers under assessment.

As for cost, returns, and marketing, hired labor is mainly a foremost concern across all case studies. This is not specific for SR production alone but for rice farming as a whole. As labor shortage becomes widespread and as hired labor becomes expensive, modernization and mechanization would definitely be a good option.

## Summary and implications

With results from the case studies, the following measures are recommended:

First, if change from subsistence to market orientation is targeted, R&D interventions should consider the particular ecosystem and socioeconomic context where SR is produced. For example, SR farmers in Bukidnon could benefit from rice modernization and mechanization, rice training programs that emphasize pest and disease management, and profitability studies that compare SR to the other high-value crops that they cultivate. Conversely, in the case of Apayao, it should be ascertained that location-specific technologies are acceptable to the communities, given the landscape and the aforementioned Isneg farmers whose perspectives are still traditional and whose sensitivities make them more comfortable with their customary methods. Local SR farmers who espouse this viewpoint, even if they are in the minority, must still be well-represented in consultative activities. Other important factors to consider for subsistence SR farmers are their awareness of adaptive strategies to mitigate the effects of calamities and severe weather conditions such as drought, to establishing market linkages, and to guide them in their entrepreneurial endeavors.

Second, if market-orientation for Abra is to be strengthened, key interventions will have to heavily depend on SR varieties that have comparable yields with ordinary rice and are short-maturing. Even without early-maturing SR varieties, communicating the benefits from SR production and linking them with markets would definitely be strategic. This will undoubtedly encourage SR production and revive the dwindling cultivation of traditional varieties, thereby aiding in the preservation of their material culture.

Third, in the case of Negros organic farmers, local misconceptions regarding SR should be allayed by emphasizing its science-based benefits. In the production side, interventions that address supply and access to organic inputs should be encouraged and supported by the government, be they government-initiated or private-led. If these cannot be immediately implemented, proper cultural management can be prioritized in training activities. Further, the organic certification process should be reviewed, especially the expenses that farmers need to shoulder to be accredited. In terms of post-production, shared facilities dedicated to processing organic rice should be supported and addressed.

Fourth, as support for all SR farmers represented in the case studies, purification and preservation of seeds that they use should be enhanced. In so doing, the intrinsic qualities found to be desirable in these varieties would be maintained and preserved.

Fifth and last, across all SR types, market development should be prioritized. Niche markets should be established to ensure a premium price for SR and would well-benefit SR producers. As an example and to capitalize on SR production that is heavily connected to IP traditions and heritage, geographical indication should be explored. Related policies should be established. In the absence of GI, development of artisanal markets can definitely boost SR production in IP areas. Moreover, local ordinances supportive of these traditional SR can be done through forging linkages between local producers and local institutional buyers. This would partly form agritourism strategies that could boost SR production by IP. On the other hand, in the case of organic farmers, an intervention that could be pursued is to focus on branding and packaging.

**Table 12.12.** Summary of SR production and marketing of SR in the four case study areas.

| Area of concern | Apayao (IP-subsistence) | Abra (IP-market oriented) | Bukidnon (non-IP subsistence) | Negros Occidental (organic and market-oriented) |
|---|---|---|---|---|
| Place | SR production is only found in upland ecosystems | Farms in higher locations can only cultivate rice once a year (remote and difficult to reach) | Farm areas are sloping and gently rolling lands | Institutionalized organic movement in Negros Island |
| | Remote and difficult-to-access farm areas | Lowland areas have irrigation and can have 2-3 rice croppings a year | Climate change causing aberrant and unpredictable rainfall | Organic Agriculture Division established by the province |
| | Problematic landscape makes it difficult to apply modern rice farming techniques and technologies | Susceptible to major crop damage during typhoons | One cropping a year | Bago City: up to five croppings every 2 years |
| People | Isneg continue to rely on traditional rice farming practices | Tingguian also believe in *anito* and shamans but majority are Christianized | Multi-diverse when it comes to culture and ethnicity (majority are Christians) | Organic farmers still the minority |
| | Still believe in *anito* and shamans but majority are Christianized | Tingguians in Manabo are known to still be steadfast in performing rituals | Can substitute corn for rice for consumption, if lacking in rice supply | Other farmers are yet to be convinced of the advantages of organic rice production |
| | | | | Organic farmers can be divided into two groups: advocates of health and environment and those who adopt for practical reasons |

*Table 12.12. Continuation.*

| Area of concern | Apayao (IP-subsistence) | Abra (IP-market oriented) | Bukidnon (non-IP subsistence) | Negros Occidental (organic and market-oriented) |
|---|---|---|---|---|
| Production | Slash-and-burn *(kaingin)* | For single crop: lower production due to insufficient water supply | Aside from rice, other major crops are also planted | Lack of supply of and access to organic inputs |
| | Rudimentary and labor-intensive rice production process | Preference for moern ordinary white rice varieties because of higher yields and shorter maturity | Shortage of available farm labor, given the employment offered in multinational companies | Difficulty with the organic certification process, given the stringent/ rigorous guidelines for organic rice production |
| | Some (but a minority) still believe that veering from traditional implements and practices would cause displeasure to *anitos* | Some farm activities are still manually done | Lack of knowledge about rice disease management posing risks in case of pest and disease problems | Struggle with organic weed management without the use of herbicides (reliance on herbicides) |
| | | | Harvesting is still manual | |
| | Majority are open-minded and eager about new technologies | Farmers are open-minded and eager about new technologies | | Farm tools and equipment (for production and postproduction) should be exclusive to organic rice to maintain purity |
| | Others can consume and cultivate their traditional varieties as long as they are acknowledged as the origin, given that these are inherited from their ancestors | Others can consume and cultivate their traditional varieties as long as they are acknowledged as the origin, given that these are inherited from their ancestors | | Organic certification process is unaffordable for an ordinary farmer (feasible only if applying as a member of a group) |
| | Low yield | | | |

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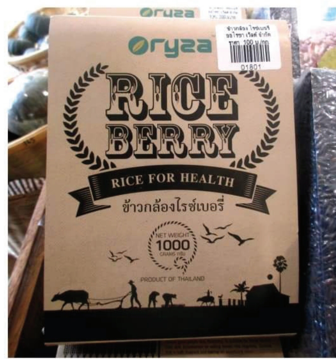
# V

# COMPARISON BETWEEN LOCAL AND INTERNATIONAL SPECIALTY RICE


ข้าวหอมมะลิ
นครพนม
Hom Mali Rice Nakhonphanom
GUARANTEE


oryza
RICE
BERRY
RICE FOR HEALTH
ข้าวกล้องไรซ์เบอรี่
1000
PRODUCT OF THAILAND


ข้าวซ้อมมือ
ข้าวกล้องไรซ์เบอรี่
ข้าวไรซ์เบอรี่

13

# PHILIPPINE SPECIALTY RICE IN THE INTERNATIONAL MARKET: CURRENT STATUS AND POTENTIALS

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Specialty rice (SR) are grown not only in the Philippines but also in several Southeast Asian countries such as Thailand, Vietnam, Cambodia, Laos, and Myanmar. In line with the objective of expanding the niche market for Philippine SR, we need to understand the SR industry from the point of view of both the producing and exporting countries. Among these countries, Thailand and Cambodia were selected as the sites for a more in-depth study to determine the competitiveness of Philippine SR in the international market. This will also give lessons that can be adopted in improving the country's SR production and marketing systems.

Thailand is producing not only fragrant rice (Jasmine) but also glutinous and pigmented rice. In fact, preliminary data collected through focus group discussions (FGD) and key informant interviews (KII) with key rice officials and farmer groups showed that they are the most advance in their system of processing and marketing their products. Cambodia, on the other hand, is comparable with major sites in the Philippines in terms of ecosystem, rice production, and marketing practices.

Northeast (NE) Thailand, also known as "Isan" and Thailand's largest region, is the chosen site in Thailand. It is composed of 20 provinces, sharing borders with Laos and Cambodia. The region has been historically and remains the main rice area within Thailand with 61% of the land dedicated to rice cultivation. Most of the areas are rainfed and have only one crop per year, with the main rice season from May to December. The area is known for premium quality rice *Hom Mali*, glutinous, and pigmented rice like rice berry. The area planted to *Hom Mali* is around 3.4 M ha. This comprises about 85% of area harvested and 81% of the output of the total *Hom Mali* rice production in the country. On the other hand, the area planted to glutinous rice is around 2.2 M ha, representing 83% of the total area harvested of glutinous rice in the country (Napasituwong, 2019). Representative samples of rice farmers planting different SR types were selected in five adjacent provinces: Khon Kaen, Maha Sarakham, Roi Et, Kalasin, and Surin (Figure 13.1).

Cambodia, on the other hand, is comparable with the major sites in the Philippines in terms of ecosystem, rice production, and marketing practices. It is known to produce some of the world's finest rice. Majority of the rice grown in the country are classified into two: aromatic or fragrant rice and white rice. Aromatic rice are further subdivided into (1) premium Jasmine rice known as *Phka Malis* with varieties such as *Phka Rumduol*, *Phka Romeat*, *Phka Rumdeang*, *Somali*, and *Neang Malis*, which are grown once a year and (2) other aromatic rice, which include *Sen Kra Ob* and *Sen Pidao* grown for two cropping seasons (The World's Best Rice, 2012, 2013, 2014). Aromatic rice accounts for about 30% of the total rice production in the country (Bunthan et al., 2018). Siem Reap, located in northwestern Cambodia, was selected as the representative province in this country. It is the 10$^{th}$ largest province in the country and cultivates about 192,110 ha of rice area, 14% of which is devoted to fragrant rice (Census of Agriculture in Cambodia, 2013 and 2015). The province is also one of the top 10 provinces that produce excellent aromatic rice. The farm level survey was conducted in two communes, Prasat with double rice crops and Yeang with a single rice crop (Figure 13.2).

For the purpose of comparison, each SR type in the Philippines is represented by one province where such SR is popularly planted. For aromatic rice, Oriental Mindoro represents the double crop system and Apayao, the single crop system (see Chapter 3). Glutinous rice is represented by Camarines Sur where there are bigger areas planted to glutinous rice (see Chapter 4). For pigmented rice, Negros Occidental represents black rice (see Chapter 5) and North Cotabato, red rice (see Chapter 6).

In the preceding discussion, these provinces are referred to whenever these countries are mentioned. With the limited number of samples for each SR

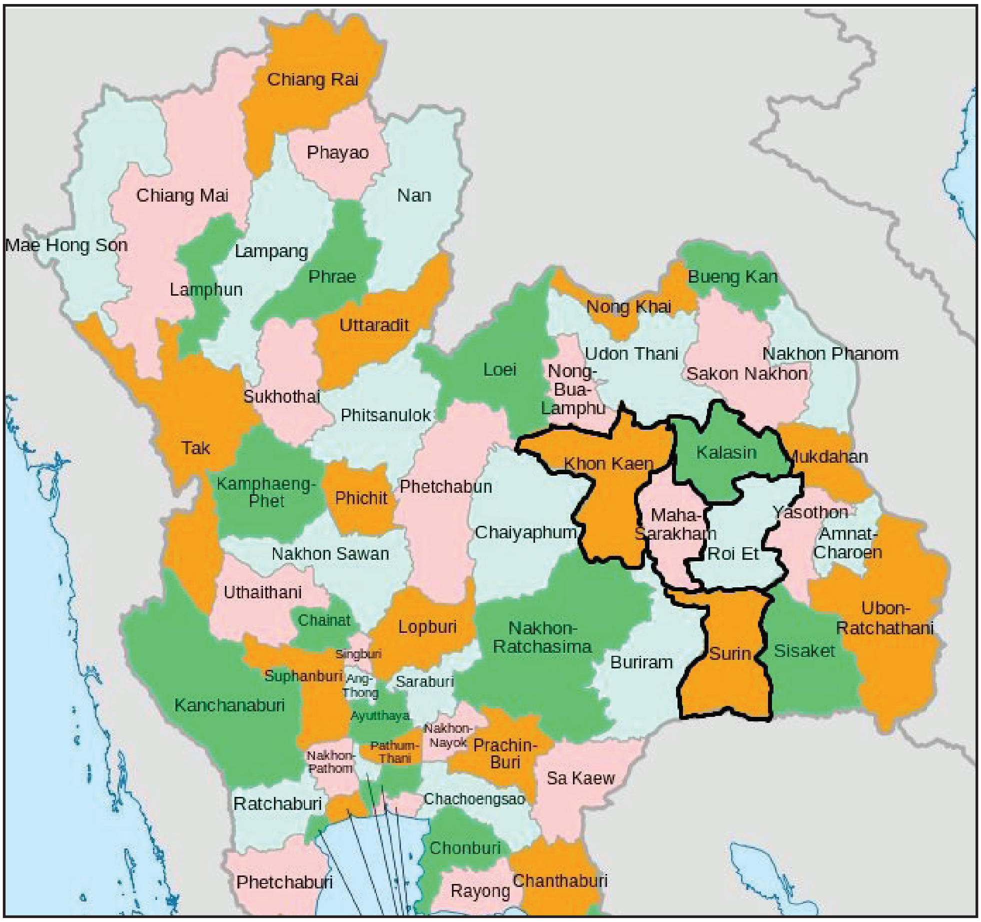


**Figure 13.1.** Location of project sites in Thailand.

type, results do not represent the countries' entire SR rice farming population, which was also identified as one of the limitations of this study. The results of the comparative analysis are discussed by SR type.

This chapter aims to (1) present a comparative analysis of the cost and return, crop production practices, and marketing systems of SR in Thailand, Cambodia, and the Philippines; and (2) identify the best practices in production and marketing that can be adopted in the Philippines to enhance SR production and marketing as well as the problems that should be dealt with to expand its export.

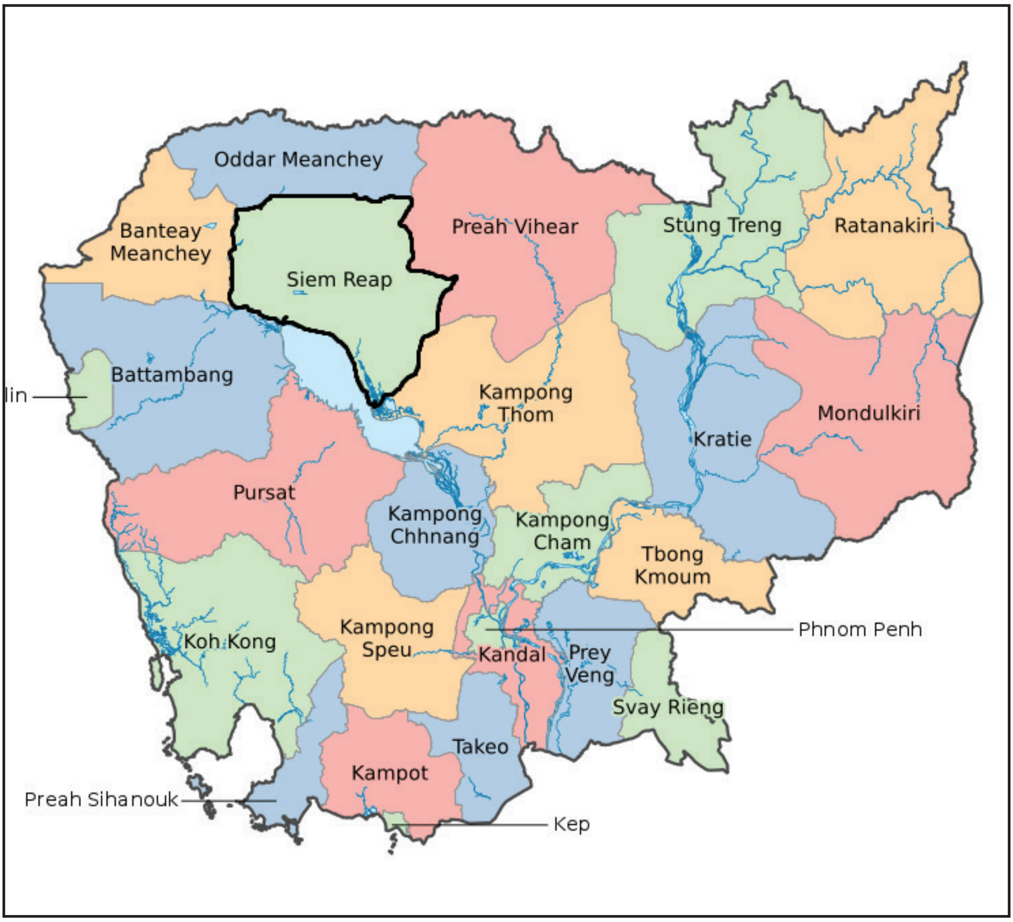


**Figure 13.2.** Location of project sites in Cambodia.

## Comparative analysis of SR production systems

### *Aromatic rice*

<u>Farm profile</u>

The survey revealed sites where aromatic rice is planted twice a year and sites where it is planted only once a year (Table 13.1). Two rice crops were possible in Oriental Mindoro and Prasat because of the presence of irrigation. Farms in the former were bigger by more than half a hectare (ha) than those in the latter. Distance from the aromatic rice farms to the nearest market is 8 km in Oriental Mindoro and 5 km in Prasat.

**Table 13.1.** Profile of aromatic rice farms in Cambodia, Thailand, and the Philippines, 2016-2017.

| Farm characteristic | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | Northeast Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Total rice area (ha) | 2.63 | 2.23 | 1.44 | 2.76 | 5.24 |
| Total aromatic rice area (ha) | 2.46 | 2.11 | 1.33 | 2.24 | 5.15 |
| Number of parcels | 1.81 | 3.00 | 1.33 | 3.43 | 3.11 |
| Area of biggest parcel planted to aromatic rice (ha) | 1.61 | 1.07 | 1.30 | 1.26 | 2.38 |
| Ecosystem (%) | | | | | |
| Upland (unbunded) | 2 | | 78 | | |
| Rainfed | 14 | | 8 | | 100 |
| Irrigated | 83 | 100 | 15 | 100 | |
| Source of water (%) | | | | | |
| NIS/CIS | 38 | 100 | 3 | 18 | |
| Small-scale irrigation system* | 45 | | 3 | | |
| Others** | | | 10 | 4 | 8 |
| Cropping pattern (%) | | | | | |
| Rice-rice | 95 | 88 | 3 | | |
| Rice-rice-rice | 2 | | | | |
| Rice-corn | | | 15 | | |
| Rice-other crops | | | 6 | | 37 |
| Rice-fallow | 0 | 3 | 78 | 100 | 63 |
| Distance to market (km) | 8 | 5 | 10 | 7 | 14 |

* Small-scale irrigation systems (SSIS) comprise shallow tube well (STW), open/dug well, deepwell, Small Water Impounding Project (SWIP), and Small Farm Reservoir (SFR).
** Others are natural sources such as rivers, streams, and free flowing wells.

Apayao, Yeang, and NE Thailand, which are mostly rainfed, can plant only one rice crop in a year. Among the three groups, NE Thailand farmers have the biggest area planted to aromatic rice (5.15 ha). Farmers from Apayao have the smallest landholdings for this type at only 1.33 ha. These farms in Apayao, Yeang, and NE Thailand are 10 km, 7 km, and 14 km away from the nearest market, respectively.

Farmer profile

Table 13.2 summarizes the basic socioeconomic characteristics of the sample farmers planting aromatic rice. It indicates that, in terms of socioeconomic characteristics such as age, sex, schooling, and training, there was not much difference between Filipino farmers and their counterparts in Cambodia and Thailand. All were more than 45 years of age with an average formal schooling of more than 6 years, although farmers from Yeang had the least number of years in school at 4 years. In terms of training, majority of the farmers from all sites have attended rice production-related training, except in Apayao where only 56% were trained. This is probably because they live in the upland areas and are far from urban centers. All farmers in Cambodia and Thailand were members of farm organizations, having the advantage of efficiently doing cooperative activities such as marketing and mechanized harvesting and threshing. Apayao has the least number of farmers who are members of rice-based organizations.

More than 90% of both Cambodia and Thailand aromatic rice farmers are owners of their land. In contrast, a mere 35% of farmers are owners of the land in both Apayao and Oriental Mindoro. A unique type of tenure, called ancestral domain, exists in Apayao (see Chapter 2).

Productivity of aromatic rice

The productivity of SR can be quantified in terms of yield per hectare expressed in tons (t). The reported yield by farmers are the volume of paddy immediately after harvest. Thus, the estimated yield is in terms of fresh weight with initial moisture content (MC) of 22%. However, in the course of the discussion, the equivalent dry yield at 14% MC is also presented.

**Table 13.2.** Summary profile of aromatic rice farmers in Cambodia, Thailand, and the Philippines, 2016-2017.

| Farmer characteristic | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | Northeast Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Age | 50 | 46 | 48 | 49 | 52 |
| Sex | | | | | |
| Female | 33 | 27 | 65 | 57 | 76 |
| Male | 67 | 73 | 35 | 43 | 24 |
| Schooling (years) | 9 | 6 | 9 | 4 | 8 |
| Farming experience (years) | 24 | 22 | 24 | 26 | 27 |
| Rice-based organization (% member) | 88 | 97 | 59 | 100 | 100 |
| Training (% with training) | 100 | 100 | 56 | 100 | 100 |
| Tenure status (%) | | | | | |
| Owner/CLT | 36 | 91 | 35 | 93 | 92 |
| Amortizing/CLT | 2 | | | | |
| Lessee | 14 | 3 | 3 | 4 | |
| Tenant | 38 | | 8 | | |
| Ancestral domain | 5 | | 53 | | |
| Others*** | 7 | 6 | 3 | 4 | 8 |

***Others include mortgagees.

The productivity of aromatic rice varied considerably across sites. Yield ranged from around 2.00 to 5.00 t $ha^{-1}$. In irrigated and double-cropped sites, the yield of aromatic rice in Oriental Mindoro was higher at 4.75 t $ha^{-1}$ compared with Prasat's 3.12 t $ha^{-1}$ (Figure 13.3). Among the single crop sites, which are mostly upland areas, Apayao had the lowest yield at 2.02 t $ha^{-1}$, while NE Thailand produced the highest yield at around 3.01 t $ha^{-1}$. Note, however, that the yield levels change a little bit if the MC is standardized to 14% (Table 13.3).

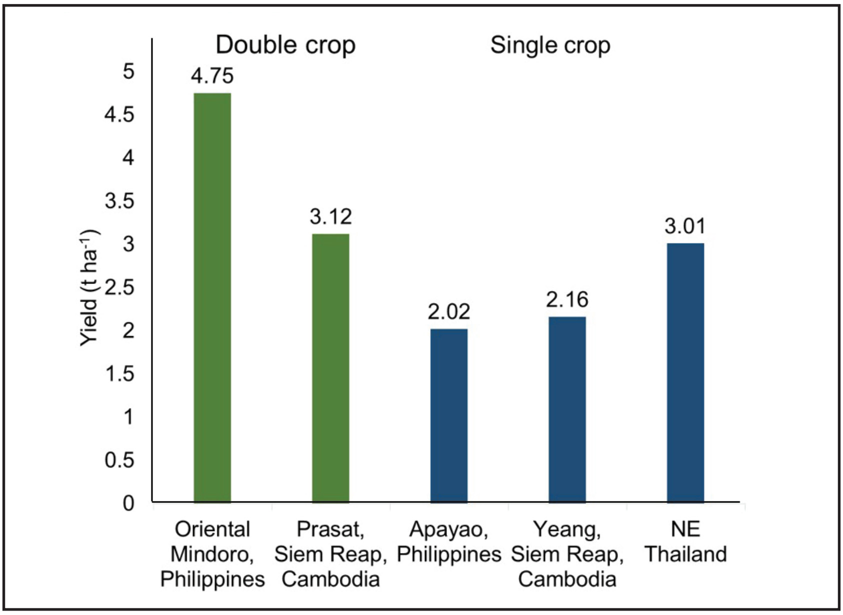


**Figure 13.3.** Farm yields of aromatic rice in Cambodia, Thailand, and the Philippines, 2016-2017.

**Table 13.3.** Comparative dry yields of all SR types in Cambodia, Thailand, and the Philippines, 2016-2017.

| | **Yield (t ha$^{-1}$) at 14 % MC** |
|---|---|
| Aromatic rice | |
| Double crop | |
| Oriental Mindoro, Philippines | 4.42 |
| Prasat, Siem Reap, Cambodia | 2.83 |
| Single crop | |
| Apayao, Philippines | 1.85 |
| Yeang, Siem Reap, Cambodia | 1.95 |
| NE Thailand | 2.62 |
| Glutinous rice | |
| Camarines Sur, Philippines | 3.41 |
| NE Thailand | 2.91 |
| Black rice | |
| NE Thailand | 2.13 |
| Negros Occidental, Philippines | 3.00 |
| Red rice | |
| NE Thailand | 2.25 |
| North Cotabato, Philippines | 1.70 |

## Material input use and management practices

### *Variety, seed class, and crop establishment*

It is noticeable that the varieties planted in double-cropped areas were quite different from those in single-cropped areas (Table 13.4). In Oriental Mindoro, aromatic rice farmers planted NSIC Rc 218 (modern variety) and *Dinorado* (local variety). In Prasat, *Sen Kra Ob* is widely cultivated by farmers (97%). In Yeang, three varieties were commonly planted, the most popular of which was *Phka Rumduol*. In NE Thailand, improved versions of the traditional *Khao Dawk Mali* (KDML) developed by their local rice research institute were planted, KDML 105 and RD 15. Apayao aromatic rice farmers, on the other hand, also planted two varieties, locally known as *Gobyerno* and Palawan.

Seeding rates in Prasat (162 kg $ha^{-1}$) and Oriental Mindoro (114 kg $ha^{-1}$) were quite high. Majority of the farmers in the former planted farmers' saved seeds. The use of high-quality seeds was quite popular in Oriental Mindoro where 55% and 10% of the farmers were using certified and registered seeds, respectively. In both double-cropped sites, direct-seeding was the most commonly adopted method of crop establishment (Table 13.4).

Among farmers in single-cropped sites, those in NE Thailand used the highest seeding rate at 102 kg $ha^{-1}$, while those from Apayao planted the least amount at 57 kg $ha^{-1}$. Farmers' saved seeds were commonly used across the three sites. In Yeang, all farmers practiced direct seeding. This crop establishment method was also popular in NE Thailand with 74% of farmers practicing this method. There were some farmers, however, who utilized a combination of direct seeding and transplanting methods in one farmland in these areas. Apayao farmers, who are in an upland area, have a unique method of establishing their crop. This is called dibbling (see Chapter 3). This explains the reason for the low seeding rate in the area.

### *Fertilizer use and management*

Table 13.5 shows the average NPK rates applied by the farmers in cultivating aromatic rice in all sites. All farmers in double-cropped sites applied fertilizers. Oriental Mindoro farmers applied twice the amount of N used and frequency of applications practiced by Prasat farmers. They also used larger amount of K. In contrast, Prasat farmers used more P fertilizer than Oriental Mindoro farmers.

For single crop, farmers in Yeang used the biggest amount of N fertilizer (36 kg $ha^{-1}$) and NE Thailand farmers had the least (13.4 kg $ha^{-1}$). This is low in comparison with what farmers in double-crop systems use. Results show that Oriental Mindoro farmers applied the biggest amount of N fertilizer. However, it must be noted that they were also the highest yielders among all farms, which indicates how N use could possibly influence yield level.

**Table 13.4.** Crop establishment practices of aromatic rice producers in Cambodia, Thailand, and the Philippines, 2016-2017.

| Item | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | NE Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Variety planted (%) | NSIC Rc 218 (57%) | *Sen Kra Ob* (97%) | *Gobyerno* (53%) | *Phka Rumduol* (54%) | KDML 105 (71%) |
| | *Dinorado* (43%) | *Sen Pidao* (3%) | Palawan (40%) | *Phka Malis* (21%) | RD15 (18%) |
| | | | | *Phka Rumdeang* (18%) | |
| Seeding rate (kg $ha^{-1}$) | 114 | 162 | 57 | 85 | 102 |
| Seed class (%) | | | | | |
| Registered | 10 | 6 | | | 21 |
| Certified | 55 | 12 | | 7 | 11 |
| Good | 2 | 12 | | 25 | 5 |
| Farmers' seed | 33 | 70 | 100 | 68 | 63 |
| Crop establishment method (%) | | | | | |
| Direct seeded | 79 | 100 | | 100 | 74 |
| Transplanted | 21 | | | | 18 |
| Dibbling | | | 100 | | |
| DS and TPL | | | | | 8 |

**Table 13.5.** Fertilizer management practices of aromatic rice farmers in Cambodia, Thailand, and the Philippines, 2016-2017.

| Item | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | NE Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Quantity used (kg $ha^{-1}$) | | | | | |
| N | 91.7 | 45.7 | 20.7 | 36.6 | 13.4 |
| P | 9.8 | 18.5 | 1.3 | 9.6 | 3.1 |
| K | 32.2 | 7.4 | 0.9 | 1.4 | 4.8 |
| Average number of application | 3.6 | 1.9 | 0.43 | 2.1 | 1.8 |
| Users of inorganic fertilizer (%) | 100 | 100 | 35 | 100 | 45 |
| Organic fertilizer used | | | | | |
| Type used (kg $ha^{-1}$) | | | | | |
| Biofertilizer | | | | | 357 |
| Green manure | | | | | 179 |
| Animal manure | | | | 345 | 1696 |
| Organic fertilizer (not classified above) | | | | | 271 |
| Users of organic fertilizer (%) | 0 | 0 | 0 | 7 | 81 |
| Users of both chemical and organic fertilizer (%) | 10 | 0 | 3 | 0 | 0 |

*Pesticide use and management*

The pest management practices of aromatic rice farmers from all sites in terms of frequency of use and amount spent for herbicide and insecticide are summarized in Table 13.6. Herbicide application is typically correlated with crop establishment. Sites showing heavy reliance on herbicides are the sites with farmers practicing direct seeding, regardless of SR type. Oriental Mindoro

(79%) farmers practiced direct seeding (Table 13.4). Nearly all (98%) were users of herbicides with an average expense of P1,736 ha$^{-1}$ (Table 13.6). Typically, farmers in Oriental Mindoro applied herbicide (60%) and insecticide (85%) more than once. This explains the higher amount spent on pesticide by these farmers compared with Prasat farmers who usually applied only once.

**Table 13.6.** Pesticide management practices of aromatic rice farmers in Cambodia, Thailand, and the Philippines, 2016-2017.

| Item | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | NE Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Herbicide | | | | | |
| Amount spent (peso ha$^{-1}$) | 1736 | 295 | 1142 | 267 | 577 |
| Users (%) | 98 | 88 | 68 | 68 | 13 |
| Frequency of application (%) | | | | | |
| 0 | 2 | 12 | 33 | 32 | 87 |
| 1 | 38 | 79 | 58 | 64 | 8 |
| 2 | 48 | 9 | 8 | 4 | - |
| 3 | 12 | | 3 | - | 3 |
| 4 | - | | - | - | 3 |
| Insecticide | | | | | |
| Amount spent (peso ha$^{-1}$) | 1237 | 344 | 360 | 15 | 40 |
| Users (%) | 95 | 73 | 45 | 11 | 3 |
| Frequency of application (%) | | | | | |
| 0 | 5 | 27 | 55 | 89 | 97 |
| 1 | 10 | 64 | 38 | 11 | 3 |
| 2 | 45 | 9 | 5 | - | - |
| 3 | 31 | | 3 | - | - |
| >=4 | 9 | | - | - | - |

**Table 13.7.** Comparative labor use of aromatic rice farmers in Cambodia, Thailand, and the Philippines, 2016-2017.

| Farm activity | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap Cambodia | Apayao Philippines | Yeang, Siem Reap Cambodia | NE Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Land preparation | 10 | 6 | 12 | 5 | 2 |
| Crop establishment | 9 | 2 | 11 | 4 | 7 |
| Crop care and maintenance | 13 | 5 | 6 | 8 | 9 |
| Harvesting, threshing, and postharvest | 3 | 3 | 24 | 12 | 4 |
| Total labor | 35 | 16 | 53 | 28 | 22 |
| % hired | 48 | 14 | 47 | 24 | 31 |

For a single crop system, Apayao farmers spent the most in pest management. Sixty-eight percent of them sprayed herbicide once. In Yeang, 68% of the farmers applied herbicide and only 11% used insecticide. This cost an average of P282 $ha^{-1}$. Lastly, herbicide and insecticide use appeared to have been an uncommon practice among farmers in NE Thailand.

Labor use and mechanization

The major activities involved in SR production were the same as those in conventional rice varieties, starting from land preparation to postharvest. Table 13.7 summarizes the labor for aromatic rice production. Labor use in all sites ranged from 16 to 53 mandays (md) $ha^{-1}$.

In a double crop system, farmers in Oriental Mindoro had higher labor use than Prasat farmers. Crop care and maintenance comprised the largest share in Oriental Mindoro at 13 md $ha^{-1}$. Notably, harvesting, threshing, and postharvest activities had the least labor use as combine harvesters are widely used in the area (Table 13.8). Prasat farmers, on the other hand, were the lowest users of labor at 16 md $ha^{-1}$. This is because all farmers used combine harvesters and established their crop through direct seeding (Table 13.8).

In a single crop systems, Apayao farmers had the highest labor use (53 md $ha^{-1}$) who used manual labor for harvesting and dibbling for crop establishment. The other sites were moderate labor users for two reasons: 1) farmers were partial adopters of direct seeding technology and 2) there was moderate mechanization as some used combine harvesters and small threshers.

In terms of source of labor, sites in the Philippines (Oriental Mindoro and Apayao) generally used more hired labor (Table 13.7). Sites in Thailand and Cambodia used more family and exchange labor (OFE).

Cost and profitability

*Gross revenue and price*

To allow the comparison of revenue, costs and prices are all expressed in Philippine peso using the current exchange rate during the time of the interview. Gross revenue per hectare was estimated by multiplying yield in kilograms per hectare by the price received by farmers during the time of sale of paddy (with husked).

Oriental Mindoro farmers' gross earnings were much higher compared with their counterparts in Prasat (Table 13.9). Their earnings amounted to more than P92,000, almost three times that of Prasat. This could be explained by the much higher yield in Mindoro and the higher price received by the farmers. However, for single crop sites, NE Thailand got the highest revenue because they got not only a relatively higher yield but also a good price. Farmers in Yeang got the lowest price, P10 $kg^{-1}$, hence, the lowest revenue.

*Costs of production*

All costs be they paid-out cost in cash or in kind (paddy) or imputed costs, were considered in estimating the costs of producing SR in 1 ha of land. Afterward, the cost of producing 1 kg of paddy was estimated based on its yield. The comparison focused on cost per kilogram of paddy.

For double-cropped areas, it took P13 to produce 1 kg of aromatic rice in Oriental Mindoro, while it took only about P8 $kg^{-1}$ to produce it in Prasat (Table 13.9). This difference in cost was due to high land rent, labor cost, and fertilizer cost incurred by farmers in Oriental Mindoro relative to those in

Prasat. In terms of composition of costs, land rent and hired labor comprised more than 50% of the costs in Mindoro; in Prasat, a much lower proportion of costs went to hired labor and land rent (Figure 13.4).

For single-cropped areas, Yeang spent the least cost at around P9 $kg^{-1}$, while Apayao had the highest amounting to P13 $kg^{-1}$ (Table 13.9). Across all sites, labor had the biggest share of total cost. In Apayao (30%) and NE Thailand (31%), hired labor was more used. In Yeang, imputed operator and family labor costs were higher (Figure 13.4). The share of costs for pesticide was zero in Thailand and in small amount in Yeang, which implies that they do not apply chemicals but use a combination of bio-pesticides and cultural management practices (Figure 13.4).

**Table 13.8.** Percent adoption of farm machinery of aromatic rice farmers in Cambodia, Thailand, and the Philippines, 2016-17.

| Farm machine | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | NE Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| Hand tractor | 95 | 91 | - | 93 | 32 |
| Four-wheel tractor | 67 | 21 | - | 11 | 68 |
| Rototiller/ floating tiller | - | 3 | - | | |
| Thresher | - | | 22 | 36 | 11 |
| Combine harvester | 100 | 76 | - | 43 | 34 |
| Rotary weeder | - | - | - | - | - |
| Water pump | - | - | - | - | 26 |
| Mechanical sprayer | - | - | - | - | 13 |
| Drum seeder | - | - | - | - | 8 |

**Table 13.9.** Profitability of aromatic rice farmers in Cambodia, Thailand, and the Philippines, 2016-2017.

| Item | Double crop | | Single crop | | |
|---|---|---|---|---|---|
| | Oriental Mindoro, Philippines | Prasat, Siem Reap, Cambodia | Apayao, Philippines | Yeang, Siem Reap, Cambodia | NE Thailand |
| | n=45 | n=33 | n=41 | n=28 | n=38 |
| **Returns** | | | | | |
| Yield (kg $ha^{-1}$) | 4,754 | 3,120 | 2,016 | 2,155 | 3,007 |
| Price (peso $kg^{-1}$) | 19 | 11 | 18 | 10 | 17 |
| Gross revenue (peso $ha^{-1}$) | 92,397 | 34,712 | 36,145 | 21,786 | 51,029 |
| **Costs (peso $ha^{-1}$)** | | | | | |
| Seed | 3,340 | 3,510 | 1,403 | 1,349 | 2,731 |
| Fertilizer | 8,199 | 5,106 | 1,260 | 2,749 | 3,467 |
| Chemicals | 4,708 | 809 | 1,639 | 282 | 104 |
| Hired labor | 14,931 | 4,412 | 7,541 | 4,599 | 11,354 |
| Operator, family, and exchange labor | 5,810 | 4,379 | 6,556 | 4,830 | 5,905 |
| Animal, machine, fuel, and oil | 309 | 1,135 | 9 | 533 | 1,452 |
| Irrigation | 418 | 213 | 3 | - | 2 |
| Food | 1,363 | 326 | 3,857 | 512 | 933 |
| Transportation | 645 | 251 | 350 | 207 | 543 |
| Land rent* | 19,038 | 3,307 | 1,983 | 3,667 | 8,293 |
| Interest on capital | 1,918 | 1,037 | 290 | 574 | 315 |
| Miscellaneous cost | 2,222 | 848 | 318 | 590 | 1,134 |
| **Total paid out cost (peso $ha^{-1}$)** | 44,173 | 16,800 | 16,580 | 10,947 | 21,720 |
| **Total cost (peso $ha^{-1}$)** | 62,901 | 25,333 | 25,211 | 19,891 | 36,233 |
| **Cost per unit (peso $kg^{-1}$)** | 13 | 8 | 13 | 9 | 12 |
| **Net income from rice farming (peso $ha^{-1}$)** | 29,495 | 9,378 | 10,934 | 1,894 | 14,797 |
| **Returns over paid out cost (peso $ha^{-1}$)** | 48,224 | 17,912 | 19,566 | 10,839 | 29,309 |

*Land rent- consists of paid out cost and imputed cost.

*Net returns*

Net returns from aromatic rice production were presented in two ways: 1) net income and 2) net returns over paid-out costs. Net income was estimated by deducting all costs from gross revenue. All costs include imputed costs as follows: a) imputed labor provided by the farmer himself, his family, and exchange labor using the current wage rate in the area, b) imputed land rent if the land is owned by the farmer, and c) interest on capital owned by the farmer. This way, opportunity costs of using resources such as labor, land, and capital owned by the farmer are accounted for in estimating net returns from the farming business. However, net returns over paid-out costs were also estimated to show net returns from the farmers' point of view, where he considers how much he gets from rice farming, including earnings for his labor and owned resources. Some farmers, particularly the less educated ones and those who consider that their labor and resources have zero opportunity, consider this as net income. The calculation of net returns assumes that all rice produced on the farm is sold directly in the market.

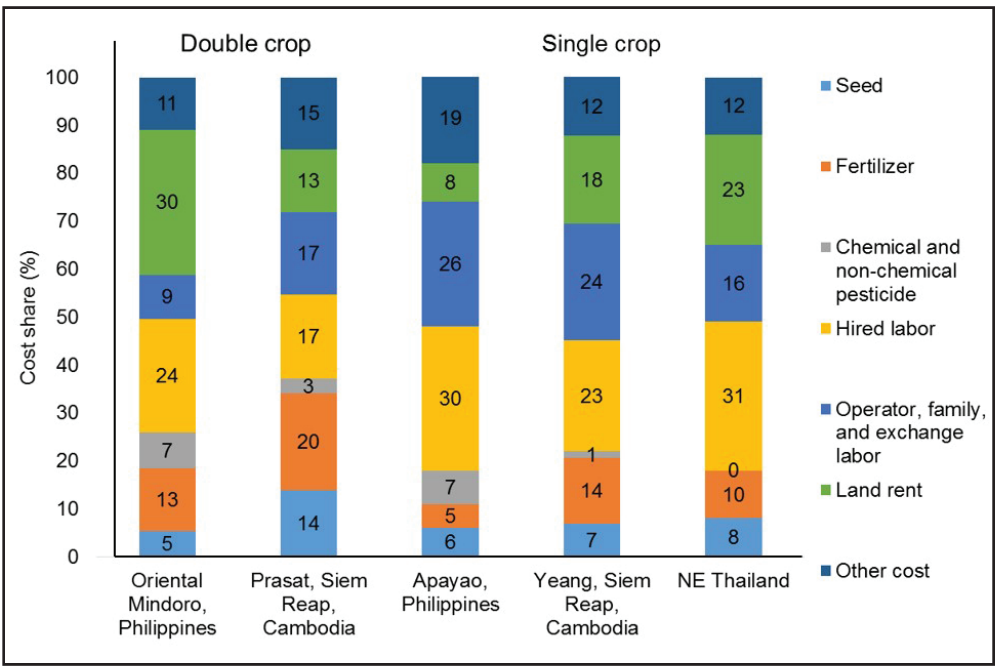


**Figure 13.4.** Cost shares (%) of the different factors of production, aromatic rice, 2016-2017.

Both net income and return over paid-out costs of Oriental Mindoro farmers were more than twice those received by Prasat farmers (Figure 13.5). This was brought about by the higher gross revenue earned by Oriental Mindoro farmers. For single-cropped farms, Yeang got the lowest net returns in both cases, getting a net income of only about P1,900 $ha^{-1}$ compared with others whose income ranged from P11,000 to P15,000 $ha^{-1}$. The ecosystem must be taken into account because of a positive effect of irrigation on yield and, subsequently, farmer's income.

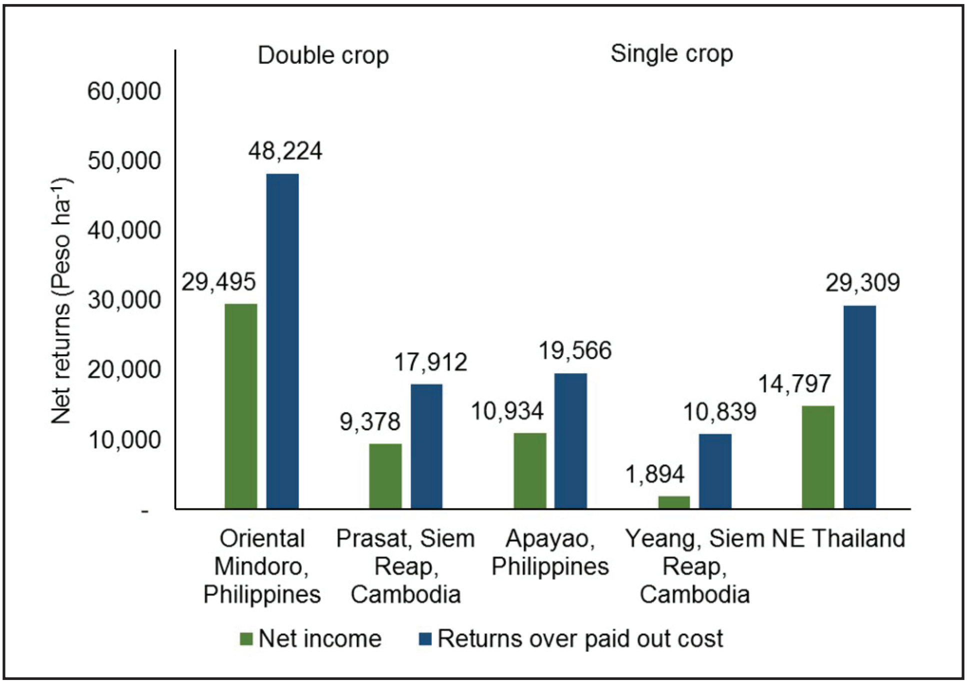


**Figure 13.5.** Comparative profitability of aromatic rice in Cambodia, Thailand, and the Philippines, 2016-2017.

***Glutinous rice***

Farm profile

The average rice areas in NE Thailand and Camarines Sur were almost the same, although, the area planted to glutinous rice by Camarines Sur farmers was slightly bigger than that of Thai farmers (Table 13.10). Farm areas in Camarines Sur were mostly irrigated (98%), allowing majority of the farmers to plant rice twice a year (84%). Some were even able to cultivate up to three rice crops (14%). The farms were 8 km away from the nearest market. In contrast, all NE Thailand farmers have only one rice crop, but 32% of them plant other crops after the rice season.

**Table 13.10.** Profile of glutinous rice farms in Thailand and the Philippines, 2016-2017.

| Farm characteristic | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Total rice area (ha) | 2.42 | 2.40 |
| Total glutinous rice area (ha) | 2.18 | 2.38 |
| Number of parcels | 1.77 | 3.47 |
| Area of biggest parcel planted to glutinous rice (ha) | 1.57 | 1.32 |
| Ecosystem (%) | | |
| Rainfed | 2 | 100 |
| Irrigated | 98 | |
| Source of water (%) | | |
| NIS/CIS | 48 | |
| Small-scale irrigation system* | 32 | |
| Others** | 18 | 15 |
| Cropping pattern (%) | | |
| Rice-rice | 84 | |
| Rice-rice- rice | 14 | |
| Rice-other crops | | 32 |
| Rice-fallow | 2 | 68 |
| Distance to market (km) | 8 | 9 |

* Small-scale irrigation systems (SSIS) comprise shallow tube well (STW), open/dug well, deepwell, Small Water Impounding Project (SWIP), and Small Farm Reservoir (SFR).
** Others are natural sources such as rivers, streams, and free flowing wells.

Farmer profile

Table 13.11 presents the basic socioeconomic characteristics of glutinous rice farmers. Farmers in Camarines Sur have the same age as their Thai counterparts. The former was equally divided between male and female, whereas the latter was female-dominant.

There was not much difference in terms of schooling and farming experience of farmers from both sites. Almost all of NE Thailand farmers were members of rice-based organizations, while only about 61% joined such organizations in Camarines Sur. All farmer-interviewees from both sites have attended rice-related production training. More than half (55%) of the farmers in Camarines Sur owned their farms and 30% were tenants. In NE Thailand, majority (91%) were farm owners.

**Table 13.11.** Summary profile of glutinous rice farmers in the Philippines and Thailand, 2016-2017.

| Farmer characteristic | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Age | 53 | 53 |
| Sex (%) | | |
| Female | 50 | 64 |
| Male | 50 | 36 |
| Schooling (years) | 9 | 8 |
| Farming experience (years) | 28 | 30 |
| Rice-based organization (% member) | 61 | 98 |
| Training (% trained) | 100 | 100 |
| Tenure status (%) | | |
| Owner/CLT | 55 | 91 |
| Amortizing/CLT | 7 | |
| Lessee | 5 | 2 |
| Tenant | 30 | 2 |
| Others*** | 5 | 4 |

***Others include mortgagees.

Productivity of glutinous rice

The average yield of glutinous rice in Camarines Sur was around 3.7 t $ha^{-1}$ (Figure 13.6), which was only 0.33 t $ha^{-1}$ higher than that in NE Thailand. However, at 14% moisture content (MC), the incremental yield of Camarines Sur was higher by 0.50 t $ha^{-1}$ (Table 13.3), which indicates that the initial MC of fresh rice from NE Thailand was a little bit higher.

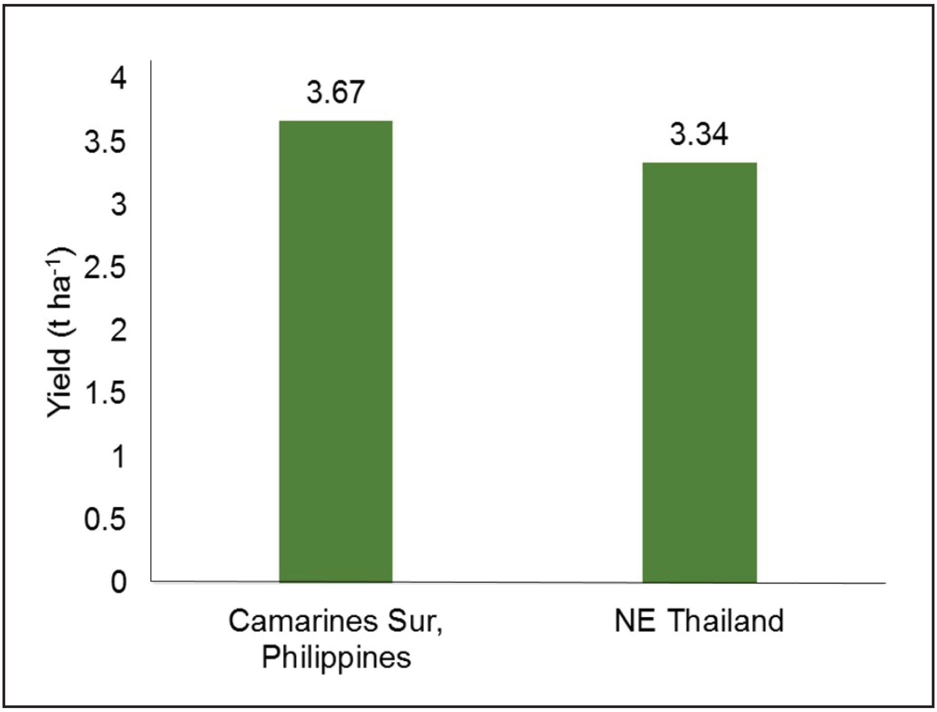


**Figure 13.6.** Farm yields of glutinous rice in Thailand and the Philippines, 2016-2017.

Material input use and management practices

*Variety, seed class, and crop establishment*

Table 13.12 shows the crop establishment practices of glutinous rice farmers in the two sites. Sixty-six percent of farmers in Camarines Sur planted *Pulutan*, while 23% cultivated *Gurong-gurong*. It is noticeable that, in spite of the eight glutinous varieties developed and released by the National

Seed Industry Council (NSIC), none was being planted by sample farmers in the Philippines. In NE Thailand, only two varieties (RD6 and Koko #6) were reported by the farmers; majority of them planted RD6 (83%).

**Table 13.12.** Crop establishment practices of glutinous rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Variety planted | *Pulutan* (66%) | RD6 (83%) |
| | *Gurong-gurong* (23%) | *Koko* #6 (11%) |
| | *Burdagul* (7%) | |
| Seeding rate (kg $ha^{-1}$) | 110 | 66 |
| Seed class (%) | | |
| Registered | | 9 |
| Certified | 5 | 15 |
| Good | 2 | 4 |
| Farmers' seed | 93 | 72 |
| Crop establishment method (%) | | |
| Direct seeding | 100 | 36 |
| Transplanting | | 60 |
| Dibbling | | |
| DS and TPL | | 4 |

Seeding rate was higher in Camarines Sur at 110 kg $ha^{-1}$ compared with NE Thailand's 66 $kg^{-1}$. Majority of the farmers in both sites used farmers' saved seeds. The crop establishment method use differed: all of the farmers in Camarines Sur practiced direct seeding, while 60% in NE Thailand transplanted rice.

*Fertilizer use and management*

Table 13.13 shows that farmers in Camarines Sur applied larger amounts of (N) fertilizer (74 kg $ha^{-1}$) than those in NE Thailand (12 kg $ha^{-1}$). Similar results were observed in P and K fertilizers applications. Farmers in Camarines Sur usually applied three times. In contrast, only 53% of farmers in NE Thailand applied inorganic fertilizers and they applied these only twice in their field.

Sixty-four percent of NE Thailand farmers applied organic fertilizer at a significant amount compared with nothing at all in Camarines Sur.

**Table 13.13.** Fertilizer management practices of glutinous rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Quantity used (kg $ha^{-1}$) | | |
| N | 74.4 | 12.1 |
| P | 11 | 3.9 |
| K | 22.2 | 5.5 |
| Average number of application | 2.7 | 2.1 |
| Users of inorganic fertilizers (%) | 100 | 53 |
| Organic fertilizer used (type kg $ha^{-1}$ used) | | |
| Biofertilizer | | 224 |
| Green manure | | 3371 |
| Animal manure | | 967 |
| Animal + green manure | | |
| Organic fertilizer (not classified above) | | 1147 |
| Users of organic fertilizer (%) | 0 | 64 |
| Users of both chemical and organic fertilizers (%) | 0 | 2 |

*Pesticide use and management*

The pest management practices of glutinous rice farmers in both sites in terms of frequency of use and amount spent for herbicide and insecticide are summarized in Table 13.14. In the Philippines, all of the Camarines Sur farmers practiced direct seeding. Thus, nearly all were users of herbicides with an average cost of P952 $ha^{-1}$. On the other hand, only 11% of NE Thailand farmers sprayed herbicides. The average amount spent was P878 $ha^{-1}$ (Table 13.14).

Glutinous rice farmers in Camarines Sur were heavy users of insecticides (95%) since all of the respondents relied on such to control their insect problems (Table 13.14). Nearly 50% of them applied once, while the rest applied it twice or thrice in the field. On the other hand, in NE Thailand, only 11% of the farmers applied insecticides in the field, spending P308 $ha^{-1}$.

Labor use and mechanization

Labor use for glutinous rice production did not differ much between Camarines Sur and NE Thailand. Both used more than 50 md $ha^{-1}$ of labor to complete the production cycle, although Camarines Sur farmers slightly used more labor (Table 13.15). Rice production in NE Thailand was less labor intensive because some farmers used big tractors for land preparation and about 17% of them used combine harvesters (Table 13.16). This has significant effects on the amount of labor use on land preparation and harvesting and threshing. Labor use for land preparation in Camarines Sur was almost threefold that in NE

**Table 13.14.** Pesticide management practices of glutinous rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Herbicide | | |
| Amount spent (peso $ha^{-1}$) | 952 | 878 |
| Users (%) | 100 | 11 |
| Frequency of application (%) | | |
| 0 | - | 85 |
| 1 | 73 | 13 |
| 2 | 25 | 2 |
| 3 | 2 | - |
| 4 | - | - |
| Insecticide | | |
| Amount spent (peso $ha^{-1}$) | 1040 | 308 |
| Users (%) | 95 | 11 |
| Frequency of application (%) | | |
| 0 | 5 | 85 |
| 1 | 48 | 13 |
| 2 | 30 | 2 |
| 3 | 16 | - |
| >=4 | 2 | - |

**Table 13.15.** Comparative labor use of glutinous rice farmers in Thailand and the Philippines, 2016-2017.

| Farm activity | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Land preparation | 16 | 5 |
| Crop establishment | 4 | 20 |
| Crop care and maintenance | 11 | 11 |
| Harvesting, threshing, and postharvest | 24 | 15 |
| Total labor | 55 | 51 |
| % hired | 82 | 27 |

**Table 13.16.** Percent adoption of farm machinery by glutinous rice farmers in Thailand and the Philippines, 2016-2017.

| Farm machinery | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| Hand tractor | 98 | 55 |
| Four-wheel tractor | 2 | 66 |
| Rototiller/floating tiller | 2 | 2 |
| Thresher | 84 | 49 |
| Combine harvester | - | 17 |
| Rotary weeder | - | - |
| Water pump | - | 23 |
| Mechanical sprayer | - | 4 |
| Drum seeder | - | - |
| Multipurpose seeder | - | 4 |

Thailand since majority used hand tractors. It almost offset the low labor use for crop establishment of Camarines Sur due to the practice of direct seeding. Similarly, NE Thailand farmers used lesser amount of labor for harvesting and threshing as some farmers used combine harvesters, which only spent 2-4 md $ha^{-1}$. In terms of source of labor, Camarines Sur relied heavily on hired labor, whereas NE Thailand used more family labor (Table 13.15). This implies the availability of agricultural labor for hire in Camarines Sur.

## Cost and profitability

### *Gross revenue and price*

The gross revenue obtained from planting glutinous rice in the two sites did not differ much, with a difference of only about P1,000. Even though the price in NE Thailand was higher by two pesos, it was offset by the higher yield in Camarines Sur, thus giving it an advantage in terms of gross revenue (Table 13.17).

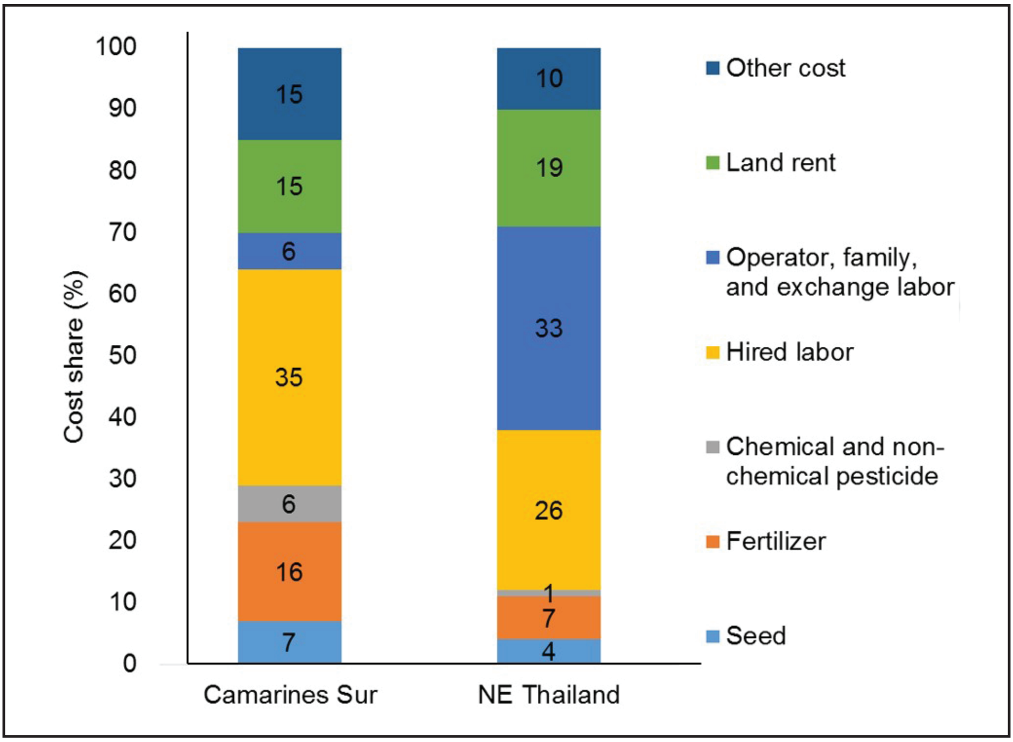


**Figure 13.7.** Cost shares (%) of the different factors of production, glutinous rice, 2016-2017.

### *Costs of production*

The cost of producing glutinous rice in Camarines Sur was lower by one peso compared with that in NE Thailand (Table 13.17). The bulk of this cost went to labor, land rent, and fertilizer. A smaller proportion went to other inputs such as chemicals, fuel, food and others (Figure 13.7). This shows that, in terms of the costs of producing glutinous rice, Filipino rice farmers turn out to be competitive with their Thai counterparts. Costs in Camarines could further be reduced if farmers use combine harvesters, which cost much less compared with small threshers.

**Table 13.17.** Profitability of glutinous rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Camarines Sur, Philippines | NE Thailand |
|---|---|---|
| | n=48 | n=47 |
| **Returns** | | |
| Yield (kg $ha^{-1}$) | 3,671 | 3,337 |
| Fresh paddy price (peso $kg^{-1}$) | 15 | 17 |
| Gross revenue (peso $ha^{-1}$) | 56,264 | 55,276 |
| **Costs (peso $ha^{-1}$)** | | |
| Seed | 2,973 | 1,759 |
| Fertilizer | 7,018 | 3,078 |
| Chemicals | 2,722 | 220 |
| Hired labor | 15,486 | 11,197 |
| Operator, family, and exchange labor | 2,514 | 14,333 |
| Animal, machine, fuel and oil | 419 | 868 |
| Irrigation | 618 | - |
| Food | 1,280 | 1,427 |
| Transportation | 381 | 783 |
| Land rent* | 6,581 | 8,293 |
| Interest on capital | 2,189 | 431 |
| Miscellaneous cost | 1,544 | 767 |
| **Total paid out cost (peso $ha^{-1}$)** | 33,675 | 20,098 |
| **Total cost (peso $ha^{-1}$)** | 43,725 | 43,155 |
| **Cost per unit (peso $kg^{-1}$)** | 12 | 13 |
| **Net income from rice farming (peso $ha^{-1}$)** | 12,539 | 12,122 |
| **Returns over paid out cost (peso $ha^{-1}$)** | 22,589 | 35,178 |

*Land rent consists of paid-out cost and imputed cost.

*Net returns*

Table 13.17 shows that, considering all costs, net income from glutinous rice production in Camarines Sur and NE Thailand were almost equal at more than P12,000 ha$^{-1}$. However, considering only paid-out costs, NE Thailand's net returns over paid-out costs were much higher. This is primarily because labor use in Thailand is provided mostly by the family, while farmers in Camarines Sur relied heavily on hired labor. The higher labor cost in Camarines Sur resulted in higher paid-out costs and, consequently, lower net returns.

***Pigmented rice***

***Black rice***

<u>Farm profile</u>

In Negros Occidental, black rice is usually planted twice a year in irrigated areas, while in NE Thailand, it is planted only once in rainfed areas (Table 13.18 Column A). On average, the area planted to black rice in both sites was around 1 ha. However, Thai farmers have bigger farms in terms of total area planted to rice of all types. Both farms were far from the market, an 11-km distance.

<u>Farmer profile</u>

Table 13.19 Column A summarizes the basic socioeconomic characteristics of sample farmers who plant black rice. The average age and number of years of formal education of rice farmers from both sites were almost the same. There were more male farmers in Negros Occidental, but the opposite was true for NE Thailand farmers. Almost all farmers from both sites were members of rice-based organizations and they actively participated in rice-related production training. Majority of farmers in both sites, 79% in Negros Occidental and 96% in NE Thailand, own their rice land, although the latter has a higher proportion of owners.

**Table 13.18.** Profile of pigmented rice farms in Thailand and the Philippines, 2016-2017.

| Farm characteristic | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Total rice area (ha) | 1.91 | 4.57 | 2.63 | 4.41 |
| Total black rice area (ha) | 0.99 | 4.53 | 2.6 | 4.14 |
| Number of parcels | 2.11 | 3.36 | 1.08 | 4.02 |
| Area of biggest parcel planted to black rice (ha) | 0.99 | 1.09 | 2 | 1.03 |
| Ecosystem (%) | | | | |
| Upland (unbunded) | | | 100 | |
| Rainfed | 7 | 100 | | 100 |
| Irrigated | 93 | | | |
| Source of water (%) | | | | |
| NIS/CIS | 61 | | | |
| Small-scale irrigation system* | | | | |
| Others** | 32 | 12 | | |
| Cropping pattern (%) | | | | |
| Rice-rice | 68 | | | |
| Rice-rice-rice | 11 | | | |
| Rice-corn | | | 82 | |
| Rice-other crops | 21 | 58 | 18 | 58 |
| Rice-fallow | | 42 | | 42 |
| Distance to market (km) | 11 | 11 | 10 | 19 |

* Small-scale irrigation systems (SSIS) comprise shallow tube well (STW), open/dug well, deepwell, Small Water Impounding Project (SWIP), and Small Farm Reservoir (SFR).
** Others are natural sources such as rivers, streams, and free flowing wells.

**Table 13.19.** Summary profile of pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Farmer characteristic | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Age | 50 | 51 | 41 | 53 |
| Sex | | | | |
| Female | 46 | 68 | 50 | 67 |
| Male | 54 | 32 | 50 | 33 |
| Schooling (years) | 10 | 9 | 9 | 8 |
| Farming experience (years) | 21 | 26 | 19 | 29 |
| Rice-based organization (% member) | 94 | 100 | 73 | 100 |
| Training (% trained) | 94 | 100 | 52 | 100 |
| Tenure status (%) | | | | |
| Owner/CLT | 79 | 96 | 69 | 89 |
| Amortizing/CLT | | | 4 | |
| Lessee | 11 | | 7 | 2 |
| Tenant | 4 | 4 | 13 | 2 |
| Ancestral domain | | | 4 | |
| Others*** | 7 | 6 | 2 | 7 |

***Others include mortgagees.

<u>Productivity of black rice</u>

As shown in Figure 13.8 Panel A, the Philippines has a better performance in terms of productivity since black rice in Negros Occidental has an average yield of about 3.27 t $ha^{-1}$ in contrast to that of NE Thailand at 2.44 t $ha^{-1}$. It must be noted, however, that setting aside the type of ecosystem, many factors influence yield levels: variety planted, fertilizer use and management, crop care and maintenance, inherent soil fertility, and environmental factors such as climate and water availability.

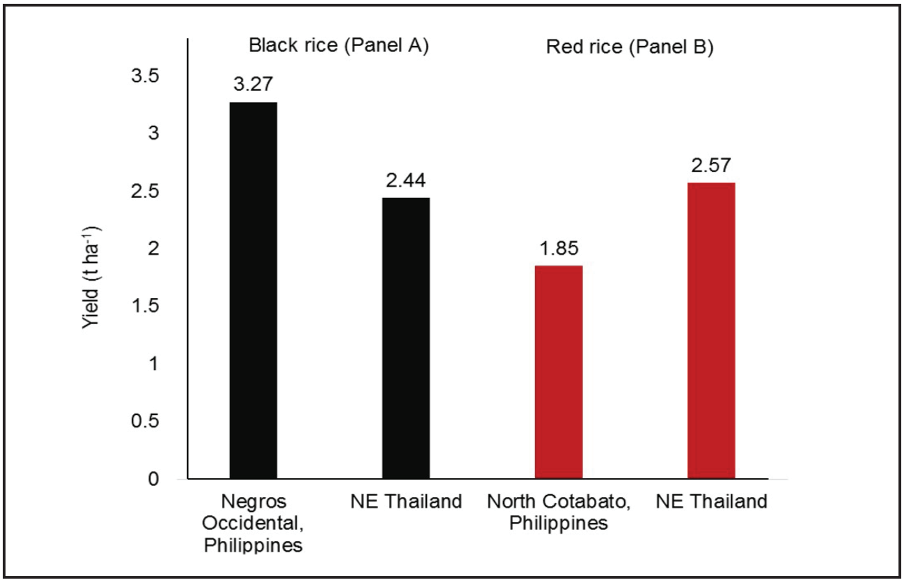


**Figure 13.8.** Yields of pigmented rice in Thailand and the Philippines, 2016-2017.

<u>Material input use and management practices</u>

*Variety, seed class, and crop establishment*

Only two black rice varieties were planted in Negros Occidental. On the other hand, *Riceberry* and Hom Nil were the more popular varieties among the three types reported by farmers in NE Thailand. Seeding rates of black rice farmers from Negros Occidental and NE Thailand were 57 kg $ha^{-1}$ and 59 kg $ha^{-1}$, respectively (Table 13.20 Column A). Twenty percent of the farmers in NE Thailand reported using registered seeds with majority (68%) still using their own produced seeds. None of the farmers in Negros Occidental reported using high-quality seeds.

*Fertilizer use and management*

Results show that NE Thailand farmers were generally non-users of chemical fertilizers (Table 13.21 Column A). Only 16% of the total sample respondents applied chemical fertilizer with minimal amount. In Negros Occidental, 57% of the farmers used chemical fertilizers. On average, they applied 31 kg $ha^{-1}$ N and a modest amount of P (6.9 kg $ha^{-1}$) and K (16 kg $ha^{-1}$). Only 50% of farmers from Negros Occidental applied organic fertilizer and in small amount. In contrast, 96% of NE Thailand farmers were organic fertilizer users.

**Table 13.20.** Crop establishment practices of pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Variety planted | Black rice (93%) | Riceberry (48%) | *Dinorado* (86%) | *Malidang* (red jasmine) (67%) |
| | Mindoro 5 (8%) | *Hom Nil* (32%) | *Awot* (11%) | Red Glutinous (25%) |
| | | Black rice (12%) | *Himumay* (2.27) | |
| Seeding rate (kg $ha^{-1}$) | 57 | 59 | 79 | 75 |
| Seed class (%) | | | | |
| Registered | | 20 | | 17 |
| Certified | | 12 | 2 | |
| Good | 11 | | 2 | 4 |
| Farmers' seed | 89 | 68 | 95 | 78 |
| Crop establishment method (%) | | | | |
| Direct seeding | 14 | 48 | 100 | 58 |
| Transplanting | 86 | 44 | | 33 |
| Dibbling | | | | 4 |
| DS and TPL | | 8 | | 4 |

**Table 13.21.** Fertilizer management practices of pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Quantity used (kg $ha^{-1}$) | | | | |
| N | 30.8 | 2.3 | 66.4 | 0.2 |
| P | 6.9 | 0.7 | 8.5 | 0.1 |
| K | 16 | 0.9 | 6 | 0.1 |
| Average number of application | 1.4 | 1.6 | 2.3 | 2.1 |
| Users of inorganic fertilizers (%) | 57 | 16 | 100 | 8 |
| Organic fertilizer used (type kg $ha^{-1}$ used) | | | | |
| Biofertilizer | | 29 | | 54 |
| Green manure | | 2388 | | 695 |
| Animal manure | | 1549 | | 1776 |
| Animal + green manure | | 1250 | | 893 |
| Organic fertilizer (not classified above) | 321 | 375 | | 190 |
| Users of organic fertilizer (%) | 50 | 96 | 0 | 79 |
| Users of both chemical and organic fertilizers (%) | 18 | 4 | 2 | 21 |

**Table 13.22.** Pesticide management practices of pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Herbicide | | | | |
| Amount spent (peso $ha^{-1}$) | 255 | 80.55 | 2039 | 0 |
| Users (%) | 25 | 8 | 98 | 0 |
| Frequency of application (%) | | | | |
| 0 | 75 | 84 | 2 | 88 |
| 1 | 18 | 16 | 29 | 13 |
| 2 | 7 | - | 33 | - |
| 3 | - | - | 29 | - |
| 4 | - | - | 7 | - |
| Insecticide | | | | |
| Amount spent (peso $ha^{-1}$) | 235 | 0 | 541 | 0 |
| Users (%) | 21 | 0 | 58 | 0 |
| Frequency of application (%) | | | | |
| 0 | 79 | 100 | 40 | 96 |
| 1 | 4 | | 33 | 4 |
| 2 | 11 | | 22 | - |
| 3 | - | | 4 | - |
| >=4 | 8 | | - | - |

<u>Labor use and mechanization</u>

Black rice farmers from NE Thailand used less labor (31 md $ha^{-1}$) than farmers from Negros Occidental (56 md $ha^{-1}$) since the latter spent more labor in all major activities (Table 13.23 Column A). The high labor use in Negros Occidental could be attributed to the popular use of small hand tractors in land preparation and small threshers in harvesting (Table 13.24 Column A), and transplanting their crop (Table 13.20 Column A), which are more labor-consuming. The lower level of mechanization and the limited adoption of direct seeding, which are all labor-saving, resulted in higher labor use.

## Cost and profitability

*Gross revenue and price*

In terms of gross revenue, Negros Occidental had an advantage of more than P7,000 $ha^{-1}$ over NE Thailand (Table 13.25 Column A). This is due to its high yield advantage of almost 1 t $ha^{-1}$. It offset the P4 $kg^{-1}$ price advantage of NE Thailand.

*Costs of production*

The cost of producing black rice was higher by more than P1 $kg^{-1}$ in Negros Occidental than in NE Thailand (Table 13.25 Column A). This is due to the significantly higher hired labor, fertilizer and pesticide costs in Negros Occidental. In terms of cost share, the bulk of Negros Occidental cost was attributed to hired labor (54%); in NE Thailand, the major proportion of cost was almost evenly distributed to land rent, operator and family labor, and hired labor. Both sites, however, spent less on fertilizer (Figure 13.9 Panel A).

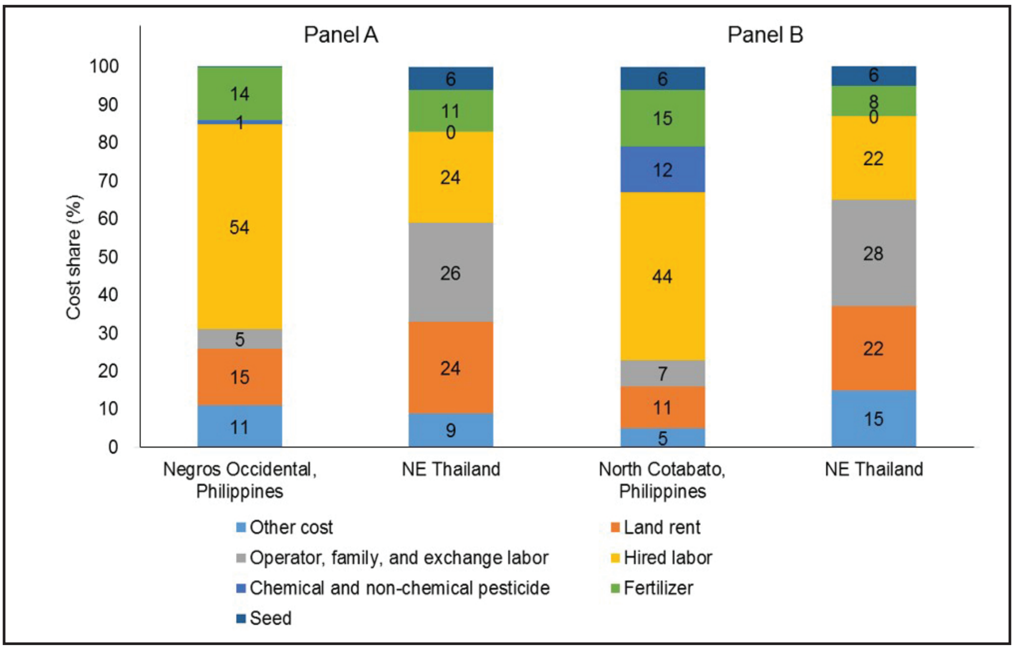


**Figure 13.9.** Cost shares (%) of the different factors of production, pigmented rice, 2016-2017.

**Table 13.23.** Comparative labor use of pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Farm activity | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Land preparation | 14 | 4 | 12 | 3 |
| Crop establishment | 12 | 10 | 1 | 7 |
| Crop care and maintenance | 14 | 9 | 12 | 10 |
| Harvesting, threshing, and postharvest | 13 | 9 | 16 | 16 |
| Total labor | 56 | 31 | 40 | 36 |
| % hired | 77 | 25 | 78 | 23 |

**Table 13.24.** Percent adoption of farm machinery by pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Farm machinery | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| Hand tractor | 55 | 36 | 5 | 54 |
| Four-wheel tractor | - | 80 | 20 | 67 |
| Rototiller/floating tiller | 34 | 4 | - | 4 |
| Thresher | 72 | 28 | 82 | 17 |
| Combine harvester | - | 28 | 5 | 21 |
| Rotary weeder | 7 | - | - | - |
| Water pump | - | 20 | - | 8 |
| Mechanical sprayer | - | - | - | - |
| Drum seeder | - | 12 | - | - |
| Multipurpose seeder | - | 4 | - | - |

**Table 13.25.** Profitability of pigmented rice farmers in Thailand and the Philippines, 2016-2017.

| Item | Black rice (A) | | Red rice (B) | |
|---|---|---|---|---|
| | Negros Occidental, Philippines | NE Thailand | North Cotabato, Philippines | NE Thailand |
| | n=29 | n=25 | n=45 | n=24 |
| **Returns** | | | | |
| Yield (kg $ha^{-1}$) | 3,272 | 2,438 | 1,848 | 2,575 |
| Fresh paddy price (peso $kg^{-1}$) | 19 | 23 | 21 | 23 |
| Gross revenue (peso $ha^{-1}$) | 62,781 | 55,721 | 38,632 | 60,268 |
| **Costs (peso $ha^{-1}$)** | | | | |
| Seed | 1752 | 1,892 | 1,811 | 2,208 |
| Fertilizer | 7101 | 3,759 | 4,279 | 2,836 |
| Chemicals | 755 | 19 | 3,275 | - |
| Hired labor | 25,232 | 8,120 | 12,768 | 8,247 |
| Operator, family, and exchange labor | 2,352 | 8,847 | 2,148 | 10,475 |
| Animal, machine, fuel and oil | 829 | 1,172 | 18 | 1,951 |
| Irrigation | 764 | - | - | - |
| Food | 1,399 | 597 | 467 | 927 |
| Transportation | 676 | 370 | 350 | 1,633 |
| Land rent* | 7,315 | 8,127 | 3,000 | 8,120 |
| Interest on capital | 997 | 241 | 370 | 264 |
| Miscellaneous cost | 701 | 691 | 227 | 798 |
| **Total paid-out cost (peso $ha^{-1}$)** | 40,541 | 16,619 | 23,263 | 18,599 |
| **Total cost (peso $ha^{-1}$)** | 49,873 | 33,834 | 28,714 | 37,459 |
| **Cost per unit (peso $kg^{-1}$)** | 15 | 14 | 16 | 15 |
| **Net income from rice farming (peso $ha^{-1}$)** | 12,908 | 21,886 | 9,919 | 22,810 |
| **Returns over paid-out cost (peso $ha^{-1}$)** | 22,240 | 39,101 | 15,369 | 41,669 |

*Land rent consists of paid-out cost and imputed cost.

*Net returns*

The profitability of black rice production in NE Thailand was much better than that in Negros Occidental (Table 13.25 Column A). The returns above paid-out cost in NE Thailand amounted to almost P39,000 $ha^{-1}$ compared with only P24,000 $ha^{-1}$ in Negros Occidental. A similar trend was seen in net income. As explained earlier, the advantage of NE Thailand in this case was the higher price received by farmers. This almost offset the yield advantage of the Negros Occidental black rice and the much lower labor cost spent by NE Thailand farmers.

***Red rice***

<u>Farm profile</u>

Both sites of red rice production have only one cropping reason. Farmlands for red rice in North Cotabato are in the upland areas with an average size of 2.60 ha. These farms are 10 km away from the nearest market. In NE Thailand, farms for red rice are generally rainfed and have an average size of 4.14 ha. They are 19 km away from the nearest market (Table 13.18 Column B).

<u>Farmer profile</u>

The basic socioeconomic characteristics of sample farmers planting red rice are summarized in Table 13.19 Column B. On the average, farmers from NE Thailand were older by 12 years compared with North Cotabato farmers. NE Thailand's farming community was female-dominant, while a balanced proportion of male and female farmers was observed in North Cotabato. Farmers from both sites have almost the same educational attainment. Only 73% of farmers interviewed in NE Thailand were members of rice-based organizations. On the other hand, only 50% of the farmers in North Cotabato were members. All farmers from both sites have attended rice-related production training with majority of farmers being members of rice-based organizations.

<u>Productivity of red rice</u>

Yields of red rice in North Cotabato and NE Thailand are shown in Figure 13.8 Panel B. Red rice in NE Thailand has better productivity, with a much higher yield of 2.57 t $ha^{-1}$. On the other hand, North Cotabato only produced 1.85 t $ha^{-1}$.

Material input use and management practices

*Variety, seed class, and crop establishment*

*Dinorado* and *Malidang* (Red Jasmine) were the most commonly planted red rice varieties in North Cotabato and NE Thailand, respectively. The choice of crop establishment method was not tied with the type of SR that farmers in the various sites were planting. As shown in Table 13.20 Column B, all red rice farmers in North Cotabato were adopters of direct seeding technology, while the rest used combinations of direct seeding and transplanting. On the average, farmers from both sites have used the same quantity of seeds, at about 75 to 79 kg $ha^{-1}$. Majority of the farmers from both sites used farmer-saved seeds.

*Fertilizer use and management*

North Cotabato and NE Thailand exhibited contrasting fertilizer management practices. North Cotabato was a substantial user of chemical fertilizers. Farmers usually applied this type twice per crop. Only 2% practiced application of both chemical and organic fertilizers. On the other hand, NE Thailand was generally an organic fertilizer user. Farmers applied a considerable amount of animal and green manure with almost zero chemical fertilizer (Table 13.21 Column B).

*Pesticide use and management*

The pest management practices of red rice farmers for both sites in terms of frequency of use and amount spent for herbicide and insecticide are presented in Table 13.22 Column B. In North Cotabato, nearly all were users of herbicides, spending on average about P1000 to P2000 $ha^{-1}$. This is partly explained by the farmers' practice of direct seeding (Table 13.20 Column B). The red rice sites showed the opposite: North Cotabato farmers relied heavily on insecticides in controlling insect problems with almost all farmers using it. In contrast, almost all (96%) farmers in NE Thailand were non-users of insecticides.

The above analysis on chemical fertilizer and pesticides usage clearly shows the difference in crop care practices of red rice farmers in the Philippines and Thailand.

Labor use and mechanization

Table 13.23 Column B shows the labor used for red rice production. The total labor use of North Cotabato farmers (40 md $ha^{-1}$) were higher relative to their counterparts in NE Thailand (36 $ha^{-1}$). North Cotabato farmers spent more labor for land preparation and crop care activities due to the popular use of hand tractors in NE Thailand (Table 13.24 Column B) greater use of fertilizer and pesticides. In contrast, they spent less labor for crop establishment due to the practice of direct seeding. Both sites have the same amount of labor for harvesting and threshing because of similar small thresher use.

Cost and profitability

*Gross revenue and price*

NE Thailand recorded a higher revenue (P60,268 per $ha^{-1}$) than North Cotabato, Philippines (P38,632 $ha^{-1}$). This is due to the high yield and high paddy prices obtained in NE Thailand. NE Thailand farmers got an average yield of about 2.6 t $ha^{-1}$ and received a price of P23 $kg^{-1}$ compared with North Cotabato's 1.8 t $ha^{-1}$ yield and P21 $kg^{-1}$ price (Table 13.25 Column B).

*Costs of production*

The costs of producing red rice was higher by P1 $kg^{-1}$ in North Cotabato than in NE Thailand (Table 13.25 Column B) because of lower yields in the former. In terms of cost share, a major portion was attributed to hired labor (44%), while the remaining items of cost have minor proportions (Figure 13.9 Panel B). On the other hand, labor costs have the highest share in total red rice production in NE Thailand. OFE labor (28%) has higher proportion than hired labor (22%). Following these cost items was land rent at 22%.

*Net returns*

The profitability of red rice production in NE Thailand was much better than that in North Cotabato (Table 13.25 Column B). NE Thailand farmers got more than twice (P23,000 $ha^{-1}$) the net income received by North Cotabato farmers (P10,000 $ha^{-1}$). Similar trends were seen in returns over paid-out costs and income. This is because of the yield, price, and cost advantage of the Thai red rice farmers.

## Comparison of SR marketing systems

Key market players starting from paddy traders, cooperatives and farmers' associations/groups, rice millers, rice flour millers, wholesalers, and retailers were interviewed to assess the marketing systems of SR in Thailand and Cambodia. This is in addition to the basic marketing questions asked during the farm level survey. Similar interviews were done for market players in the Philippines (see Chapters 7 and 8). However, data collection for Thailand and Cambodia was confined only to the marketing channels and their role in the marketing of SR. Marketing costs and geographical flows were not collected due to limited time and reluctance of interviewees to provide cost information. Owners of big rice mills and flour mills, which are considered big business establishments, were hesitant to provide data on volume, costs, and detailed prices of their products. These reasons limited the comparison of marketing channels and systems in the selected sites.

### *The Philippines and Thailand*

Regardless of SR type, the key marketing players in the Philippines were the farmers, paddy traders/assemblers, millers and wholesalers, and retailers. These are the channels where paddy passes through before process milled rice reaches the consumer (Chapter 8). Normally, paddy is procured or assembled by paddy traders and is then passed or sold to millers. Some farmers directly sell paddy to millers. The millers then mill the rice and then sell the milled rice to the rice wholesaler/retailer and finally to the consumer. A typical example is the marketing channel of aromatic rice in Oriental Mindoro, Philippines (see Chapter 8). On the other hand, the market channels of Thailand are shown in Figure 13.10. Farmers sell their paddy in four market outlets: cooperatives with rice mill, farmers' associations, commercial rice mills, and paddy traders. Farmer cooperatives and associations help in consolidating the produce of farmers and making it available in the market as paddy or milled rice. They also assist members in the marketing of their products at premium prices, thus guaranteeing fairness in measurements and assessment of grain quality. Additionally, the cooperatives are equipped with good milling and packaging facilities, operating like commercial mills as they both sell in the domestic and export markets.

In exceptional cases, cooperatives also sell paddy to commercial rice mills when their milling capacity could no longer handle the supply of paddy from farmer members. With this scheme, the farmer, aside from receiving a relatively higher price than those who sell to paddy traders, also gets a share of the earnings of the cooperative inasmuch as they are considered owners. The system by which farmers are organized into cooperatives and farmers associations to facilitate bulk marketing and processing of SR was not practiced in the Philippines.

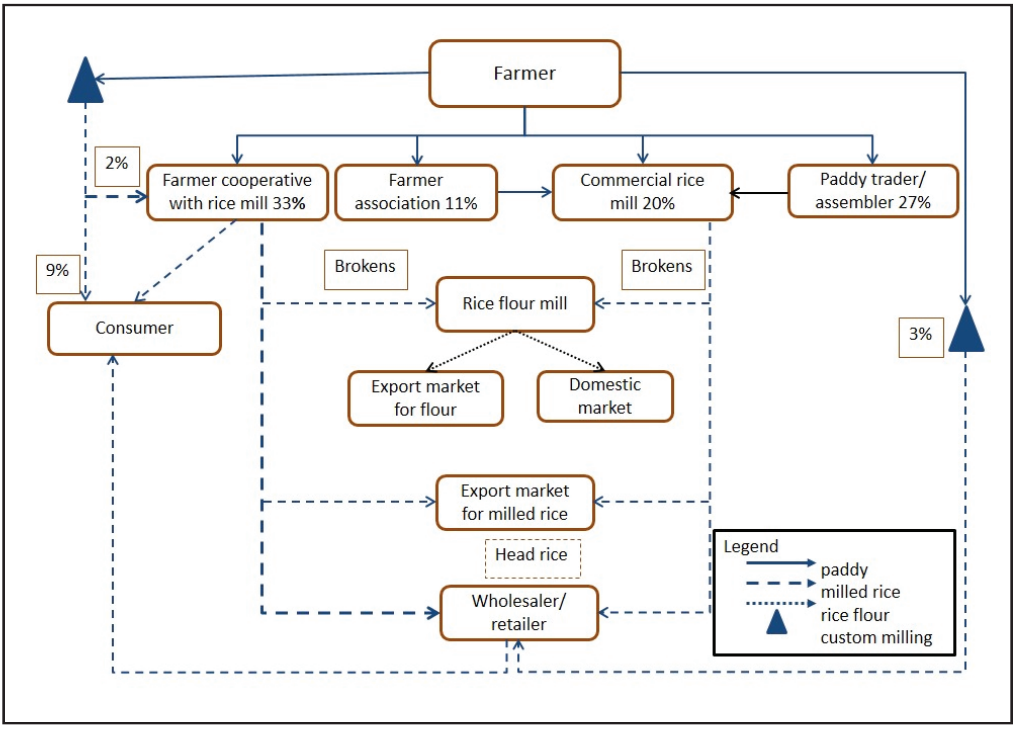


**Figure 13.10.** Marketing channels of specialty rice in NE Thailand.

Milled rice grain consists of whole grains or head rice and brokens that are usually sold at a much lower price. In the special case of glutinous rice, these brokens were bought by rice flour mills and converted into glutinous rice flour. The rice flour mill in Thailand is a state-of-the-art facility. In contrast, the processing of glutinous rice flour here in the Philippines is still very crude and done on a small scale. This processed glutinous flour of Thailand is then sold in both domestic and export markets. Interestingly, one of the export markets is the Philippines. This is in addition to the milled rice that could either be aromatic rice, glutinous rice, or pigmented rice being exported in several countries all over the world. As in the Philippines, a very small proportion of Thai farmers did custom milling and then sold milled rice directly to consumers and rice retailers.

The Philippines was far behind Thailand in terms of milling and packaging facilities not only for ordinary white rice but also for SR. In Thailand, there were big and well-equipped rice mills operating on commercial scale and their packaging and labelling systems are of international standards. Vacuum packaging of SR was practiced down to the level of farmers' cooperatives.

In terms of government support, the Philippines again lagged behind. The government of Thailand, through its Ministry of Commerce, provided enormous support to facilitate efficient marketing of SR products. These included financial assistance in design and packaging, product promotion through trade fairs and exhibits, and linking with supermarkets. They did extensive capacity-building activities such as training on processing new rice products and registering trademarks. On top of these, they also conducted educational tours for the farmers.

***The Philippines and Cambodia***

The marketing channels for aromatic rice in Siem Reap, Cambodia, are shown in Figure 13.11. Similar to the Philippines, SR farmers in Siem Reap sell their paddy either through paddy traders or directly to rice millers. Sometimes, paddy collectors assemble the paddy in a certain place to facilitate easy loading and transport. These paddy collectors are paid a fee for the assembly work. As in the Philippines, there are no farmer cooperatives or farmers' groups in the area that handle the marketing and processing of paddy. Paddy traders sell paddy purchased from farmers in three possible outlets: commercial rice millers, paddy traders in the Vietnam or Thailand borders and the Golden Rice Company.

This rice company is located in Phnom Penh, a 10-12-hour drive from Siem Reap, the site where the farm and marketing surveys were conducted. Golden Rice is a very big company that officially exports rice to other countries, while commercial rice millers usually sell the milled rice to wholesalers/retailers in the domestic market. This is where the Cambodian SR market has an advantage over the Philippines. Cambodia is a major exporter of aromatic rice.

In terms of commercial rice mills selling to domestic consumers, the transport, milling machinery, drying, and packaging facilities are similar to those used in the Philippines. They also have small and medium-sized rice mills located near the rice production areas; they sell to wholesalers and retailers and also directly to domestic consumers. Wholesaler and retailers also sell unpacked SR in the market, just like in the Philippines.

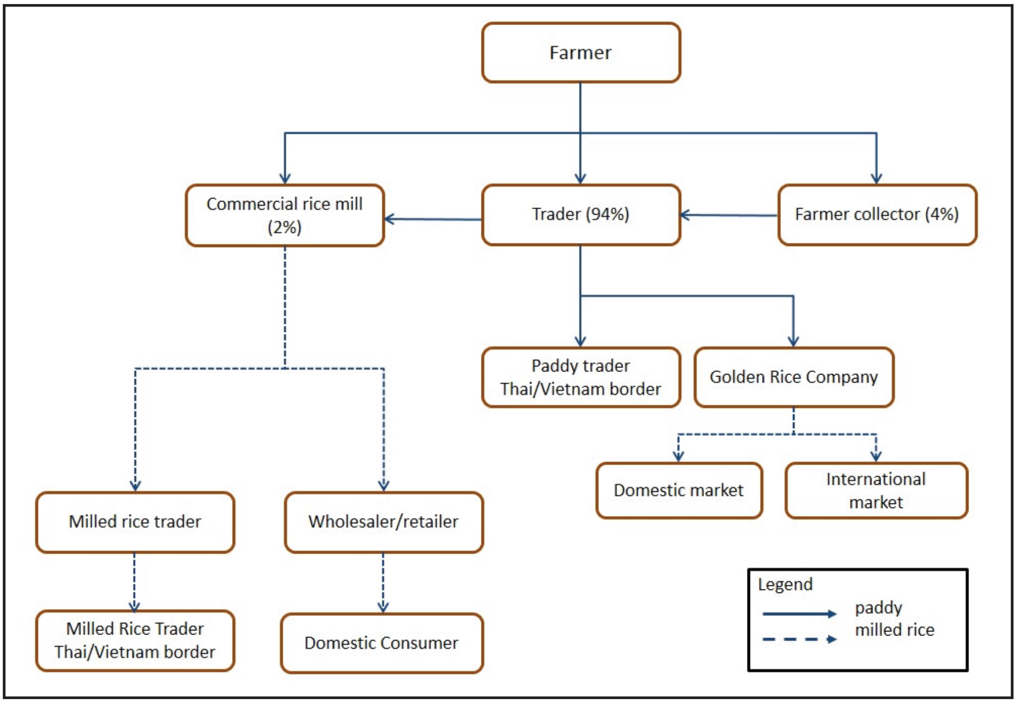


**Figure 13.11.** Marketing channels of aromatic rice in Siem Reap, Cambodia.

## Potential for exports of Philippine SR

Limited records of Philippine SR exports showed that the country is already exporting SR (pigmented and aromatic rice) to other countries such as Dubai and Singapore, Hongkong, and the United States but in very limited quantity. The initial exports were coordinated by DA through its national rice program directorate and it started with only 35 t of aromatic rice and black rice (Official Gazette Phil, 2013). Lately, on June 30, 2017, The Don Bosco Multipurpose Cooperative (DBMPC) shipped 13.5 t of organic pigmented rice to the United Arab Emirates and the United States (Gonzales, 2017). DBMPC also established "Bios Dynamis," a company that specializes in organic black, brown, and red rice. Since 2012, it already has gotten two organic certifications from the Organic Certification Center of the Philippines and CERES GmbH. As a pioneer exporter of organic rice, Bios Dynamis products have been consistently shipped to Germany and Hong Kong. There have been repeat orders coming from Poland and Italy and there were occasional exports to Macau, Malaysia, Singapore, and around Europe. These exclude the export of heirloom rice to the United States, which has been going on even in small amounts since 2005 (Commanda, 2015). However, DA officials are confident that the country will eventually increase its export volume of SR in the near future.

To explore the potential of exporting SR at least in other countries in Southeast Asia, key informant interviews of current and potential importers of SR in Singapore were conducted. Data were collected on demand requirements not only in quantity but also in quality. The information gathered showed that the company that imports pigmented rice from the Philippines encountered these problems: 1) delay in supply due to delay in securing permit from the National Food Authority; 2) packaging - incomplete labels (e.g., no expiration date, nutritional benefits), improperly sealed package, no standard or system in place to ensure product packaging quality, and 3) unsustainable supply. A potential importer of SR indicated their willingness to import SR from the Philippines if the supplier can provide at least 10 t of pigmented rice for market testing.

These information show the potential of increasing exports of pigmented rice, but, it must first take into account the problems that were encountered in importing SR from the Philippines. The processing of import permits should be streamlined to encourage exporters and importers as well. The packaging system in the country should be developed to the level similar to that in other exporting countries, like Thailand, where vacuum packaging is already being used and complete information in labels provided. Lastly, there should be efforts to promote the cultivation of pigmented rice in suitable large areas of land to increase volume of production, thus ensuring adequate supply to potential importers.

## Summary and implications

Aromatic, glutinous, and black rice in the Philippines have better productivity than those grown in Thailand and Cambodia. This puts the country at an advantage when it comes to SR production. In contrast, the yield of red rice in the country is much lower than that in Thailand.

Looking into production costs, Filipino glutinous rice farmers turn out to be more competitive than their counterparts in Thailand. However, the cost of producing aromatic and pigmented rice in the country is slightly higher than that in Thailand and Cambodia.

In terms of gross revenue, Filipino aromatic rice farmers' gross earnings for a season is much higher compared with what Cambodian farmers obtain. However, for single-cropped sites, Thailand has the highest revenue because they get not only a relatively higher yield but also a good price. Farmers in Cambodia received the lowest price and yield, hence, the lowest revenue. This is true not only for aromatic rice producers but also for all SR producers. The gross revenue from planting glutinous rice in the Philippines and its counterpart did not differ much. The Philippines got a higher gross revenue than Thailand because of its higher yield, even though the price of paddy in Thailand was higher. Among black rice producers, the Philippines has an advantage because of its significantly higher yield despite the lower price. The reverse is true in the red rice situation. Thai farmers earned a higher revenue because of the high yield and high paddy prices.

Yield performance, production cost, and net returns are highly affected by the crop management practices adopted by the farmers. First, farmers in the Philippines who plant the four types of SR, excluding Apayao, are relatively high users of fertilizers. NE Thailand is the least user, regardless of rice type. Cambodian farmers are intermediate users. Second, Filipino farmers are generally more reliant on pesticides.

Another important factor is labor use. There is no indication that quantity of labor use depends on the type of SR grown. Labor use ranges from as low as 16 to 53 md $ha^{-1}$ regardless of rice type. Labor-intensive areas are those either using small threshers for threshing and manual labor for harvesting (e.g., Camarines Sur, Apayao, and Negros Occidental). In Prasat, farming is not labor-intensive as all farmers use combine harvesters and establish their crop through direct seeding. Other sites are moderate labor users because their farm activities are partly mechanized. This means that the amount of labor use is highly correlated with their level of mechanization and adoption of direct seeding technology.

There are still areas that can be explored to improve SR production in the Philippines. The high cost of SR production in the country can be reduced by the adoption of labor-saving machinery such as combine harvesters and adoption of direct seeding. The heavy dependence on pesticides should be lessened to avoid the risk of building pesticide resistance and increasing the incidence of pest outbreaks in the future. Cultivation of pigmented rice should be encouraged in suitable large areas of land to increase volume of production and consequently increase export potential. However, this should be coupled with assistance in organizing and improving the marketing system. The country has a comparative advantage in glutinous rice production in the international market. Thus, bigger scale production of glutinous rice must be encouraged to meet local demand and thereby reduce imports. This could be done by including SR in various government programs that enhance rice productivity and competitiveness. Availability of good seeds in particular for almost all SR is one of the problems cited by farmers; hence, the government must look for ways to solve the seed supply problem.

There is still much to be learned in the marketing of SR in the Philippines, particularly increasing its export of pigmented rice. Based on feedback from importers of pigmented rice in the Philippines, the following should be done to improve and enhance export potential of SR and make it more competitive. First, it should take into account the problems encountered in importing SR from the Philippines. The process of getting permits for imports from the Philippines should be streamlined to encourage exporters and importers as well. The packaging system in the country should be developed to match the standard already being used in other exporting countries such as Thailand. In addition, there is a need to enhance milling facilities for SR to improve grain quality and milling recovery.

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# COMPARATIVE GRAIN QUALITY AND HEALTH-PROMOTING PROPERTIES OF SPECIALTY RICE PRODUCED AND MARKETED ACROSS LOCAL AND INTERNATIONAL SITES

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Specialty rice (SR) accounts for only about 10% of global rice production. Accordingly, far less attention has been given to these premium rice with unique quality traits even though they command a higher price in the market. SR are popularly grown in Southeast Asian countries such as Thailand, Vietnam, Laos, Cambodia, Myanmar, and the Philippines.

Among these SR, aromatic rice is the most well known in the international market. Thailand, India, and Pakistan are predominantly leading producers and exporters of high-quality aromatic rice in the world. In fact, Thailand proudly owns one of the most recognized aromatic rice known as Jasmine rice, while the famous aromatic Basmati rice originated in India and Pakistan. In addition to these famous varieties are other fragrant rice varieties found in rice-growing countries of Asia (Singh et al., 2020) such as Cambodia's Malys Angkor and Vietnam's ST24 (Arunmas, 2019; Chan-in et al., 2020).

Glutinous rice are most often widely consumed where they are grown, mainly in the dry areas of northern Thailand, Laos, and Cambodia. As with other SR, glutinous rice varieties have relatively lower yield. However, the lower produce is compensated for by higher prices. The increasing demand, especially in the export market, is now well recognized. Moreover, glutinous rice has an ancient cultural importance worldwide, especially in East Asia such as China, Japan, Korea, and most countries in Southeast Asia (Sattaka, 2016). It is being cultivated in 37 countries around the world, but production is concentrated mostly in the Asian regions (Sattaka et al., 2014). Glutinous rice also serves as staple food for more than 20 million people in the Greater Mekong Sub-region (GMS), especially in Lao PDR, northern and northeastern Thailand, and ethnic groups in northern Vietnam.

Some SR are highly regarded not for aroma but for their color. These pigmented rice are known for their high nutritional quality and are considered to have medicinal value in certain places. Nowadays, black and red rice are grown by local farmers using organic practices in Southeast Asian countries such as Thailand, Myanmar, and Cambodia. In Thailand, they have developed a national and international reputation of having diverse pigmented rice varieties with notable characteristics. Some of the long-established varieties include *Sangyod*, a variety with reddish brown pericarp (Saetan, 2010; Panomjan et al., 2016); *Kao Kam* or *Kao Niaw Dam* from the north and northeast areas; *Pi-i-su* from the highlands (Boonsit et al., 2010); and the newly developed varieties such as *Hom Mali Nil*, Red *Hom Mali* (Htwe et al., 2010) and *Riceberry* (Posuwan et al., 2013). The demand for pigmented rice is about 60,000-70,000 t in Thailand at a growth rate of 2-3% per year (Wattanutchariya et al., 2016). Among the black rice varieties, *Riceberry* has the largest market of about 20,000 t annually, while *Hom Nil* has about half of it only. *Riceberry*, a crossbreed between *Hom Nin* and Jasmine 105, has a dark violet pericarp and slender shape. It turns soft and aromatic after cooking. The cultivation of *Riceberry* increased over the years as a response to growing customer demand (Wattanutchariya and Kuaites, 2017). For red rice, *Sangyod* and Red *Hom Mali* have the highest demand of 10,000 t annually (Wattanutchariya et al., 2016).

Meanwhile, the various challenges faced by local farmers in the Philippines, as in the other Asian countries, have diminished their interest in producing SR. However, efforts are now being made to improve the production and marketing of SR. As a matter of fact, demand for SR is growing in the Philippines as well as in the international market. These SR, which are considered high-value crops, mainly target niche markets. Furthermore, with the increasing global consumer awareness, people tend to be more health-conscious and highly interested in the nutritional quality of food (Abesekara, 2008). The eating and cooking qualities of rice are important determinants of its economic value in the export market and consumer acceptance (Pingali, 1997). This is because preferences for rice cooking and eating qualities within a certain region with corresponding culture may or may not be acceptable in other cultures.

To determine the competitiveness of local SR in the international market, an evaluation of their grain quality characteristics and health-promoting properties was conducted in comparison with rice varieties from countries that dominate the SR industry, specifically Thailand and Cambodia. This aims to stimulate efforts in the agricultural sector to increase SR production as well as facilitate SR adoption and high-quality rice farming and marketing.

In particular, local and imported aromatic, glutinous, black, and red rice varieties were obtained and subjected to evaluation. For grain quality, physical attributes, physicochemical properties, cooking parameters, Instron cooked rice hardness, and sensory profile were assessed. The pigmented rice samples were also evaluated for anthocyanin and phenolic content as well as total antioxidant activity to determine their health-promoting properties.

The limitation of this study is the difference in terms of form of rice between the obtained local and imported SR varieties. The local samples were in paddy form, whereas samples from Thailand and Cambodia were in either unpolished or polished forms. In addition, the freshness of the imported SR varieties is not known since most of them were obtained from either millers or local supermarkets. Thus, the results of the study and the consequent implications of the comparison of the rice's grain quality characteristics and health-promoting properties were based solely on the conditions of the SR varieties analyzed on hand.

This chapter describes the various grain quality parameters and the different antioxidant levels of imported SR varieties from Northeast Thailand and Siem Reap, Cambodia, and local SR varieties obtained from selected corresponding provinces in the Philippines. It highlights the results of the comparative analysis of the important characteristics for each SR type. This certainly includes their key unique traits: aroma for aromatic rice, amylose for glutinous rice, and color and antioxidants for both black and red rice. It also enumerates the other best rice varieties for each SR type that were identified in other provinces in the Philippines. Finally, the chapter presents the summary and implications of this study.

## SR samples and sources

Nine local and eight imported SR varieties were obtained from the selected project sites in the Philippines and neighboring Southeast Asian countries Thailand and Cambodia (Figure 14.1). The number of samples for each type (aromatic, glutinous, black, and red rice) is also indicated. The local varieties were collected from farmers in paddy form and the imported ones were obtained from farmers, millers, or local supermarkets in either unpolished or polished form. The aromatic rice samples came from Northeast Thailand, Siem Reap in Cambodia, and the provinces of Apayao and Oriental Mindoro in the Philippines. The local glutinous rice variety was obtained from Camarines Sur, while the imported sample was from Northeast Thailand. Both imported black and red rice varieties came from Northeast Thailand. In the Philippines, the black and red rice varieties were collected from Negros Occidental and North Cotabato, respectively. The samples were cleaned and processed in the Rice Chemistry and Food Science Division (RCFSD) laboratory of PhilRice. They were also stored properly prior to analyses.

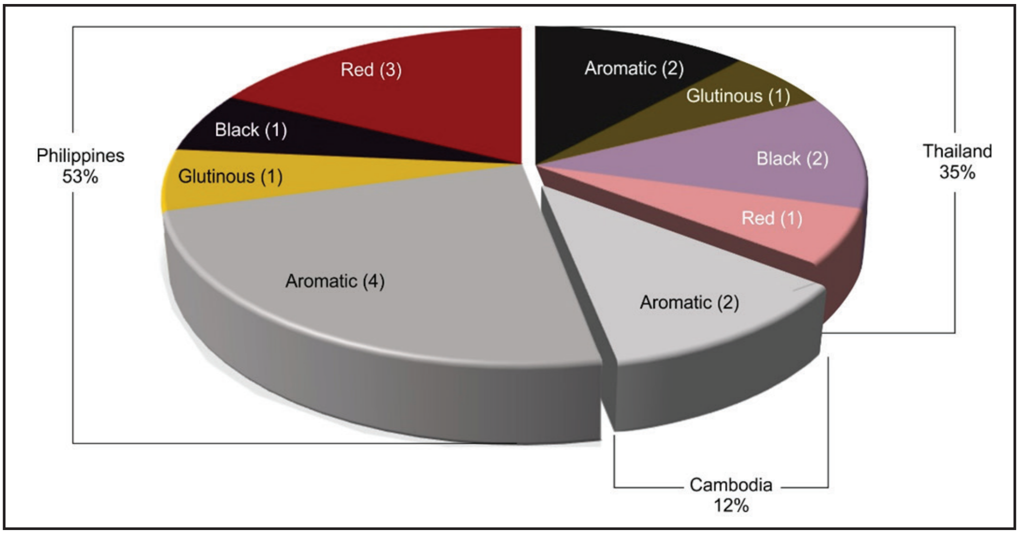


**Figure 14.1.** Percentage distribution of local and imported SR varieties in selected project sites with the corresponding number of samples for each type.

## Evaluation of grain quality

After processing the samples, grain quality parameters were evaluated following standard protocols specified in Chapter 9. These include the determination of physical attributes (grain length and shape), physicochemical properties (amylose content [AC], gelatinization temperature [GT], and crude protein content), cooking parameters, Instron cooked rice hardness, and sensory characteristics in both raw and cooked forms. The same classifications and recommended values for grain quality parameters as those listed in Table 9.1 (Chapter 9) were used.

### Determination of health-promoting properties

The total anthocyanin content (TAC), total phenolic content (TPC), and total antioxidant activity (TAA) of the local and imported SR varieties were evaluated using the spectrophotometric methods described in Chapter 9.

<u>Aromatic rice</u>

For aromatic rice (Figure 14.2), two varieties each from Thailand (Thai white rice and *Khao Hom Mali*) and Cambodia (*Sen Kra Ob* and *Phka Rumduol*) were compared with local varieties from Apayao *(Azucena* and *Gobyerno*) and Oriental Mindoro (*Dinorado, Dinurado Haba*, and NSIC Rc 218 A). Table 14.1 summarizes the ranges of values obtained for grain quality characteristics of these aromatic rice samples.

All imported aromatic rice varieties had long and slender grains, while the local samples were medium to long, with intermediate shape. They also differed in GT as the imported varieties had low GT values, while the local had low to intermediate. There was a wider range in protein content (4.1 – 8.3%) among local samples, with the highest noted in *Azucena* (8.3%).

In terms of sensory characteristics of the raw form, all aromatic rice varieties had similar scores for color and gloss. However, the imported samples were generally whiter and glossier than the local ones.

Obviously, aroma was the most important quality parameter in this type of SR. Although seldom present in raw form, it is pleasantly surprising that the perceptible *pandan*-like scent was detected in *Gobyerno*. When cooked, it also exhibited comparable aroma with Thai white rice and the two varieties from Cambodia (Figure 14.3). *Azucena* and NSIC Rc 218 A exhibited stronger *pandan*-like aroma than *Khao Hom Mali*. *Dinorado* and *Dinurado (Haba)* from Oriental Mindoro did not produce aroma when cooked. It is noteworthy that *Gobyerno* had perceived aroma in its raw and cooked forms, even when stale.

**Table 14.1.** Grain quality characteristics of aromatic rice from Thailand, Cambodia, and the Philippines.

| Parameter | Northeast Thailand | | Siem Reap Cambodia | | Apayao and Oriental Mindoro Philippines | |
|---|---|---|---|---|---|---|
| | Value | Classification | Value | Classification | Value | Classification |
| ***Physical attributes*** | | | | | | |
| Grain length (mm) | 7.1 – 7.2 | Long | 7.3 – 7.4 | Long | 5.9 – 7.0 | Medium – long |
| Grain shape | 3.3 – 3.5 | Slender | 3.5 – 3.6 | Slender | 2.1 – 3.0 | Intermediate |
| ***Physicochemical properties*** | | | | | | |
| Amylose content (%) | 12.3 – 12.9 | Low | 11.6 – 16.2 | Low | 13.2 – 19.4 | Low – Intermediate |
| Gelatinization temperature | 6.1 – 6.4 | Low | 6.0 – 7.0 | Low | 4.2 – 5.0 | Intermediate |
| Crude protein (%) | 6.8 – 7.7 | | 6.9 – 7.1 | | 4.1 – 8.3 | |
| Instron cooked rice hardness ($kg/cm^2$) | 1.1 – 1.5 | Soft | 1.2 – 1.4 | Soft | 1.3 – 1.9 | Soft – medium |
| ***Sensory characteristics*** | | | | | | |
| *Raw* | | | | | | |
| Aroma | 1.0 | No aroma | 1.0 | No aroma | 1.0 – 1.5 | No aroma – slightly aromatic |
| Color | 2.4 – 2.9 | Creamish white – white | 2.2 – 2.8 | Creamish white – white | 1.9 – 2.4 | Creamish white |
| Gloss | 2.3 – 2.4 | Slightly glossy | 1.2 – 3.2 | Dull – glossy | 1.2 – 1.6 | Dull – slightly glossy |
| Translucency | 3.8 - 4.0 | Translucent | 4.0 | Translucent | 1.8 - 3.8 | Chalky - translucent |
| *Cooked* | | | | | | |
| Aroma (freshly cooked) | 1.3-1.9 | No aroma – slightly aromatic | 2.0 | Slightly aromatic | 1.0 -1.9 | No aroma – slightly aromatic |
| Gloss | 2.3 – 2.4 | Slightly glossy | 2.8 | Glossy | 1.8 – 2.9 | Slightly glossy – glossy |
| Cohesiveness | 2.3 – 2.7 | Slightly cohesive – cohesive | 3.0 | Cohesive | 2.2 – 2.9 | Slightly cohesive – cohesive |
| Tenderness (cooked) | 2.9 | Tender | 3.0 | Tender | 2.3 – 3.0 | Slightly tender – tender |
| Taste | 1.1 – 2.1 | Bland – slightly tasty | 2.0 | Slightly tasty | 1.0 – 1.9 | Bland – slightly tasty |


**Figure 14.2** Aromatic rice samples from Thailand, Cambodia, and the Philippines.

Cooked rice tenderness was assessed through both sensory and Instron means. The first method involves humans as sensory panelists and the second uses a texture machine. Based on sensory scores, all the aromatic rice varieties were perceived to be tender (Figure 14.4). The most tender were NSIC Rc 218 A and the two Cambodian varieties. *Dinurado (Haba)* was the least tender. Similarly, in terms of Instron cooked rice hardness, all samples had soft texture, except for *Gobyerno* with medium (Figure 14.5). The softest were Thai white rice and *Pha rum doul* with similar values.

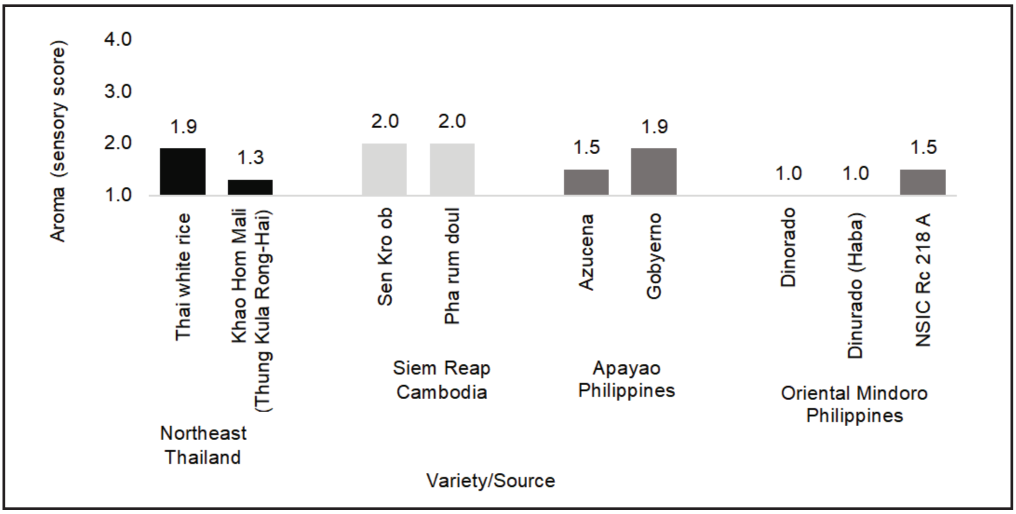


**Figure 14.3.** Aroma (freshly cooked) of aromatic rice from Thailand, Cambodia, and the Philippines.

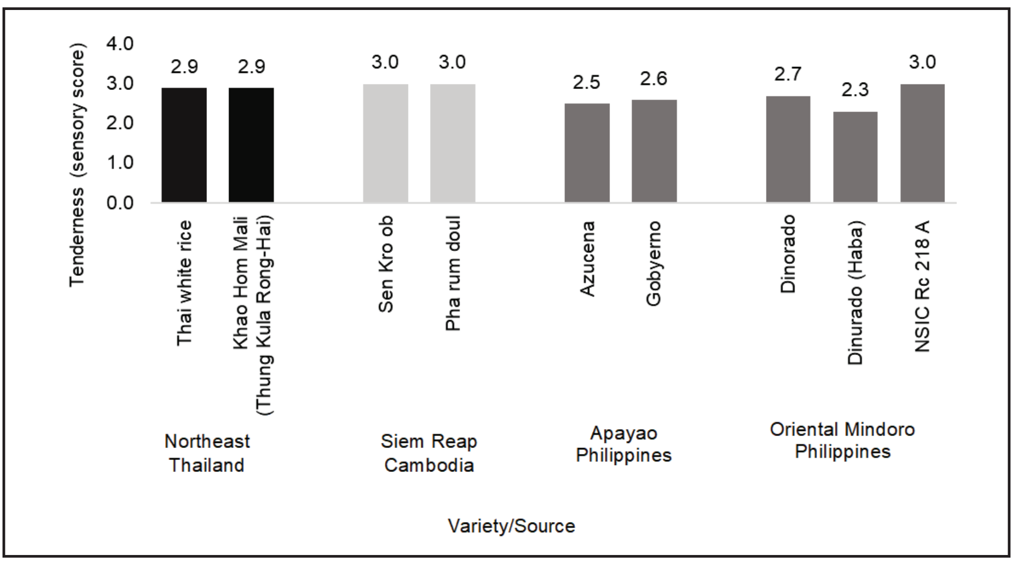


**Figure 14.4.** Tenderness (sensory) of aromatic rice from Thailand, Cambodia, and the Philippines

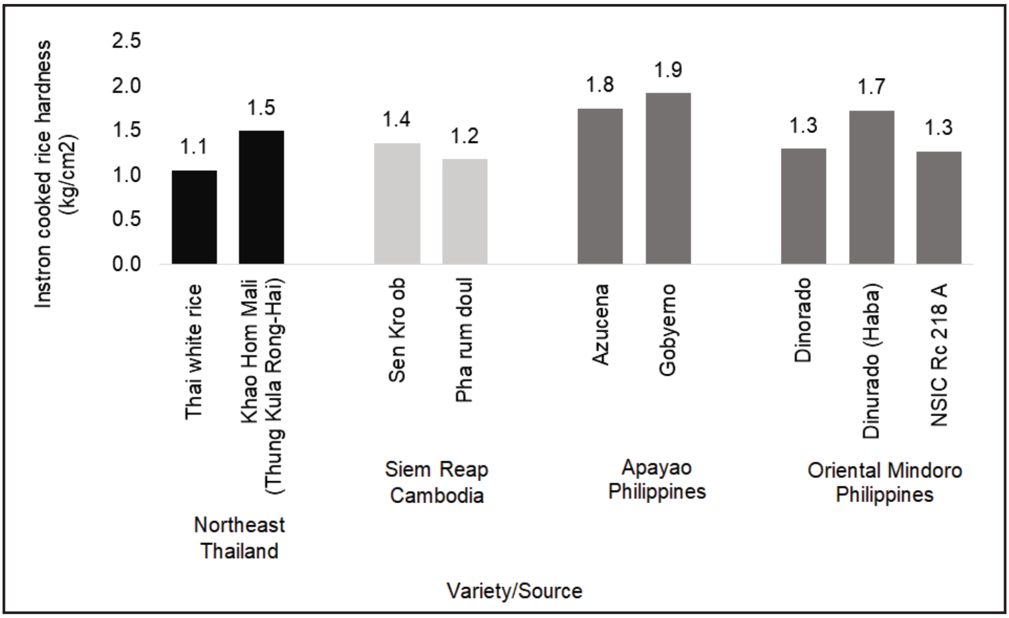


**Figure 14.5.** Tenderness (Instron cooked rice hardness) of aromatic rice from Thailand, Cambodia, and the Philippines.

In sensory evaluation, aroma and taste go hand in hand because the nose and the mouth are interconnected. Consequently, most samples with perceived aroma tend to be evaluated to have taste as well. Therefore, sensory scores for aroma usually coincide well with those for taste. This was observed again here as those aromatic rice varieties discussed above to have *pandan*-like scent were also identified to have taste. Among these, only *Gobyerno* was comparable with the best-tasting Thai white rice and the two Cambodian varieties (Figure 14.6). *Dinorado* and *Dinurado (Haba)* from Oriental Mindoro, which were evaluated to have no aroma when cooked, were also perceived as bland.

Except for *Azucena* and *Gobyerno* with intermediate AC, the rest of the aromatic rice varieties had low AC (Figure 14.7). This generally translates into soft texture. The highest and lowest values were obtained from *Gobyerno* and *Pha rum doul*, respectively. The results closely coincided with the Instron cooked rice hardness data that showed *Gobyerno* having the highest value and *Pha rum doul*, practically the lowest. This was just a little bit higher than Thai white rice, which recorded the lowest Instron cooked rice hardness.

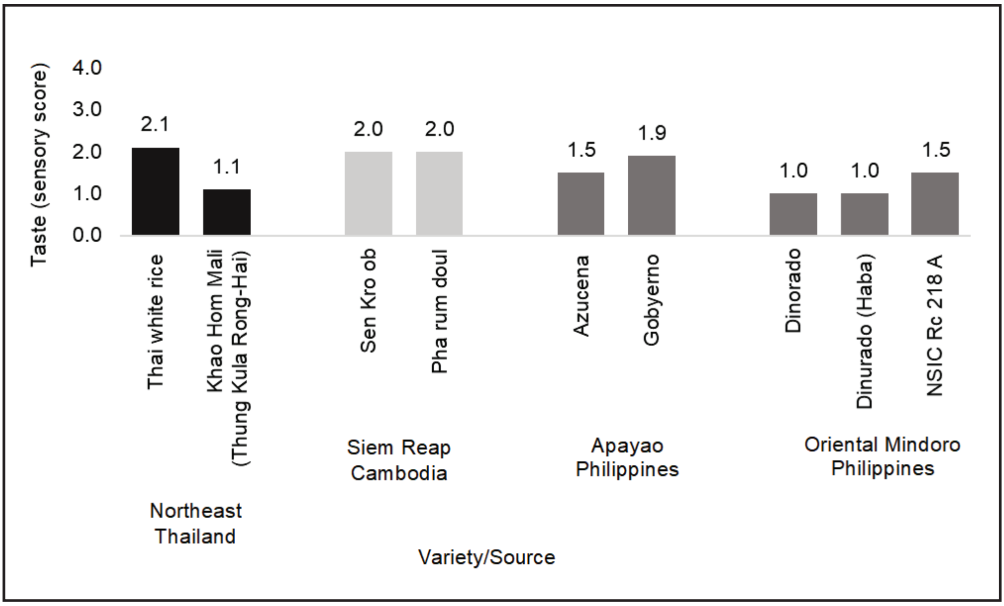


**Figure 14.6.** Taste (sensory) of aromatic rice from Thailand, Cambodia, and the Philippines.

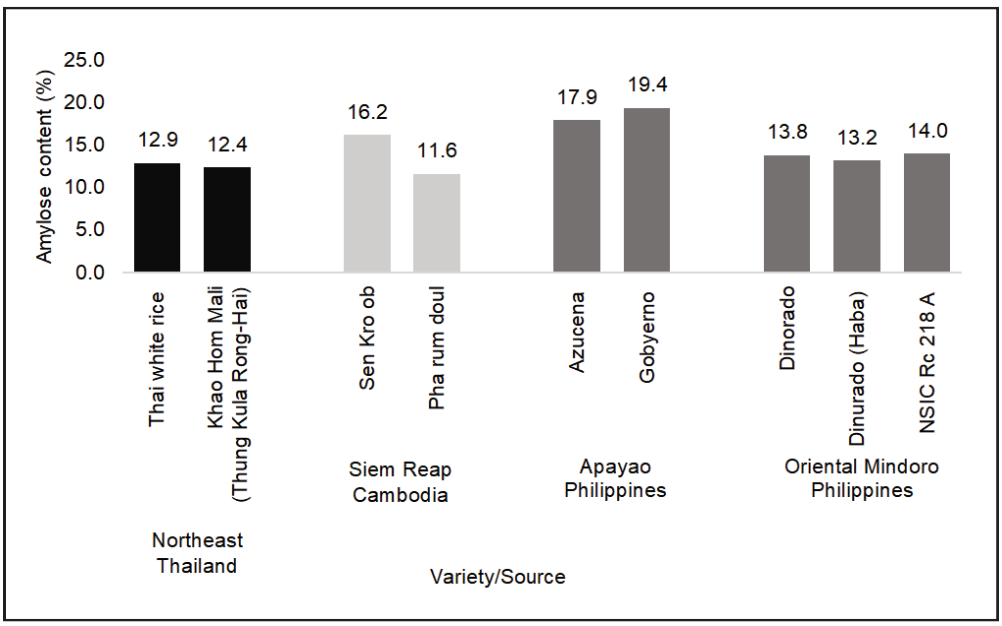


**Figure 14.7.** Amylose content of aromatic rice from Thailand, Cambodia, and the Philippines.

Based on the most important quality attribute for aromatic rice, our local variety *Gobyerno* from Apayao was comparable with the imported samples in terms of *pandan*-like scent. The remaining samples from the Philippines were either similar to or better in aroma than Thailand's *Khao Hom Mali*. Aside from the aromatic rice varieties mentioned here, other local varieties of this type are also available, *Tumindog* from North Cotabato and *Biganti* Plus from Negros Occidental.

<u>Glutinous rice</u>

The unique trait of glutinous rice, also known as waxy or sticky rice, is its starch with little or almost no amylose and its high amount of amylopectin. This is responsible for the sticky quality of cooked glutinous rice. The true-to-type glutinous rice has an AC of 0 – 2% only (Juliano, 1979). The glutinous rice varieties *Kaowaong* RD6 from Thailand and *Gurung-gurong* from Camarines Sur, Philippines (Figure 14.8) were compared in terms of grain quality characteristics (Table 14.2).

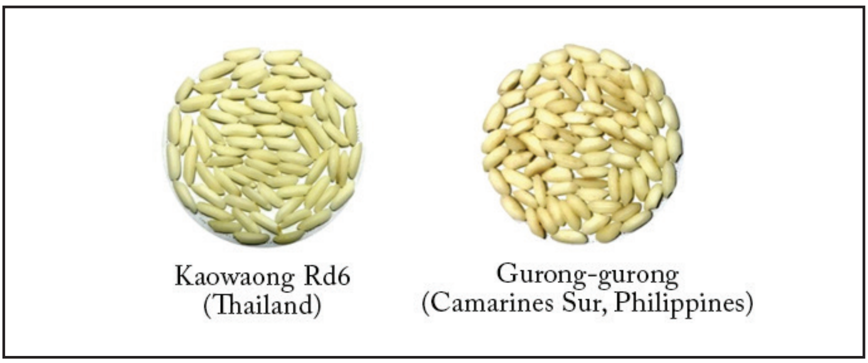


**Figure 14.8.** Glutinous rice samples from Thailand and the Philippines.

Based on physical attribute evaluation, the sample from Thailand had long and slender grains, while the local sample had medium and intermediate. Filipinos are more accustomed to the typical shorter grain of this SR, as was commonly observed in their traditional glutinous rice varieties. As to physicochemical properties, *Gurung-gurong* had higher GT and higher crude protein content than Thailand's *Kaowaong* RD6.

**Table 14.2.** Grain quality characteristics of glutinous rice from Thailand and the Philippines.

| Parameter | Northeast Thailand | | Camarines Sur, Philippines | |
|---|---|---|---|---|
| | Value | Classification | Value | Classification |
| ***Physical attributes*** | | | | |
| Grain length (mm) | 6.8 | Long | 5.7 | Medium |
| Grain shape | 3.1 | Slender | 2.4 | Intermediate |
| ***Physicochemical properties*** | | | | |
| Amylose content (%) | 1.7 | Waxy | 0.5 | Waxy |
| Gelatinization temperature (°C) | 6.0 | Low | 4.5 | Intermediate |
| Crude protein (%) | 6.5 | | 8.6 | |
| Instron cooked rice hardness (kg/cm$^2$) | 0.6 | Very soft | 0.6 | Very soft |
| ***Sensory characteristics*** | | | | |
| *Raw* | | | | |
| Aroma | 1.0 | No aroma | 1.0 | No aroma |
| Color | 3.0 | White | 2.0 | Creamish white |
| Gloss | 1.0 | Dull | 1.5 | Slightly glossy |
| Translucency | 1.0 | Opaque | 1.0 | Opaque |
| *Cooked* | | | | |
| Aroma (freshly cooked) | 2.0 | Slightly aromatic | 1.5 | Slightly aromatic |
| Gloss | 3.8 | Very glossy | 3.5 | Very glossy |
| Cohesiveness | 3.8 | Very cohesive | 3.5 | Very cohesive |
| Tenderness (cooked) | 3.8 | Very tender | 3.5 | Very tender |
| Smoothness | 3.8 | Very smooth | 3.6 | Very smooth |
| Taste | 3.0 | Tasty | 2.0 | Slightly tasty |

Considering the sensory scores for raw rice, the local sample was less white but glossier than the imported one. Both had no perceived aroma. They also obtained similar scores for cooked rice.

Since amylose is the key determinant of cooking and eating qualities, this is considered the most important physicochemical parameter. Incidentally, as previously discussed, this is also the key unique trait of glutinous rice. Based on laboratory analysis, both are technically genuine glutinous rice varieties. However, our very own *Gurung-gurong* had significantly lower AC than the imported one (Figure 14.9).

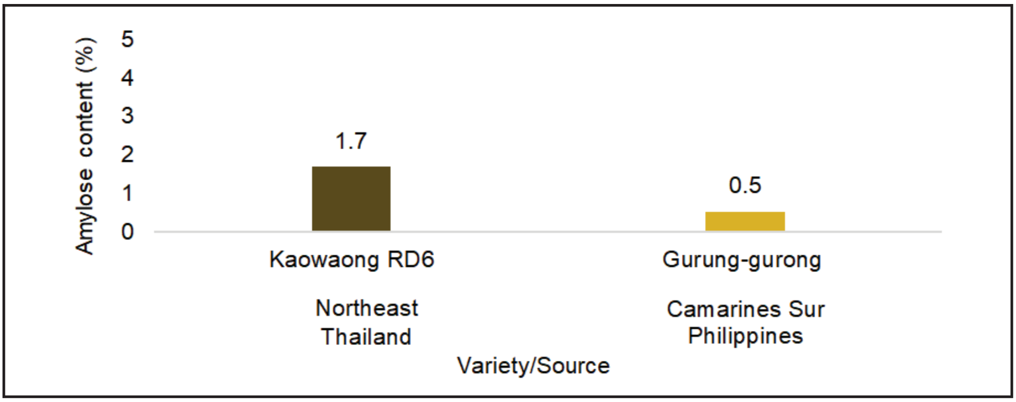


**Figure 14.9.** Amylose content of glutinous rice from Thailand and the Philippines.

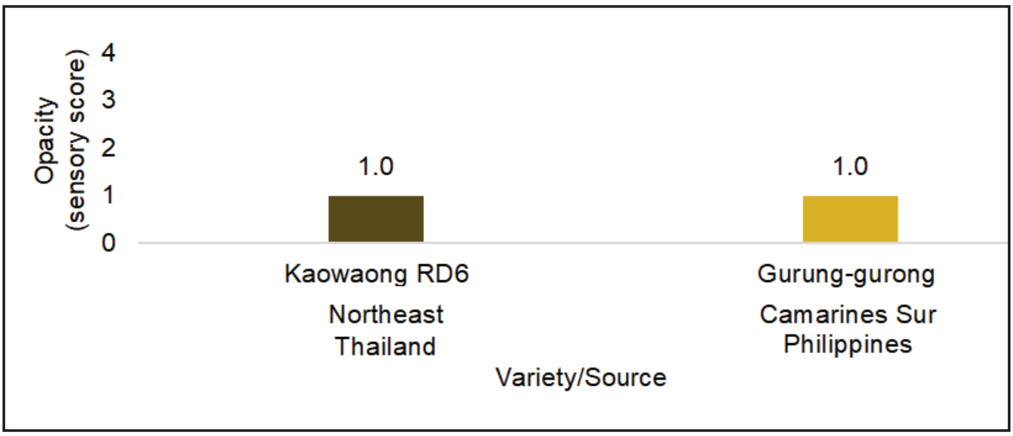


**Figure 14.10.** Opacity (sensory) of glutinous rice from Thailand and the Philippines.

Another unique trait of glutinous rice is its distinct opaque whiteness. This is due to the starchiness of grains that makes it different from varieties having grains with more translucent appearance (Wittenberg, 2007). Based on sensory evaluation, both *Kaowaong* RD6 and *Gurung-gurong* had the typical opaque grains (Figures 14.10) of glutinous rice and were very cohesive (Figures 14.11).

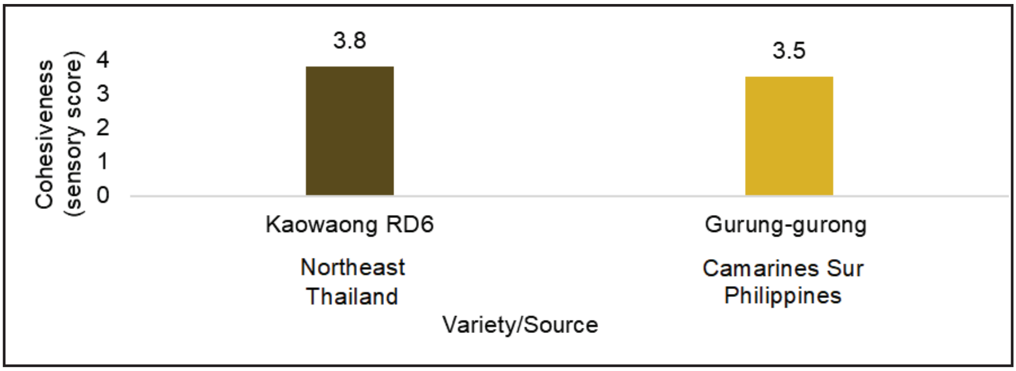


**Figure 14.11.** Cohesiveness of glutinous rice from Thailand and the Philippines.

The two varieties were perceived to be both very tender by the sensory panelists (Figure 14.12). Based on Instron measurement, both were also judged very soft (Figure 14.13).

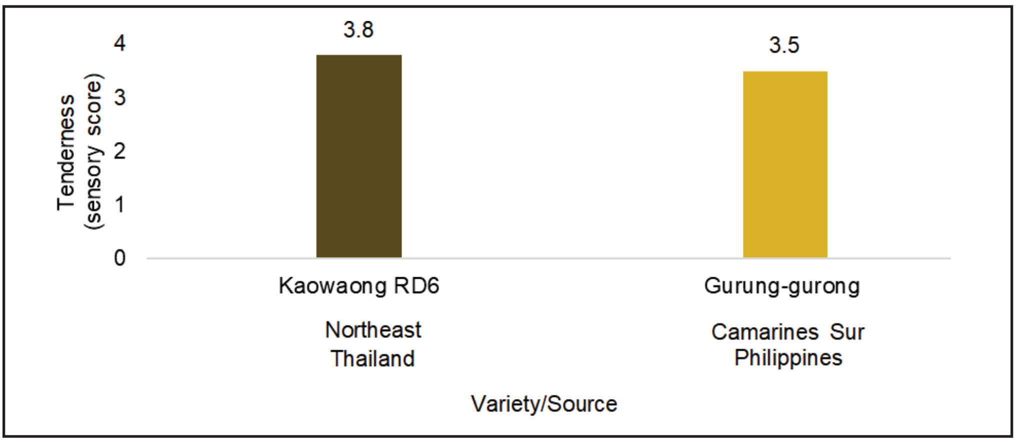


**Figure 14.12.** Tenderness (sensory) of glutinous rice from Thailand and the Philippines.

Based on the most important trait for glutinous rice, *Gurung-gurong* from Camarines Sur had significantly lower AC than *Kaowaong* RD6 from Thailand. It also had shorter grain dimensions, which are more preferred in the Philippines. Both glutinous rice varieties were comparable in terms of the other important grain quality characteristics for this SR type, particularly opacity, cohesiveness, and cooked rice tenderness. Aside from *Gurung-gurong*, other

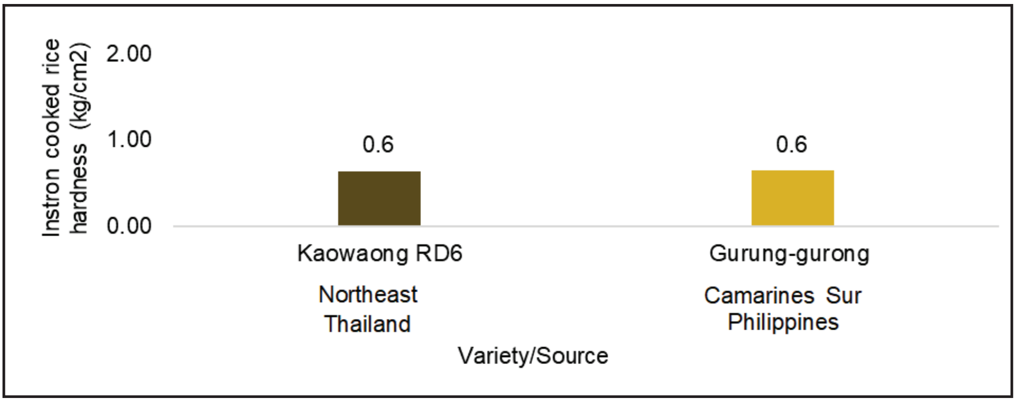


**Figure 14.13.** Tenderness (Instron cooked rice hardness) of glutinous rice from Thailand and the Philippines.

high-quality glutinous rice varieties with very low AC were also identified from other provinces in the Philippines: *Waray* from Abra, *Pinalwa* from Samar, and Miracle and *Sinongsong-Malagkit* from Oriental Mindoro (Table 9.8 in Chapter 9). They also scored considerably high in the other important grain quality characteristics earlier discussed.

Black Rice

The grain quality characteristics and health-promoting properties of two black rice varieties from Thailand, *Khao-Klong-Rice-Ber-Ry* and *Khao Hom Dok Ma Li* 105, were compared with Mindoro Black, a local black rice variety from Negros Occidental (Figure 14.14). The imported samples had shorter grain length and intermediate to slender shape, whereas the local one had long with intermediate shape. They had obvious differences in terms of AC and GT, with Thailand varieties having lower values. In terms of protein content, *Khao Hom Dok Ma Li* 105 and Mindoro Black had the same amount, while *Khao-Klong-Rice-Ber-Ry* had a lower value (Table 14.3).

Pigmented rice are prized for their unique color brought about by anthocyanins. Therefore, unpolished black rice samples in cooked form were evaluated for color by the sensory panelists. Figure 14.15 shows that Mindoro Black obtained intense black rating, which was comparable with that of *Khao-Klong-Rice-Ber-Ry*; but it was lower than *Khao Hom Dok Ma Li* 105, which got a very intense black rating.

**Table 14.3.** Grain quality characteristics of black rice from Thailand and the Philippines.

| Parameter | Northeast Thailand | | Negros Occidental, Philippines | |
|---|---|---|---|---|
| | Value | Classification | Value | Classification |
| **Grain quality** | | | | |
| ***Physical attributes*** | | | | |
| Grain length (mm) | 5.7 – 6.4 | Medium | 6.9 | Long |
| Grain shape | 2.5 – 3.2 | Intermediate - Slender | 2.7 | Intermediate |
| ***Physicochemical properties*** | | | | |
| Amylose content (%) | 3.4 – 11.5 | Very Low - low | 16.0 | Low |
| Gelatinization temperature (°C) | 5.8 – 6.0 | Low | 4.8 | Intermediate/low |
| Crude protein (%) | 7.7 – 8.1 | | 8.1 | |
| Instron cooked rice hardness ($kg/cm^2$) | 1.1 – 1.9 | Soft – medium | 2.6 | Hard |
| ***Sensory characteristics*** | | | | |
| *Raw* | | | | |
| Aroma | 1.0 | No aroma | 1.0 | No aroma |
| Color | 2.4 – 3.6 | Slightly intense – very intense | 2.6 | Intense |
| Gloss | 1.2 – 1.8 | Dull – slightly glossy | 2.0 | Slightly glossy |
| Translucency | 2.0 | Chalky | n/a | |
| *Cooked* | | | | |
| Aroma (freshly cooked) | 1.0 – 1.2 | No aroma | 1.0 | No aroma |
| Color | 3.3 – 3.8 | Intense – very intense | 3.0 | Intense |
| Gloss | 2.7 – 4.0 | Glossy – very glossy | 3.1 | Glossy |
| Cohesiveness | 2.1 – 4.2 | Slightly cohesive – very cohesive | 2.0 | Slightly cohesive |
| Tenderness (cooked) | 2.7 – 3.7 | Tender – very tender | 1.9 | Slightly tender |
| Taste | 1.5 | Slightly tasty | 1.6 | Slightly tasty |
| **Health-promoting properties** | | | | |
| Total anthocyanin content (mg C3GE/kg) | 857.8 - 1105.8 | | 803.0 | |
| Total phenolic content (mg GAE/g) | 0.8 – 1.3 | | 1.5 | |
| Total antioxidant activity (mg TE/g) | 1.2 – 1.4 | | 1.7 | |


**Figure 14.14.** Black rice samples from Thailand and the Philippines.

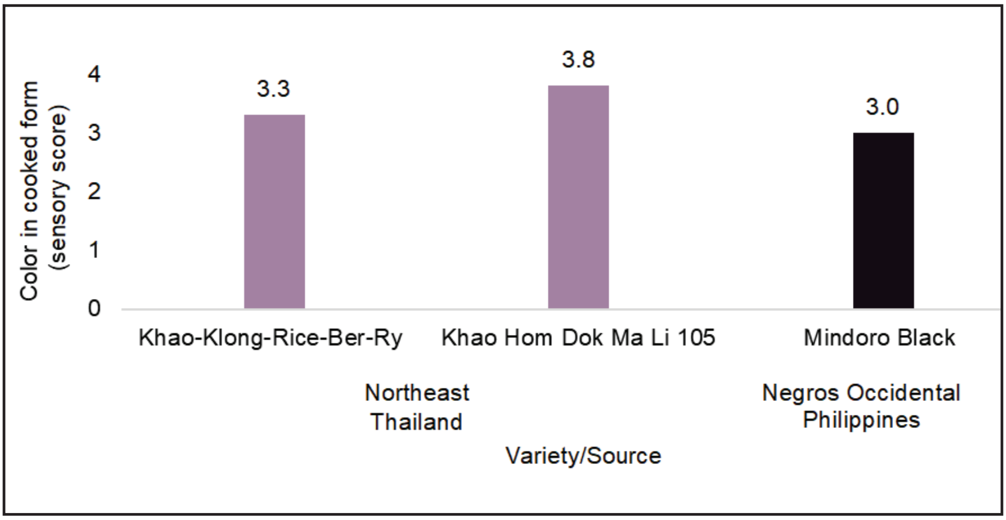


**Figure 14.15.** Color (sensory) of black rice from Thailand and the Philippines.

The tenderness results based on sensory evaluation (Figure 14.16) and Instron cooked rice hardness (Figure 14.17) corresponded very well. *Khao Hom Dok Ma Li* 105 was consistently the softest, followed by *Khao-Klong-Rice-Ber-Ry*. Mindoro Black was the least tender. The tenderness excellently paralleled the previously discussed AC.

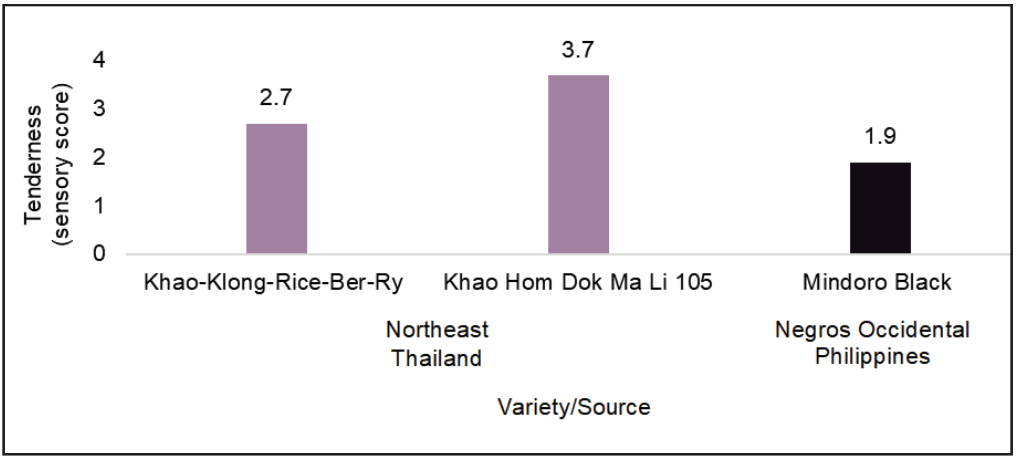


**Figure 14.16.** Tenderness (sensory) of black rice from Thailand and the Philippines.

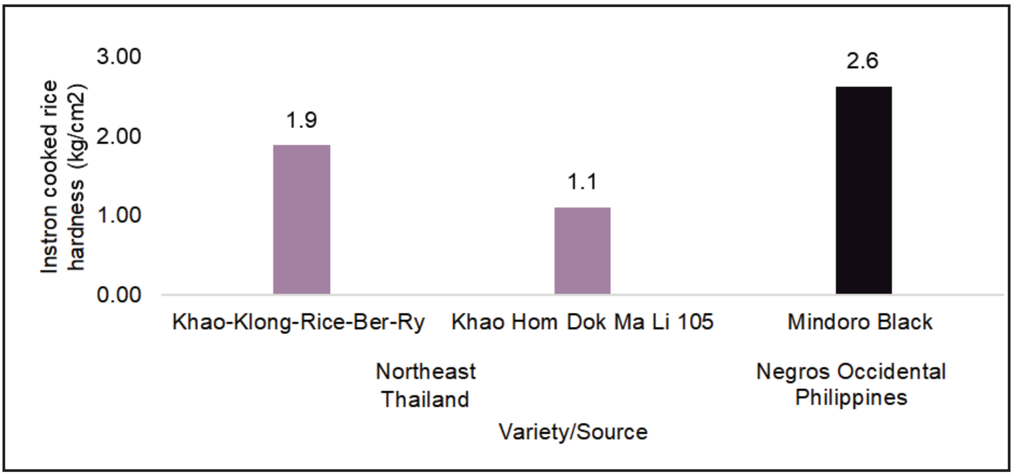


**Figure 14.17.** Tenderness (Instron cooked rice hardness) of black rice from Thailand and the Philippines.

Meanwhile, all three black rice varieties had no perceived aroma (Figure 14.18). They also had similar sensory scores for taste (Figure 14.19).

Pigmented rice, including black and red, are considered premium rice not only for their unique color but also for their health-promoting properties. All pigmented rice varieties were also evaluated for their health-promoting properties, including TAC, TPC, and TAA. Figure 14.20 shows the TAC of the three black rice varieties assessed. Consistent with its grain color, Mindoro

Black had TAC comparable with that of *Khao Hom Dok Ma Li* 105 but lower than that of *Khao-Klong-Rice-Ber-Ry*. However, our local black rice exhibited significantly higher TPC (Figure 14.21) and TAA (Figure 14.22) than the two imported samples. Based on the health-promoting properties, therefore, Mindoro Black is better than the imported black rice from Thailand due to its considerably higher amount of antioxidants.

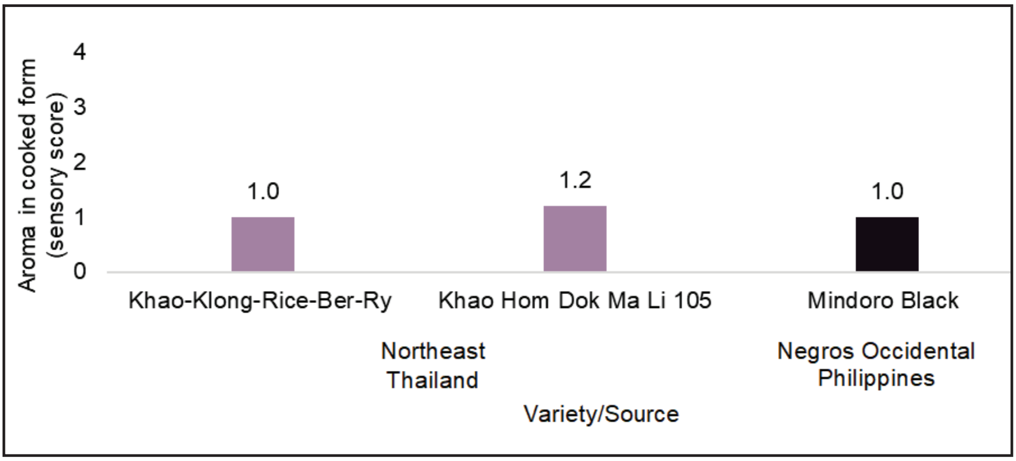


**Figure 14.18.** Aroma (cooked) of black rice from Thailand and the Philippines.

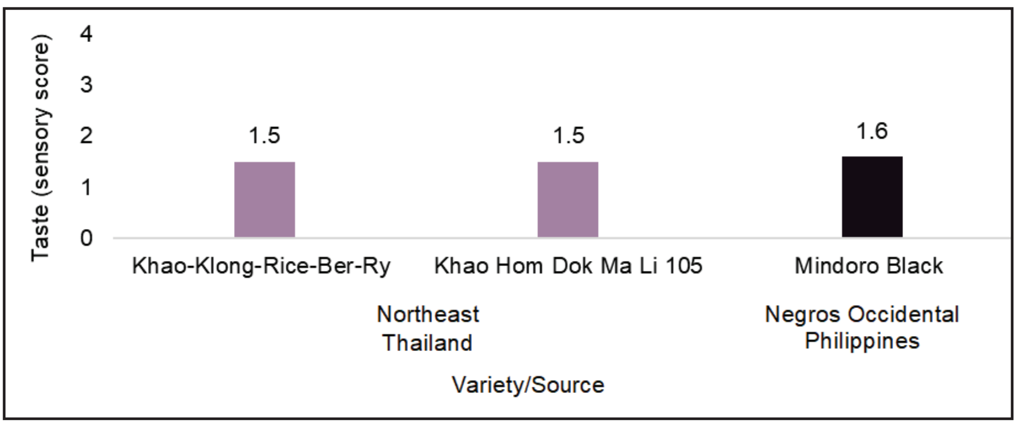


**Figure 14.19.** Taste of black rice from Thailand and the Philippines.

In fact, there are more local black rice varieties from other provinces in the country with even more health-promoting properties. The best in terms of TAC (range, 804.3 – 1438.6 mg C3GE/kg) include Black *Polotan* from Camarines

Sur, *Calatrava* and *Bingawan* from Iloilo, *Balatinaw* from Abra, and *Sinelat* from Apayao (Chapter 9, Figure 9.36). In terms of TPC, the aforementioned rice varieties (except *Balatinaw*, replaced by BR 261 from Iloilo) were also the top performers, with 1.7 – 3.2 mg GAE/g (Chapter 9, Figure 9.37). It is interesting to note that the five black rice varieties in terms of TAC also had the highest TAA, with 1.92 – 5.97 mg TE/g (Chapter 9, Figure 9.38). Therefore, it can be deduced that our black rice varieties are way better than the imported samples when it comes to health-promoting properties.

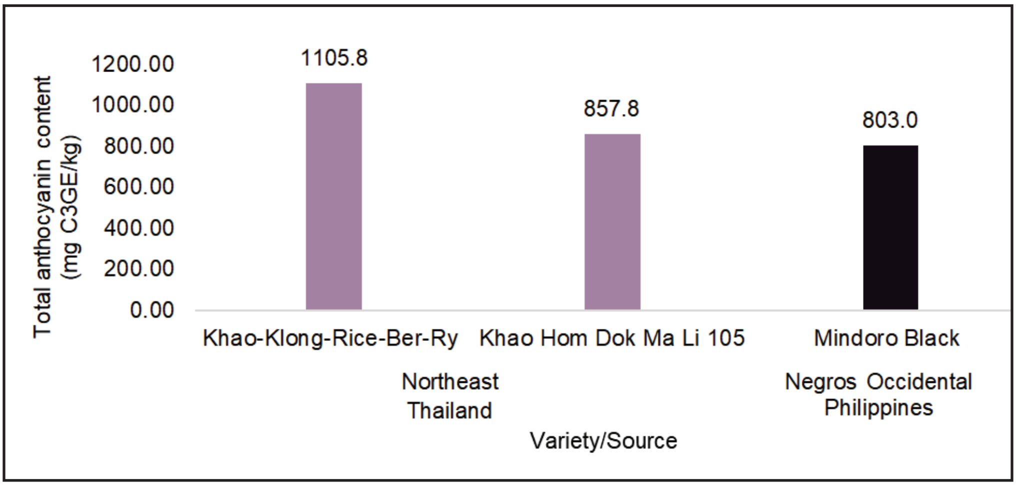


**Figure 14.20.** Total anthocyanin content of black rice from Thailand and the Philippines.

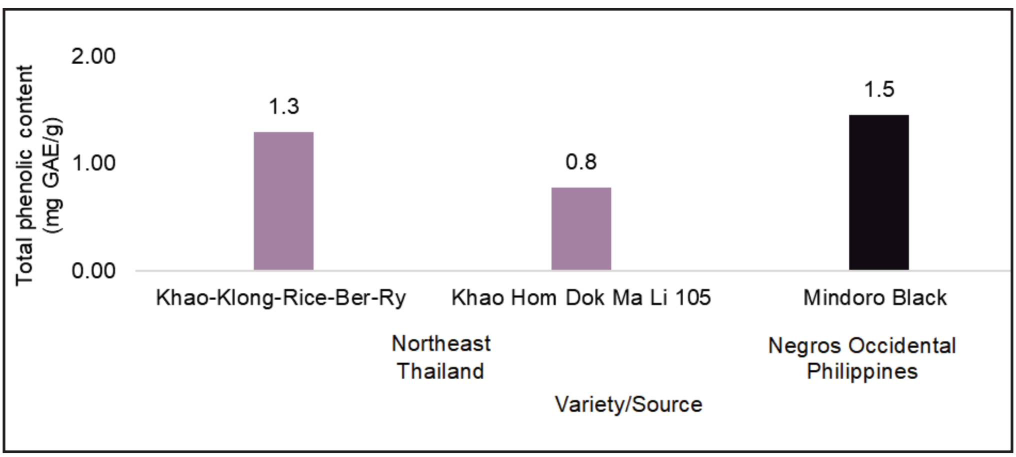


**Figure 14.21.** Total phenolic content of black rice from Thailand and the Philippines.

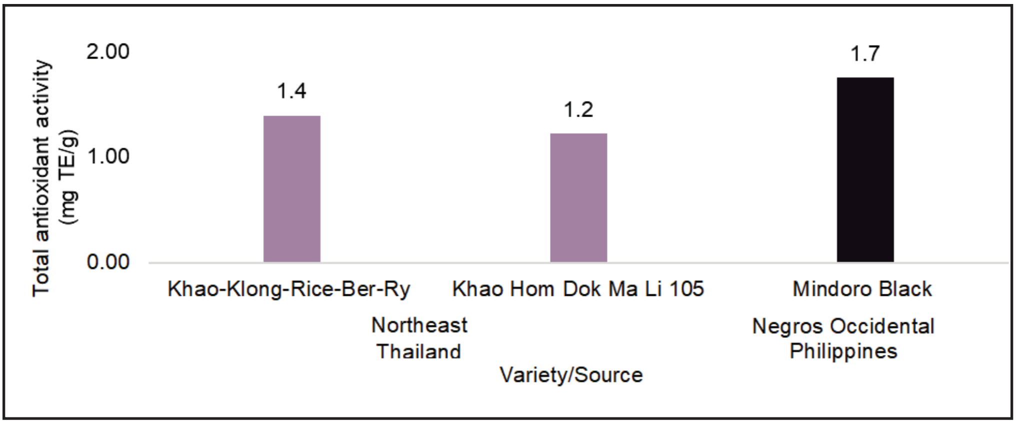


**Figure 14.22.** Total antioxidant activity of black rice from Thailand and the Philippines.

<u>Red Rice</u>

The grain quality characteristics and health-promoting properties of red rice varieties Organic *Sangyod* from Northeast Thailand were compared with those of *Pulot, Awot* B, and *Dinorado* B of North Cotabato, Philippines (Figure 14.23). Organic *Sangyod* had medium length and slender shape, while all local red rice had medium and intermediate grains, except for *Awot* B with short and bold grains. The imported variety had lower AC and GT than the local samples (except for *Pulot*). It also had the highest protein content (Table 14.4).

Based on sensory evaluation, Organic *Sangyod* was rated to have very intense red grains by the panelists (Figure 14.24). This was a notch higher than the rating obtained by the three local red rice varieties from North Cotabato, which was only intense red.

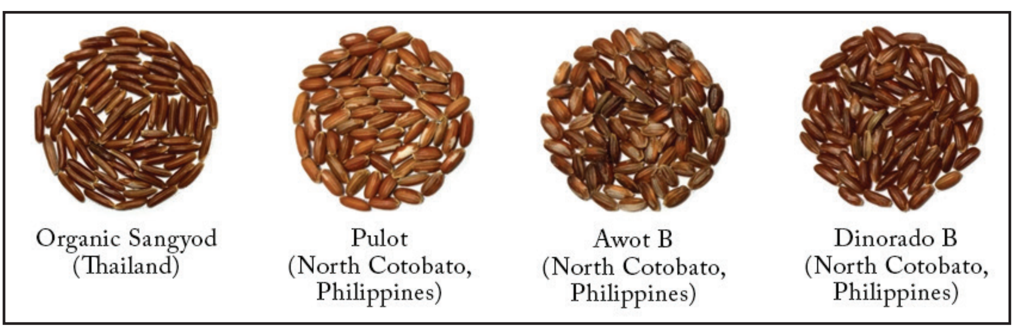


**Figure 14.23.** Red rice samples from Thailand and the Philippines

**Table 14.4.** Grain quality characteristics of red rice from Thailand and the Philippines.

| Parameter | Northeast Thailand | | North Cotabato, Philippines | |
|---|---|---|---|---|
| | Value | Classification | Value | Classification |
| **Grain quality** | | | | |
| ***Physical attributes*** | | | | |
| Grain length (mm) | 6.3 | Medium | 5.4 – 5.7 | Short – medium |
| Grain shape | 3.6 | Slender | 2.0 – 2.3 | Bold – intermediate |
| ***Physicochemical properties*** | | | | |
| Amylose content (%) | 12.0 | Low | 4.8 – 21.0 | Very low – intermediate |
| Gelatinization temperature (°C) | 4.0 | Intermediate | 3.8 – 5.0 | Intermediate |
| Crude protein (%) | 9.9 | | 6.5 – 9.4 | |
| Instron cooked rice hardness ($kg/cm^2$) | 2.4 | Medium | 1.9 – 2.9 | Medium – hard |
| ***Sensory characteristics*** | | | | |
| *Raw* | | | | |
| Aroma | 1.0 | No aroma | 1.0 | No aroma |
| Color | 3.5 | Very intense | 2.6 – 3.2 | Intense |
| Gloss | 2.2 | Slightly glossy | 1.7 – 2.5 | Slightly glossy - glossy |
| Translucency | 3.5 | Translucent | n/a | |
| *Cooked* | | | | |
| Aroma (freshly cooked) | 1.0 | No aroma | 1.0 – 1.1 | No aroma |
| Color | 3.5 | Very intense | 2.8 – 3.1 | Intense |
| Gloss | 2.3 | Slightly glossy | 1.9 – 2.7 | Slightly glossy to glossy |
| Cohesiveness | 1.5 | Slightly cohesive | 1.4 – 1.8 | Separated – slightly cohesive |
| Tenderness (cooked) | 2.2 | Slightly tender | 1.5 – 1.9 | Slightly tender |
| Taste | 1.2 | Bland | 1.2 – 1.4 | Bland |
| **Health-promoting properties** | | | | |
| Total anthocyanin content (mg C3GE/kg) | 40.1 | | 25.9 – 194.1 | |
| Total phenolic content (mg GAE/g) | 2.0 | | 2.2 – 4.2 | |
| Total antioxidant activity (mg TE/g) | 3.4 | | 4.1 – 9.2 | |

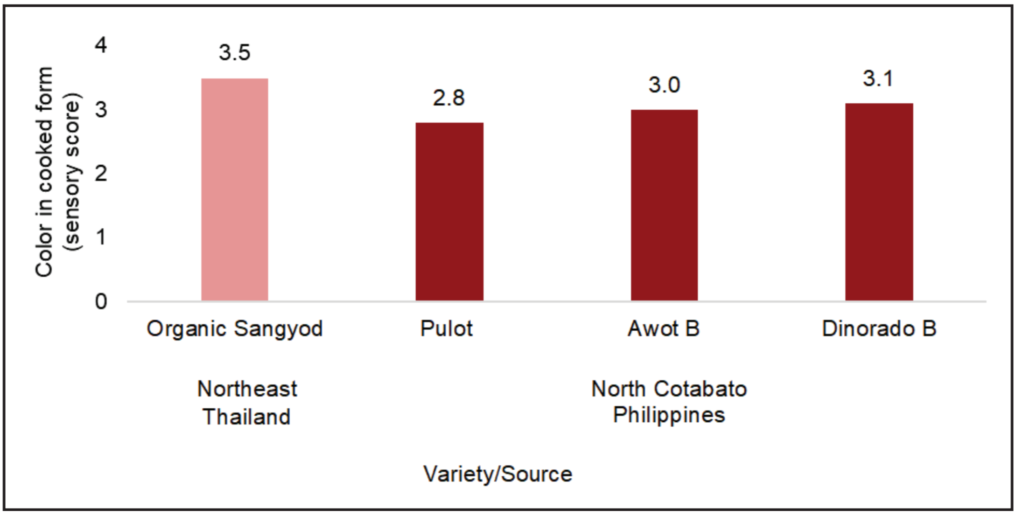


**Figure 14.24.** Color (cooked) of red rice varieties from Thailand and the Philippines.

The sensory scores for cooked rice tenderness showed that all red rice varieties were perceived to be just slightly tender (Figure 14.25). Based on Instron measurements, *Pulot* and *Awot* B were classified to have medium texture (Figure 14.26), comparable with Thailand's Organic *Sangyod*. On the other hand, *Dinorado* B was classified as hard. All imported and local red rice varieties had no aroma (Figure 14.27) and had bland taste (Figure 14.28).

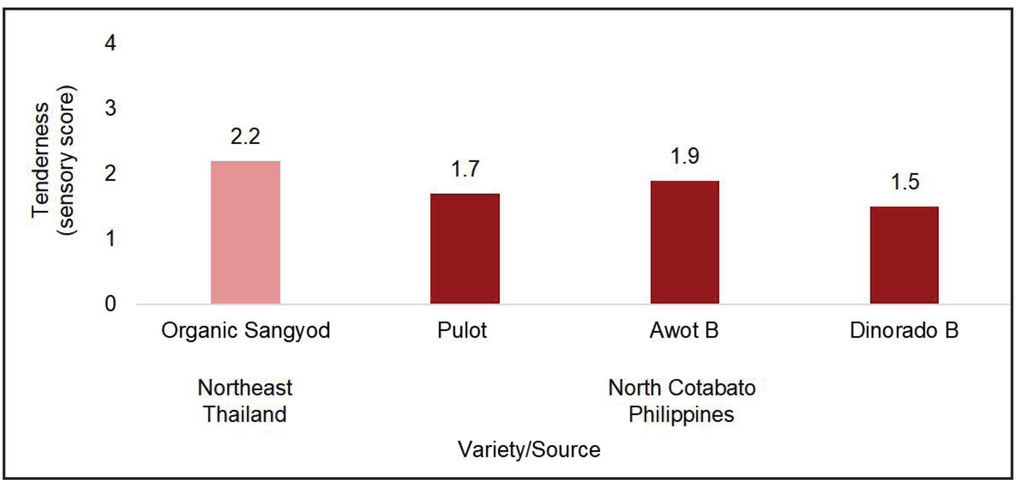


**Figure 14.25.** Tenderness (sensory) of red rice varieties from Thailand and the Philippines.

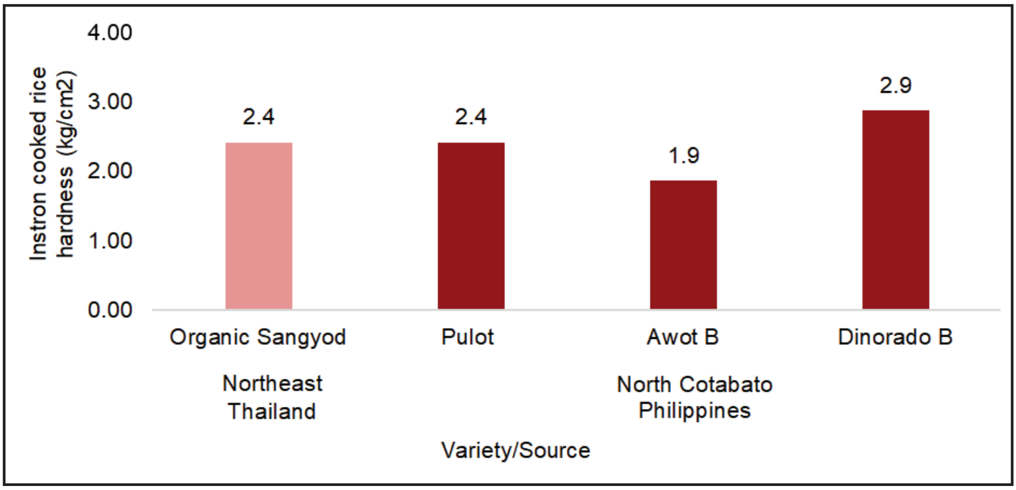


**Figure 14.26.** Tenderness (Instron cooked rice hardness) of red rice varieties from Thailand and the Philippines.

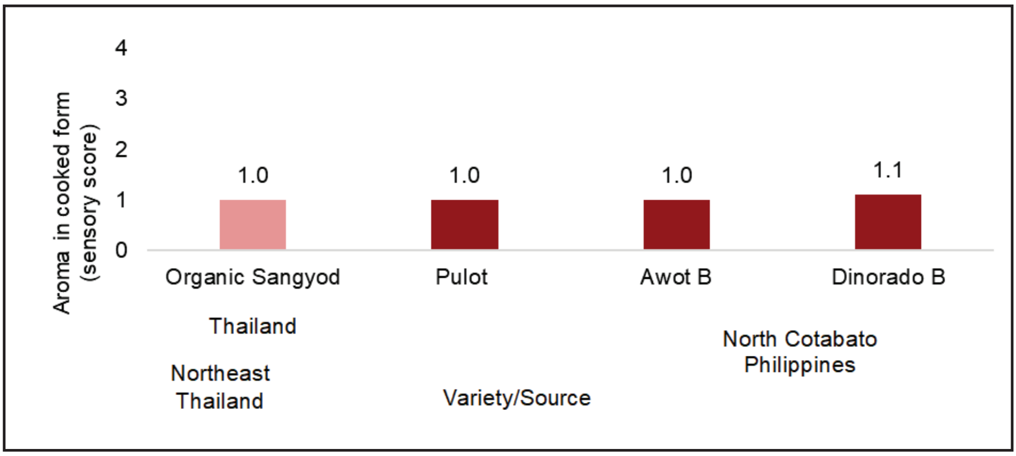


**Figure 14.27.** Aroma (cooked) of red rice varieties from Thailand and the Philippines.

In terms of health-promoting properties, TAC (Figure 14.29), TPC (Figure 14.30), and TAA (Figure 14.31) were determined. Thailand's *Sangyod* had comparable TAC as North Cotabato's *Dinorado* B and *Awot*. However, *Pulot* had a staggering five times higher value than the imported sample. All local red rice varieties gave higher TPC than *Sangyod*. *Dinorado* B was identified as the best in terms of TPC. Similarly, all varieties from North Cotabato also

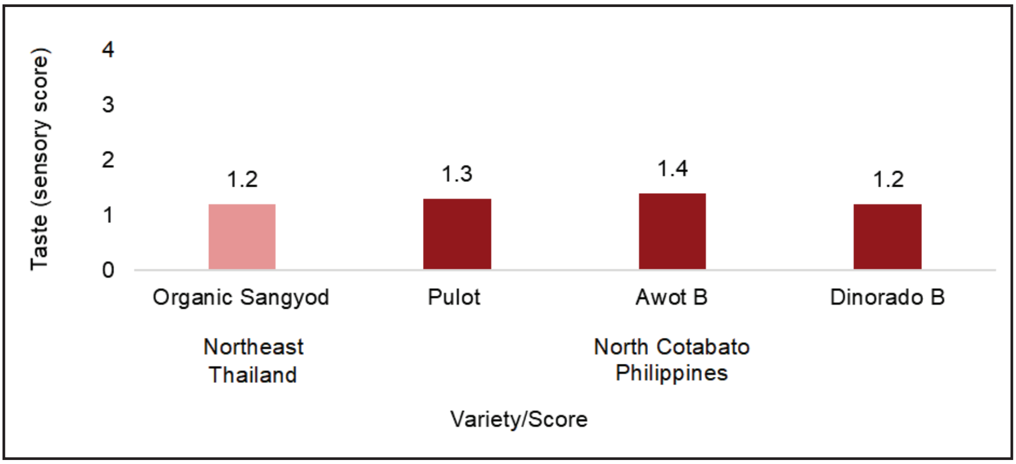


**Figure 14.28.** Taste of red rice varieties from Thailand and the Philippines.

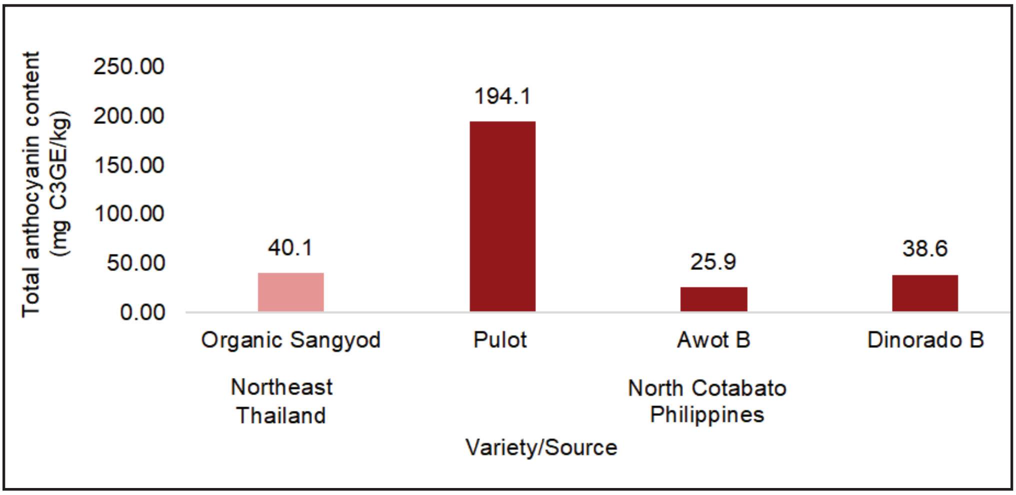


**Figure 14.29.** Total anthocyanin content of red rice varieties from Thailand and the Philippines.

performed better than the Thailand variety in terms of TAA. Similar ranking as TPC was observed: *Dinorado* B > *Pulot* > *Awot* B. It is noteworthy that *Dinorado* B, despite having lower TAC, exhibited the highest TPC and TAA among the samples. This means that this particular red rice variety contains significantly more of the other kinds of antioxidants than just anthocyanins.

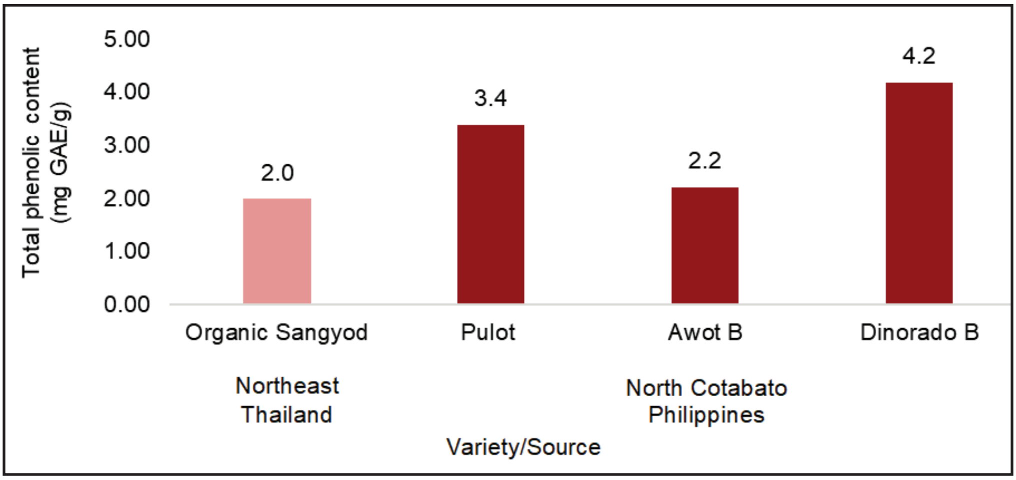


**Figure 14.30.** Total phenolic content of red rice varieties from Thailand and the Philippines.

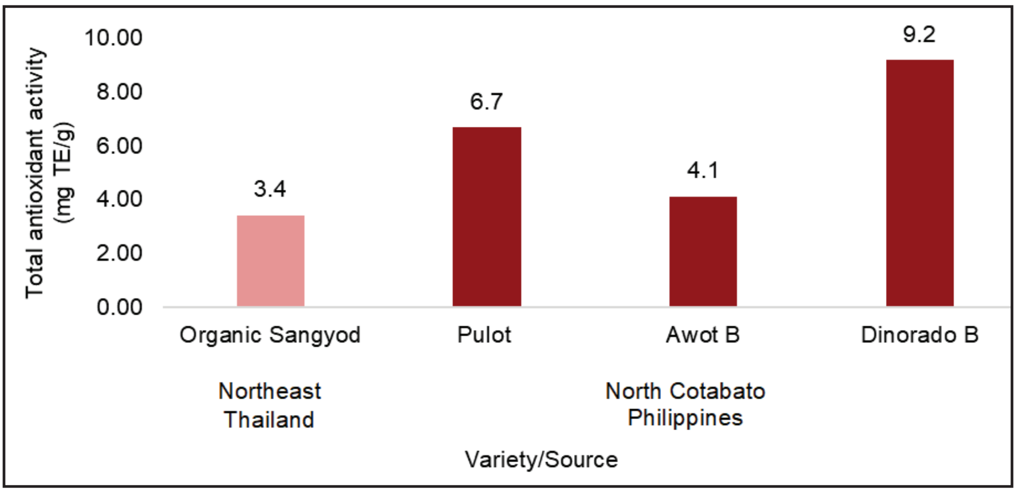


**Figure 14.31.** Total antioxidant activity of red rice varieties from Thailand and the Philippines.

Aside from these healthier local red rice varieties, there are also other equally important red rice in the Philippines with high amounts of antioxidants (Chapter 9, Figures 9.40, 9.41, and 9.42). These include *Denorado, Intramis*, and *Dinorado* from Bukidnon (TAC); *Denorado* and *Kapukaw* from Bukidnon and *Dinorado* A from North Cotabato (TPC); and *Dinorado, Denorado, Kapukaw*, and *Intramis*, all from Bukidnon (TAA).

## Summary and Implications

This chapter comprehensively compared the different grain quality characteristics and health-promoting properties of nine local and eight international SR varieties from the selected project sites. The eight aromatic, two glutinous, three black, and four red rice varieties were obtained from the provinces of Apayao, Oriental Mindoro, Camarines Sur, Negros Occidental, and North Cotabato in the Philippines; Northeast Thailand; and Siem Reap, Cambodia. It highlighted the comparison of unique traits of each SR type.

For aromatic rice, the distinct *pandan*-like scent, which makes it highly desirable by consumers in many countries, was considered. Since it is very rare for raw rice grains to have aroma, it is good to realize that only the local variety *Gobyerno* had detectable *pandan* scent. When cooked, it also exhibited aroma comparable with that of Thai white rice and *Sen Kro ob* and *Pha rum doul* from Cambodia. It is also interesting to note that *Gobyerno* had perceived aroma in all forms, including raw, cooked, and even staled. For the most important unique trait of glutinous rice, *Gurung-gurong* from Camarines Sur had considerably lower AC than Northeast Thailand's *Kaowaong*.

The characteristic distinct color of pigmented rice is the most critical. In black rice, the local Mindoro Black from Negros Occidental had intense color when cooked, comparable with *Khao-Klong-Rice-Ber-Ry* from Northeast Thailand. However, it was lower than the darker *Khao Hom Dok Ma Li* 105 with perceived very intense black color. Although local red rice varieties *Dinorado* B, *Awot* B, and *Pulot* from North Cotabato had intense red color, Organic *Sangyod* from Northeast Thailand had darker red hue as evidenced by the very intense red color rating by panelists.

Aside from their valued color, pigmented rice are also excellent sources of health-promoting components in the form of antioxidants. These are effective scavengers of free radicals, the culprits in the onset of non-communicable illnesses such as cancer, diabetes, and cardiovascular diseases. Thus, a comparison of local and international pigmented rice in terms of TAC, TPC, and TAA was conducted. As observed in its grain color, Mindoro Black had the same level of the major pigment anthocyanin as Thailand's *Khao Hom Dok Ma Li* 105 but it had a lower amount than the darker *Khao-Klong-Rice-Ber-Ry*. However, this local black rice variety exhibited significantly higher TPC and TAA than the two Thai varieties. For red rice, *Dinorado* B and *Awot* from North Cotabato had comparable TAC than Northeast Thailand's Organic *Sangyod*. Even better was the astounding roughly 500% higher level of *Pulot*. Moreover, all local red rice varieties gave higher TPC and TAA than Organic *Sangyod*. Hence, our local black and red rice varieties had more health-promoting properties than those from Thailand.

To reiterate, the comparison of local and imported SR varieties in terms of their critical unique traits showed that local ones have a competitive advantage. Aside from the comparable aroma of other local rice varieties, we have identified *Gobyerno* with distinct *pandan*-like scent in raw and cooked rice forms, and even when staled. Our local glutinous rice variety *Gurung-gurong* had an advantage in terms of AC. Moreover, it can be deduced that both our black and red rice varieties are superior in terms of health-promoting properties.

This shows that there are indigenous SR varieties in the Philippines that possess excellent grain quality characteristics and health-promoting properties. Consequently, we can potentially increase the production of SR for export, enabling us to compete in the world market with other SR-producing countries such as Thailand and Cambodia. However, we need to improve the accessibility and availability of high-quality seeds of these SR varieties. Appropriate crop production management to increase yield and effective postharvest management practices to maintain grain quality characteristics and health-promoting properties must be conducted. Furthermore, the use of smaller packaging with attractive and informative product labels is highly recommended. Enhanced promotion of the unique characteristics of the different SR types, (including the health benefits of pigmented rice), their market potential, and other potential uses is also encouraged.

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# VI

# STATUS, POTENTIALS, AND PROSPECTS OF SPECIALTY RICE



15

# RECOMMENDED ACTION PLANS FOR DEVELOPING THE PHILIPPINE SPECIALTY RICE INDUSTRY

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Improving the competitiveness of local rice farmers is one of the primary visions of the rice industry. To achieve this, the Department of Agriculture (DA) has continuously initiated efforts to help farmers cope with the challenges brought about by trade liberalization. One of the envisioned pathways is the exploration of the full potential of specialty rice (SR) such as aromatic, glutinous, and pigmented rice (black and red) as a viable alternative enterprise for farmers.

In general, the SR industry comprises about 10% of total rice area harvested in the Philippines, approximately 470,200 ha. However, the production of different types of SR is rather scattered in provinces with a significant production of traditional varieties. Although SR are planted in some irrigated or favorable areas, many of the sites are mountainous and have large portions of highland areas, making them conducive to SR production. The sparse production of SR leads to dispersed supply, making access more difficult.

With urbanization and increasing income, a growing number of consumers are now shifting to rice with premium qualities like SR. This indicates a rising demand for SR both at the local and international markets. The willingness of consumers to pay for quality and high nutritional value despite the high price offers a great opportunity for farmers to increase their income by tapping this market.

This undertaking was able to obtain findings on the production and trade of SR in the Philippines. The DA, through the National Rice Program (NRP), must consider these results to mainstream strategies in developing the SR industry in the country. Moreover, emphasizing the development of SR as a key component in the NRP, along its ordinary white rice counterpart, will boost the overall rice industry. This will consolidate sparse and scattered local initiatives concerning SR. This is in alignment with the DA's vision of a food-secure Philippines with prosperous farmers and fisher folks. In addition, this is also supportive of the eight paradigms that make up the new thinking in agriculture, particularly export promotion. To carry out these identified directions, the recommended action plan is presented through the following sections: (1) supply and demand estimates with specific recommendations that are essential for each specific SR type, (2) specific recommendations for SR subsistence farming, and (3) general recommendations on supply expansion, demand development and marketing strategies, value addition, R&DE strategies, policy directions, and future studies.

## Supply and demand estimates with specific recommendations

### *Aromatic rice*

Aromatic rice comprises the largest share (73%) in the total SR area harvested. With an estimated area of 345,000 and an average yield of 3.14 t ha$^{-1}$ (14% MC), the estimated local production of aromatic rice (in milled equivalent) is about 671,000 t. Additionally, the country imports aromatic rice at 12,500 t year$^{-1}$. This translates to a total supply of about 683,500 t. The bulk of the local aromatic rice supply comes from MIMAROPA where modern aromatic rice variety (NSIC Rc 218) is commonly grown. The production area is mostly irrigated and can be planted twice a year for market-oriented producers. Nonetheless, there are subsistence farmers who also produce traditional varieties of aromatic rice, which are commonly found in upland areas (e.g., Apayao) with single crop a year. The Philippines commonly imports aromatic rice from Thailand, mostly sourced from its northeast region and bordering parts of Cambodia. Results show that the cost of producing aromatic rice in the Philippines is higher compared with imported ones (see Chapter 13).

On the demand side, it is assumed that 80% of the individuals belonging to the upper-middle to rich classes are those who are more likely to purchase aromatic rice. On top of this, about 25% of those in the middle-middle income class are also assumed to demand aromatic rice. With an average per capita consumption of 87 kg year$^{-1}$, this leads to an annual food demand of roughly 600,000 t. With a yearly seed requirement of 17,000 t (milled equivalent), the total demand for aromatic rice is estimated at 617,000 t year$^{-1}$. This shows that local supply with minimal imports marginally meets the domestic demand for aromatic rice. Aromatic rice is usually demanded in highly urbanized areas such as Metro Manila and CALABARZON, and some parts of Central Luzon (e.g., Bulacan and Pampanga). Potential demand areas in the south are the cities of Cebu and Davao.

Grain quality analysis of local aromatic varieties detected the presence of *pandan* scent. However, it was not found in milled aromatic rice samples collected from Thailand. This could be attributed to the uncertain harvest date of these samples, which are obtained from supermarkets. Though Thai aromatic rice is well known for its intense aroma, this is an ephemeral characteristic, which means that the aroma compound dissipates within a few months. The rapid loss of aromatic intensity leads to preference toward freshly harvested aromatic rice. This gives a natural advantage for locally produced aromatic rice relative to imported aromatic rice, implying an opportunity for import substitution. This could partly explain the lower volume of aromatic rice imports relative to that of ordinary white rice.

Specific recommendations to enhance the aromatic rice industry in the country are outlined. First, ensuring the seed supply of aromatic rice is important. One of the reasons farmers cannot maintain the quality and sustain cultivation of aromatic rice is seed quality and availability. To guarantee seed quality and availability, specially that of modern aromatic variety (e.g. NSIC Rc 218), PhilRice stations nearest existing and potential production areas should sustain and maintain its production and commercialization. The NRP and the Rice Competitiveness Enhancement Fund (RCEF) Seed Program can also consider making certified seeds of this variety available in specific regions specializing in aromatic rice such as MIMAROPA.

With regard to postharvest practices, proper drying is essential to maintain the aroma and achieve better milling recovery. If weather permits, sun drying is still the best option. Best drying practices such as using the right thickness of paddy layer (i.e., not more than 4 inches thick) and frequent stirring (i.e., every 30 minutes) are recommended. Most mechanical dryers using biomass or petroleum as fuel are not recommended as this leaves a smoky odor that could mask the *pandan* scent of aromatic rice. Electric mechanical dryers can be an alternative if such shared facility is available because this can accommodate a bigger volume to reduce cost. Moreover, the storage facility should ensure appropriate temperature and humidity not only to maintain the recommended moisture content of 12-14% but also to preserve the aroma. Most preferably, aromatic rice should be stored in paddy form for a shorter storage period than ordinary rice.

To widen the demand base and ensure affordable price, blending of aromatic rice with ordinary white rice is recommended to cater to specific preferences of consumers. This includes an optimum mixture of aromatic and ordinary rice varieties. This blend of rice should come with truthful labeling for fair and transparent disclosure of rice quality. PhilRice, through its Rice Chemistry and Food Science Division (RCFSD), can assist in determining this optimum blend.

***Glutinous rice***

Glutinous rice has a modest share of 6% to the total SR area in the country, estimated at 26,000 ha. At an average yield of 3.09 t $ha^{-1}$ and with an average milling recovery of 50%, the estimated local supply of glutinous rice (milled equivalent) is about 41,000 t $year^{-1}$. Though glutinous rice is commonly planted by farmers throughout the country in a small portion of their farms like in Iloilo, it is regularly planted on a bigger scale in Camarines Sur and Abra. Some farmers in these provinces specialize in the production and marketing of glutinous rice. The production area of glutinous rice is usually irrigated, which can be planted twice a year. However, in spite of the presence of modern glutinous varieties, traditional glutinous ones such as *Gurong-gurong*, *Waray*, and *Pilit* are more popularly used.

On the other hand, the import volume of glutinous rice amounts to 94,000 t, which can be broken down into milled glutinous rice (70,000 t); glutinous rice flour (23,000); and rice cake and porridge mix (less than 600 t). Thus, total supply of glutinous rice in the country is approximated at 135,000 t. The Philippines commonly imports glutinous rice from Vietnam and Thailand.

On the consumption side, demand for glutinous rice was assumed to be 50% of the total use for processing, noting that it is commonly used for manufacturing rice-based food products. However, it is also recognized that other rice-food products may also use non-glutinous rice. Given that the 4%

of total rice utilization is accounted for by the processing use (PSA, 2020), the estimated processing demand for glutinous rice is 246,000 t. On top of this, the seed requirement is about 1,300 t (milled equivalent). Thus, total demand for glutinous rice is estimated at 247,000 t annually. Glutinous rice generally flows from its main production area in Camarines Sur toward the main market areas in CALABARZON and Metro Manila, particularly in Binondo where it is commonly traded.

The lower amylose content (AC) of glutinous rice dictates its soft, waxy, and sticky texture. Grain quality analysis shows that the Philippines' glutinous variety (such as *Gurong-gurong*) has lower AC compared with imported samples collected from Thailand. Moreover, the yield of local glutinous is also higher and consequently production cost per kilogram is lower than imported ones. These show the competitiveness of local glutinous rice relative to imports. Given the big gap between supply and demand for glutinous rice, there is a high potential of expanding this industry.

The following outlines the specific recommendations to enhance the glutinous rice industry in the country. First, seed supply of glutinous rice is vital. The unavailability of certified/pure seeds of modern/traditional glutinous variety in the formal seed system is identified as the key problem in sustaining production of glutinous rice and maintaining its quality. PhilRice stations nearest the identified production area should produce foundation and registered seeds of modern glutinous varieties (NSIC Rc 21 and Rc 31). Farmers' access to these seeds can be enhanced through the Next Gen Project's Participatory Variety Selection by demonstrating cultivation of glutinous varieties and giving seed starter kits in specific production areas (e.g., Camarines Sur).

In terms of production area expansion, glutinous rice can be promoted as a viable alternative to ordinary rice due to its premium price. With better returns, farmers who just allocate a small portion of their area to glutinous rice may opt to venture on a bigger production scale. They may be able to shift from subsistence to market-oriented farming. A feasibility study for a 10-hectare glutinous rice farm is available for reference.

Maintaining the purity of glutinous rice is also vital to provide consistent quality desired particularly by institutional buyers. To do this, glutinous rice farmers must have access to dedicated postharvest facilities (e.g., dryer and rice mill) to avoid mixing with ordinary rice.

*Pigmented rice*

Of the two pigmented rice, red rice has the higher share to total SR area harvested. It accounts for 20% or 96,000 ha annually. With an average yield of 2.2 t $ha^{-1}$ and a milling recovery of 63%, the locally produced red rice is estimated at 134,000 t per year. Red rice is commonly produced in rainfed upland areas, particularly in North Cotabato, Samar, and Bukidnon. Red rice is mostly traditional varieties and can be planted only once a year.

On the other hand, black rice comprises only 1% of total SR area harvested, amounting to 3,100 ha. With an average yield of 3.0 t $ha^{-1}$ and a milling recovery of 54%, the annual local supply of black rice is estimated at 5,000 t. A big concentration of local production of black rice is found in Negros Occidental where it is cultivated in irrigated areas twice a year. There are no known imports of pigmented rice in the country, but this may be small if there is any.

As to the demand side, consumers of pigmented rice are assumed to be coming from the upper middle to rich classes, just like in the case of aromatic rice. This is attributed to the health-promoting properties of pigmented rice, which are commonly given premium by such consumers. It is assumed that 15% of this group of consumers procures red rice. Given a per capita consumption of red rice at 74 kg $year^{-1}$, its food demand is estimated at 57,000 t. Additionally, the seed requirement (milled equivalent) is around 5,000 t, making total demand for red rice at 62,000 t. Red rice is commonly demanded in the Islamic areas of Lanao del Sur and Maguindanao where people are historically adapted to its taste and texture as table rice. It also reaches the provinces of Misamis Oriental and Bukidnon and is commonly sold to consumers who wish to have better and healthier diet.

Black rice is consumed less as table rice compared with red rice, but it is also used to produce rice-based food products. Thus, it is assumed that only 5% of the upper middle to rich income group in the country purchase black rice. On average, per capita consumption for black rice is about 47 kg $year^{-1}$, translating into an annual food demand of 12,000 t. Due to the small area planted to black rice, the seed requirement is minimal at 150 t. Thus, total demand for black rice is merely 12,150 t. Black rice is commonly marketed in big supermarkets in Metro Manila and other urban areas. In particular, there is a large market found in Bacolod City.

Aside from the domestic demand, both red and black rice are demanded internationally as their nutritional benefits and other alternative uses become widely known. The common export destinations for these SR are Singapore, Hongkong, Malaysia, Macau, Dubai, Europe, USA, and Canada. In the Philippines, the group of Bios Dynamis has experience in exporting pigmented rice (see Chapter 13).

Quality wise, local pigmented rice is comparable with and sometimes better than the pigmented rice produced in neighboring countries. In terms of health-promoting properties such as anthocyanin and phenolic content and antioxidant activity, the Philippine pigmented rice are comparable with, if not better than, the samples of pigmented rice collected from Thailand. Given that the cost of producing pigmented rice in the Philippines is comparable with that in Thailand, its better nutritional properties can be an advantage. This implies that the pigmented rice industry in the Philippines can be developed for export.

The following outlines the specific recommendations to improve the pigmented rice industry in the country. First, aside from increasing productivity, the feasibility of organic pigmented rice production must also be explored and enhanced (if already existing) to acquire a premium price. Support to existing and prospective organic black rice producers must be provided through 1) training on the production of organic pesticides and fertilizers; and 2) development of simple machinery to lessen the huge labor requirements of producing such chemicals.

In terms of increasing the demand for pigmented rice, a unique way to market it in the country is to promote it as an "artisan" product. This could be done to some of North Cotabato's red rice and black rice from Negros Occidental, which are grown in a unique traditional way, besides promoting their extremely good glutinous characteristics and health-promoting properties (see Chapter 9). This should be accompanied by excellent packaging and labeling where the assistance of DOST and DTI is most needed.

Moreover, value-adding opportunities for pigmented rice may include the following: 1) develop it as food supplements, taking into account its health-promoting characteristics; 2) explore its use as a natural food colorant; and 3) cultivate it as an organic rice. Moreover, although not yet practiced in the Philippines, a geographic indication system should be applied to pigmented rice that possess qualities and acquire a reputation due to its origin or place of original cultivation. As such, the product will command a higher price relative to those whose origin is not specified.

## Recommendations for subsistence SR production

Aside from market-oriented SR production, another important component of SR supply is subsistence farming. Should this type of SR producers venture into commercial farming, the following strategies are recommended.

### *Seed supply*

To guarantee seed quality and availability of traditional varieties, seed multiplication of purified traditional SR varieties should be sustained through a community seed bank (CSB). The CSB is a repository of local seeds that facilitates seed exchange among community members (Vernooy et al., 2017). PhilRice, in collaboration with the Agricultural Training Institute (ATI), must conduct training on seed purification and multiplication among SR farmer groups or cooperatives. This will maintain the purity of the seeds that are endemic to the community. In addition, PhilRice must see to it that these seeds are also deposited and conserved in the PhilRice Genebank aside from the CSB.

### *Crop management*

Traditional crop management practices that are still productive must be maintained to preserve the cultural significance of SR. However, small machines (e.g., micro-tillers, panicle threshers), which can be locally fabricated, should be promoted to enhance SR production.

### *Demand development and marketing strategy*

To enhance the market potential of SR, the following strategies should be explored. First, an “artisanal” rice market should be developed to add premium to some SR varieties that are grown in a unique traditional way by the local people. This should be done along with DOST- and DTI-assisted packaging and labeling. Second, SR can be incorporated as a vital component of culinary tourism to promote its consumption and consequently increase demand. Third, rice branding should be explored to popularize the uniqueness of locally produced SR (e.g., Apayao aromatic rice). Lastly, organic production of SR should be considered to add value.

## General recommendations

### *Supply expansion*

Seed supply

In SR production areas using traditional varieties, PhilRice can assist in seed purification and multiplication. Whenever available, starter seed can be initially sourced from the PhilRice Genebank through its Genetic Resource Division (GRD). In partnership with the concerned local government unit agriculture office and the corresponding DA-regional field office, seed multiplication of purified traditional aromatic varieties can be sustainably carried out through CSB. This will maintain the purity of the seeds that are endemic to the community. However, farmers must be trained on proper seed management and purification. PhilRice, in collaboration with ATI, must conduct training on seed purification and multiplication among SR farmer groups or cooperatives.

Crop management

SR may be planted in either favorable or upland ecosystem. For varieties planted in favorable environments, *PalayCheck*, an integrated crop management system, can still be followed. For SR varieties that are more prone to pest and disease damage, integrated pest management (IPM) may be given focus to minimize reliance on pesticide use. In other ecosystems that are unfavorable, specific management practices that are applicable (e.g., seeds, pest and disease management, etc.) can still be recommended and promoted. The upland rice crop management system developed by PhilRice, through its former project, the Upland Rice Development Program (UPRDP), should also be promoted.

Area expansion

Expanding the production area for SR is recommended in provinces near the major markets (e.g., Oriental Mindoro and CALABARZON for Metro Manila; Bohol for Cebu; Davao region for Davao City), where the opportunity cost of land is relatively higher, making the cost of producing ordinary rice more expensive. Shifting to SR production can provide better returns compared with ordinary rice due to the former's premium price. It should be facilitated by the local agricultural office, from the RFO down to MAO.

Drying

Rice experts on milling and drying recommend sun drying (weather permitting) as the best option for drying paddy to maximize milling recovery. However, farmers seem to either over/underdry their paddy resulting in low milling recovery. Proper sun drying in terms of thickness of paddy layer to be dried and proper frequency of stirring must be disseminated to farmers. This should be included in the farmers' training modules. In addition, shared drying facility must be encouraged for maximum use.

Organize SR farmers

It is recommended that SR farmers be organized into cooperatives to achieve economies of scale and enable them to engage in business transactions particularly with institutional buyers. Studies show that individual small farmers cannot tap this market because they do not have a business personality (e.g., cannot issue official receipts). ATI can train them through Farm Business School (FBS) and their technical capacity strengthened through Farmer Field School (FFS). When farmers are organized, they can be easily linked to institutional buyers through contract growing schemes.

Contract growing

One option to enhance large-scale production of SR is a contract growing arrangement that directly links farmers to the market. However, this involves a lot of planning, aside from the need for financial capital and an assured market for the product. This needs assistance from DA-AMAS or DTI for initial implementation, after which the private sector could take over.

Create database of farmers/suppliers

A database of farmers/suppliers who produce SR should be created by the DA in partnership with the concerned LGU agriculture office for easier monitoring of supply. This will include information on area planted and yield. The database of seed recipients of various DA programs related to seed distribution can be the starting point to locate producers of modern SR. Later on, this database can be enriched with a list of traditional SR producers as information become available. Furthermore, ICT application should be explored to create a system by which SR producers could easily be located to facilitate easy market linkages.

***Demand development and marketing strategies***

<u>Create database of institutional buyers</u>

There is no reliable directory of institutional buyers such as hotels, restaurants, food manufacturers, and supermarkets in the country that could be easily accessed by SR producers. Similarly, the country has no database of importers and exporters from other countries. To tap this very important market for SR, the above information should be accessible to SR producers, not only for digital marketing but also for the regular system of marketing. Thus, a database of institutional buyers and importers and exporters of SR should be developed. This directory should be easily accessible to both producers and consumers for faster and more efficient market linkages. DA-AMAS should also facilitate the creation of a directory of institutional buyers (e.g., rice-based food product (*kakanin*) processors, food manufacturers such as White King, supermarkets, and hypermarkets) of SR and connect this with the producer database to create a digital platform for electronic trading

<u>SR as part of culinary tourism</u>

It is recommended to explore food as a vital component of culinary tourism. Making special products from glutinous rice for the tourists' dining-out experience or as "pasalubong" can be one way of promoting consumption and consequently increasing demand. Some examples of these are the *Royal Bibingka* of Ilocos Sur, *suman* of Bulacan, and *bibingkang kanin* of Nueva Ecija. These can be further developed for the export market. Aromatic rice may be promoted in restaurants. Pigmented rice, because of its color and nutritional properties, could also be promoted for culinary tourism, especially in regions where they are produced. The creation of special or unique menus using pigmented rice should be encouraged. Food enthusiasts would be delighted to try them because of their uniqueness compared with ordinary white rice or other products. In addition, travelers are known for bringing home special products from their trips. Hence, small packages of pigmented rice that are unique in the locality can be marketed through native delicacy stores and duty-free shops that are accessible to both local and international travelers. This should be coordinated or initiated by the Department of Tourism (DOT).

Local and international trade fairs

The unique quality of local SR varieties should be promoted to boost consumption and utilization of these types through trade fairs organized by DA-Agriculture and Marketing Assistance Service (DA-AMAS). It should also facilitate the creation of a directory of institutional buyers of aromatic rice and connect such with the producers' database to create a digital platform for e-trade. Government agencies may join the promotion efforts by using aromatic rice as tokens for different events.

The participation of SR producers in international trade fairs should be encouraged and sponsored by DTI to enable them to showcase their produce. This will not only promote the marketing of SR but also expose the farmers to other products that they could produce or market. They can learn a lot on how to advertise their products.

Vacuum-sealed packaging

To lengthen shelf-life and maintain the unique and premium characteristics of SR, vacuum-sealed packaging is recommended. The Department of Science and Technology (DOST) can provide assistance on improved packaging coupled with truthful labels. Consider smaller packaging (2 or 5 kg) to emphasize unique branding and encourage consumers to buy. It will be a good option for new and potential consumers who would like to try the product if they are available in small handy packages. Travelers who are conscious of their luggage weight will opt for smaller packages too.

***Value addition***

Product development should be pursued to identify and create new viable products that would source out raw materials from local producers and hence, benefit them with higher income. Examples of new SR value-adding opportunities may include functional foods, nutraceuticals, ethnopharmacology -based products, and beauty and personal care items. R&D projects can be funded by private entities (e.g., Universal Robina Corporation, Nestle Philippines, Bench, Oryspa, etc.) and implemented by public research/academic institutions (e.g., PhilRice, DOST-RDI, SUCs). Farmers may opt to cultivate SR as an organic rice to increase its value. Additionally, as earlier discussed, a geographical indication (GI) system may be put in place. This should be applied to SR that possess qualities and reputation that are due to its origin or where it was originally cultivated. In this case, SR could have a premium price advantage relative to ordinary white rice.

***RD&E directions***

Strengthening the RD&E thrusts on these three major facets — breeding, genetic resource preservation, and extension — would undeniably contribute to the overall development of the SR industry. Fundamentally, breeding efforts should be well-supported and sustained, albeit at a smaller magnitude compared with the other breeding objectives. For all SR types, it is recommended that focus be given to improving existing varieties rather than developing new ones. Improvement of existing SR varieties would ensure that the current widely used varieties will be given priority and thus shorten the breeding process toward achieving higher yields but still maintaining the preferred characteristics of both producers and consumers.

Another thrust that should be emphasized is the continuous genetic resource preservation of SR (both traditional and modern varieties) at the PhilRice Genebank. Regular and reliable collection of these SR genetic resources would not only guarantee breeding parents but also safeguard the material culture of the Philippine rice farming landscape. Moreover, depositing these SR materials in the Genebank would entail routine characterization of their agromorphological characteristics, thereby documenting how these genetic resources differ from or match those already stored.

***Policy directions***

To create an enabling environment for the SR industry, the following policies should be put in place and advocated. First, the Bureau of Agriculture

**Table 15.1.** Summary of recommendations for all SR types.

| Recommendation | Aromatic | Gluti-nous | Pigmented | Concerned institution/s |
|---|---|---|---|---|
| **Supply expansion** | | | | |
| Formal seed system for modern SR varieties | ✓ | ✓ | ✓ | PhilRice, DA-RFOs, LGU-agriculture offices |
| Community seed banking for traditional SR varieties | ✓ | ✓ | ✓ | PhilRice, DA-RFOs, LGU-agriculture offices, ATI |
| Promotion of *PalayCheck* for SR varieties planted in favorable ecosystems | ✓ | ✓ | ✓ | PhilRice, DA-RFOs, LGU-agriculture offices, ATI |
| Promotion of upland rice crop management system for SR varieties planted in unfavorable ecosystems | ✓ | ✓ | ✓ | PhilRice, DA-RFOs, LGU-agriculture offices, ATI |
| Best practices of drying and storage to maintain unique and premium characteristics | ✓ | ✓ | ✓ | PhilRice, DA-RFOs, LGU-agriculture offices, ATI |
| Community access to dedicated postharvest facility | | ✓ | ✓ | DA-RFOs, LGU-agriculture offices |
| Area expansion for SR production | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices |
| Organic pigmented rice | | | ✓ | Organic certifying bodies |
| Organization of SR farmers | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices, DA-AMAS, DTI, PhilRice |
| Contract growing arrangement | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices, DA-AMAS, DTI |
| Creation of database of SR farmers/suppliers | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices, DA-AMAS, DTI, PhilRice |
| **Demand development and marketing strategies** | | | | |
| Blending with ordinary white rice | ✓ | | | PhilRice |

*Table 15.1. Continuation.*

| Recommendation | Aromatic | Glutinous | Pigmented | Concerned institution/s |
|---|---|---|---|---|
| Artisanal pigmented rice | | | ✓ | DOST, DTI, PhilRice |
| Promotion of SR as part of local culinary tourism | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices, DOT, DTI, PhilRice |
| Promotion through local and international trade fairs | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices, DA-AMAS, DTI, PhilRice |
| Creation of database of SR institutional buyers | ✓ | ✓ | ✓ | DA-RFOs, LGU-agriculture offices, DA-AMAS, DTI, PhilRice |
| Vacuum-sealed packaging | ✓ | ✓ | ✓ | DOST, PhilRice |
| **Value addition** | ✓ | ✓ | ✓ | PhilRice, DOST, DTI |
| **RD&E directions** | | | | |
| Breeding efforts to improve existing varieties | ✓ | ✓ | | PhilRice, IRRI |
| Breeding efforts to increase yield and improve grain quality | | | ✓ | PhilRice, IRRI |
| Continuous preservation through genebank | ✓ | ✓ | ✓ | PhilRice, IRRI |
| Extension strategies | ✓ | ✓ | ✓ | PhilRice, DA-RFOs, LGU-agriculture offices |
| **Policy directions** | | | | |
| Truthful labeling | ✓ | ✓ | ✓ | DA, DOST, DTI |
| Institutionalization of system for application and awarding of geographic indication | ✓ | ✓ | ✓ | DA, IPOPhil |
| Standardization and institutionalization of organic certification process | ✓ | ✓ | ✓ | DA, Organic certifying bodies |
| Linkage of IP SR producers to NCIP | ✓ | ✓ | ✓ | DA, NCIP |

and Fisheries Standards (BAFS) should establish grain standards for SR to provide stringent criteria in classifying SR and ensuring quality for consumers consistent with international commitments. Compliance to the standards should be regulated by DTI. Second, truthful labelling should be strictly enforced by DTI for fair and transparent disclosure of rice quality. PhilRice through RCFSD can assist in determining this optimum blend of SR varieties. Third, the GI system in the country must be institutionalized and should be developed by the Intellectual Property Office of the Philippines (IPOPhil) to recognize the distinct origins of SR, protect consumers and legitimate producers, and uphold unique characteristics inherent to the Philippine SR. Securing GI approval will accord premium prices for the products, resulting in higher farm income. Fourth, the organic certification process should be reviewed, given its costliness and complexity. Simplifying and reducing cost will encourage organic farming. Fifth, resolutions and ordinances on serving SR in fast food establishments, restaurants, and dining places should be crafted and implemented to boost the SR industry. Lastly, data collection of pertinent information (e.g., area planted, yield, price, import, export, suppliers, and users) should be institutionalized to establish a database that is accessible and useful to SR industry stakeholders.

Overall, the summary recommendations to enhance the SR industry in the country is presented in Table 15.1.

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