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FULL PAPER

Assessing the Profitability of Glutinous Rice Production in the Philippines

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Rice trade liberalization has negatively affected the income of Filipino rice farmers, and this could provoke them into reducing their rice cultivation. Production of glutinous rice, which has progressing demand at local and international levels, could be an alternative for farmers to keep their rice farming enterprise viable. However, there have been very few interventions to increase its yield level and local production. This could be linked with the limited information and data about its production dynamics, marketing, and full potential. Hence, this paper assessed the potentials and profitability of glutinous rice production in the Philippines. A total of 93 farmers were selected through multi-stage random sampling and interviewed in the provinces of Camarines Sur, Iloilo, and Abra. Descriptive statistics and costs and returns were used for data analysis. Results showed that local glutinous rice production is profitable with positive net returns in all sites. Return on investment ranges from 15 to 29%. Findings pointed out that the current local glutinous rice industry has a high potential for expansion and opportunity for import substitution. Strategies for yield enhancement, production cost reduction, and premium quality preservation are recommended.

Keywords: costs and returns, import substitution, glutinous rice, profitability, specialty rice

INTRODUCTION

In 2019, the Philippines shifted to open trade policy when its import quota system was replaced with tariff through the enactment of the Republic Act 11203 commonly known as the Rice Tariffication Law (RTL). This setup permits the entry of cheaper imported rice (*Oryza sativa* L.) in the country that resulted in adverse repercussions to local farmers (Briones 2021). The buying price of dry paddy per kilogram (kg^{-1}) hit a record low of 0.33 USD (Php 16.47) the lowest average price since 2014 (PSA 2021). Farmers who are selling wet paddy have experienced even worse. The lower buying price of paddy is an expected result of this policy (Piadozo 2010) but was aggravated by price and supply speculations. Furthermore, it has been projected that in three to five years of RTL implementation, local rice production and area harvested will decline by 9.7% and 7.2%, respectively (Perez and Pradesha 2019). An expected recourse of smallholder farmers is to either shift their production to other enterprises or diversify their farming system to recover incurred losses (Corpuz 2020).

This predicament of the local farmers is a consequence of the country's rice production system being uncompetitive. Bordey et al. (2016) found that due to high production costs, local rice marked at a higher price relative to the produce of other Southeast Asia (SEA) countries. This puts local farmers at a disadvantage since consumers will naturally patronize cheaper with same quality rice (Balakrishnan et al. 2000). To address this situation that worsened with the entry of cheaper rice imports, local producers should find ways to lower their production costs. On one hand, the government under the RTL initiated budget allocation for the Rice Competitiveness Enhancement Fund (RCEF), envisioning that through this intervention the country can position its rice production at par with other SEA countries (Balié et al. 2020). Meanwhile, some scholars are looking into the other side of the RTL. Trade liberalization could be considered double-edged; it exposes the local market to imported goods but at the same time opens opportunities for exports albeit small and niche markets (Gaglio 2017). In line with the Department of Agriculture's (DA) export promotion thrusts, local farmers can take advantage of the globally growing demand for specialty rice (SR) to keep their rice farming enterprise viable. SR are unique rice varieties with characteristic aroma, kernel color, and chemical composition which make them easily distinguishable from ordinary white table rice. SR, known for their good eating qualities, health benefits, industrial uses, and high market value, are regarded as among the world's superior goods (Chaudhary et al. 2001). They have different lens of potentials in terms of production, marketing, pricing, and competitiveness vis-à-vis ordinary white rice (Chaudhary et al. 2001).

One of the types of SR that the local farmers can highly consider is glutinous rice (GR), also known as sticky or waxy rice. This rice is commonly cultivated in south, east, and SEA, concentrated in the Indochina Peninsula (Sattaka 2016 and Yamanaka et al. 2004). Also considered "GR zone", the center of its biodiversity is Lao PDR (Isvilanonda 2013). In milled form, GR is unique and distinguishable from ordinary white rice because of its opaqueness. When cooked, GR has a sticky texture because of its very low to nil amylose content (AC) and high concentration of amylopectin (Chung et al. 2010).

GR has different cultural and ethnic uses (Yamanaka et al. 2004). In some countries, it has been used as an ingredient for food and beverage processing, while in Lao PDR and the northern part of Thailand, it is their table rice (Gnanamanickam 2009; Juliano and Villareal 1993; and Golomb 1976). Some notable delicacies of GR are now gaining worldwide popularity such as *mochi* of Japan and *tteokbokki* of Korea.

In the Philippines, GR is locally known as *malagkit* or *pilit*, it is an important staple food in the country's cuisine and culture. It is commonly used in a variety of traditional dishes and desserts such as various forms of rice cake or *kakanin* and hot soup dishes, while some indigenous groups use this as the main ingredient for making rice wine or *tapuy*.

In the Philippine culture, GR is often associated with special occasions, such as weddings, feast days, and other celebrations. It is also a symbol of unity and prosperity, as it is often shared among family and friends during festive gatherings (Relado-Sevilla et.al. 2020).

The local popularity of GR and its products is undisputed as 73% of Filipinos are fond of them (Ballesteros and Abilgos-Ramos 2019). Accordingly, the commercial and household demands for GR increased with the rise of income and growth in population (Chaudhary 2003). Notably, the progress in sticky rice-based products processing industry is putting pressure on the GR production capacity of the country.

Among all SR types in the country, GR has the smallest estimated area at 26,000 ha accounting for only 6% of the total area devoted to SR in the country. At an average yield of 3.09 t ha^{-1} at 14% moisture content (MC) and with 50% milling recovery, the estimated local GR production is 41,000 t per year only. On the contrary, GR is the most common SR type in Filipino households; for the institutional market, it is most in-demand (Mataia et al. 2020). This is for the reason that GR is assumed to account for 50% of the total rice used for processing. Given that 4% of total rice utilization is for processing (PSA 2021), this would translate to a 246,000 t requirement. Moreover, the seed requirement is about 1,300 t (milled rice equivalent). Overall, the estimated demand for GR is 247,000 t annually, which includes the needs of farmers, households, and food processors.

This dire shortage of GR in the country has pushed the stakeholders to import from Vietnam and Thailand. The Bureau of Customs (BOC) reported 23,700 t of imported GR in 2019. Years earlier, Tridge (2016) reported the country has ranked 22nd in terms of GR import volume. The estimated imported volume of GR is around 94,000 t, comprised of milled rice (70,000 t), flour (23,000 t), and cake and porridge mix (less than 600 t). This composition of imports points to the growing popularity of GR flour. Mataia et al. (2020) found out that at the industry level, flour is more preferred than milled rice because with it, processors can save time and resources.

However, despite the popularity, high market price, and steadily growing local demand for GR, there have been few and limited interventions to improve its production (Alvaran et al. 2017). This hinders the locals from realizing the benefits of the progressing market of GR and its products. The limited intervention could be linked with the lack of enough information and studies about the production dynamics, marketing, and full potential of local GR. Hence, this research was pursued to fill a portion of this gap. This paper aims to (1) present farm and farmer profiles; (2) describe the current production system and farming practices; (3) examine the productivity and profitability; and (4) provide recommendations to favor the GR industry.

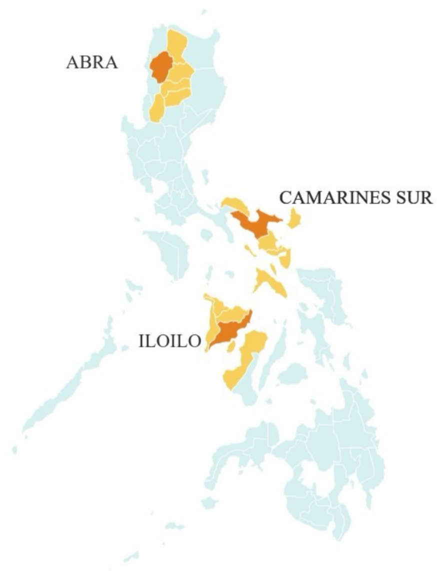

Figure 1. Location of the selected study sites.

MATERIALS AND METHODS

Site selection

Due to limited information about the concentration of local GR farmers, initial site selection was based on the area harvested of traditional rice varieties per province data of the Philippine Statistics Authority (PSA). In 2016, site scanning was conducted to validate the identified area. Scanning activity is composed of site visits, consultations, focus group discussions (FGD), and key informant interviews (KII) in potential target areas. It was indeed found that due to the Filipino's consumption behavior, GR farming is scattered across the country, mostly small-scale (> 0.5 ha), and only for home consumption. Moreover, semi-large-scale production of GR can only be found in limited areas of the country - Camarines Sur in Bicol Region, Abra in Cordillera Administrative Region (CAR), and Iloilo and Negros Occidental in Western Visayas.

Corresponding to high concentration of GR farmers, three provinces and five municipalities were selected as final study sites (Figure 1): Ocampo and Bato in Camarines Sur; Zarraga in Iloilo; and Manabo and Luba in Abra.

Data and collection method

Multi-stage random sampling was engaged in the selection of participants. The initial stage is the selection of representative provinces which is mainly based on the site-scoping results. A series of surveys followed the site scanning: poll survey and farm-level survey. A one-page poll survey questionnaire aided in determining the GR farmers who participate in the market. From the list of identified market-participating farmers, the respondents of the study were selected through the fishbowl method.

Initially, the quota of sample size per province is set to 45 but due to limited number of GR farmers participating in the market, the quota was not met and fewer sample size was realized. A total of 93 farmers were randomly selected and interviewed: 44 from Camarines Sur, 28 from Iloilo, and 21 from Abra. A farmer-respondent must be a GR farm operator, either as owner, lessee, tenant, or mortgagee, and must be selling a percentage of his/her produce. The reference period covered the harvests of 2017.

Primary and secondary data were used in this study. Primary data were gathered through a farm-level survey targeting market-oriented GR farmers. Data collected included quantity of output, input use, costs, prices, and crop management practices. Secondary data from the BOC, DA, and PSA were collected in relation to import-export matters, supply and demand, GR varieties, and assessment of grain quality.

Analytical methods
Descriptive statistics such as measures of central tendency were analysed. All identified outliers from the dataset were removed to minimize variations. A farm budget structure to produce GR in the selected sites was constructed using actual and inputed prices. Relevant cash costs included seed, fertilizer, pesticide, irrigation, machine rental, fuel and oil, transportation, labor (land preparation, crop establishment, care and maintenance, harvesting and threshing, and postharvest). Meanwhile, the non-cash costs considered are the operator, family, and exchange (OFE) labor, the rental value of land, and the interest cost of capital. All were computed on a per hectare basis. Gross revenue was determined as the product of rice yield (after threshing) and the price of wet paddy. Finally, net returns above production cost ha^{-1} were computed using Equation 1 below:

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

where π is net returns, y is rice yield, p is the price of paddy, and x's are the cost items. Using the farm budget structure, the costs of rice production and returns of GR farming were estimated across provinces. To test profitability, the rate of return on investment (ROI) was computed for each province using the Equation 2 below:

$$ROI = \left(\pi \div \sum_j x_j\right) * 100 \quad (2)$$

Scope and limitations
This study faced certain limitations. First, the collected information was based on farmer interviews. Thus, the accuracy of information was affected by the capacity of the farmers to estimate input use or recall total expenditure in GR farming for each cropping season. Second, there was a language barrier during the data collection as some of the enumerators were not fluent in the vernacular of the target sites. Finally, high data variability was expected due to wide variations in rice-growing conditions (*e.g.*, different production ecosystems, farming practices, and farm size, among others) of GR in the country as well as limitations of the sampling method.

Even with these shortcomings, this baseline study is a milestone to fill in the lack or insufficiency of data and studies about local GR production. In addition, this dataset remains the most updated source of information for reviewing the local GR production. Overall, results from this study will be useful for farmers, researchers, and policymakers.

Table 1. Profile of glutinous rice farmers, 2017.

Profile	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/widow	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	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
Farmer Field School/ 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

RESULTS AND DISCUSSION

Farmer and farm characteristics
Generally, GR farmers are in their 50's, married, and have three children (Table 1). They are seasoned farmers and consider rice farming as their primary

Table 2. Profile of glutinous rice farms in Camarines Sur, Iloilo, and Abra, 2017

Characteristics	Camarines Sur	Iloilo	Abra
	n=44	n=28	n=21
Average total rice area (ha)	2.38	1.98	1.3
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	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)	0.6	0.6	0.2
Distance to market (km)	8	4	24
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-vegetables	-	-	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

source of income. They have reached secondary education and most of them own the land they till, while some were tenants or lessees. In Camarines Sur, farmers are equally distributed among males and females, with most being active in attending rice-related trainings. Majority of them are members of farmers cooperatives and associations (FCA), but 41% are not. In terms of capitalization, 46% of them needed to borrow to operate.

In Iloilo, GR farming is dominated by female farmers (79%). Only a minority of 4% are not members of FCA. It has the highest organizational membership among the study areas. Even so, a significant percentage (48%) of farmers have not attended any rice-related training. They are the most financially independent with only 30% farmer-borrowers.

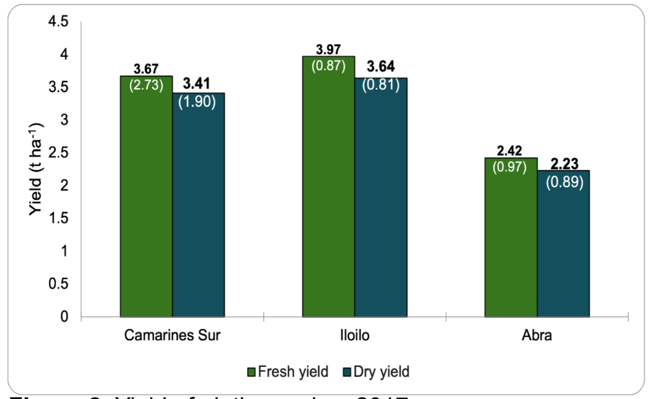

Figure 2. Yield of glutinous rice, 2017.

GR farming in Abra is male-dominated (57%). Seventy-six percent (76%) of the respondents are members of the *Tingguian* (or *Itneg*) ethnicity – the original inhabitants of the province before the influx of *Ilocano* migrants. Same with Camarines Sur, the majority are members of an organization, but a considerable portion (33%) are not. Consequently, 43% of them have not yet attended any rice-related training. Among the three provinces, Abra registered the highest percentage of borrowing (71%).

In terms of farm profile, the average landholding of all farmer-respondents is larger compared to the national average of 1.29 ha (PSA, 2015). Farm size ranges from 1.30 ha to 2.38 ha, as shown in Table 2. These farms are low in elevation, irrigated, and located near roads. In Camarines Sur, farmers allocated 95% of their landholding (2.21 ha) for GR production. Farms are irrigated by the national irrigation system (NIS) (48%), small-scale irrigation system (SSIS) (32%), and natural water sources (18%). These farms are 8 kilometers (km) away from the market, most have clayey soil, and are adopting the rice-rice cropping pattern.

In Iloilo, only 27% of the landholding (0.26 ha) was allocated for GR production. Farms are 4 km away from the market and have rice-rice-mungbean (61%) or rice-rice (29%) cropping patterns. Only 18% is rainfed and the rest are irrigated by SSIS (29%), NIS (25%), and natural sources (18%). Forty-six percent of the farms have loamy soil while other farms have clayey (21%) or other soil types (33%).

Meanwhile in Abra, 77% of the land area (0.88 ha) was used for GR production. Their farms are located farthest from the market (24 km). They have clayey soil and pursue various cropping patterns in this order: rice-rice (48%), rice-fallow (19%), rice-vegetables and rice- tobacco (both 14%). These are sustained by different irrigation systems. In Luba, water is usually sourced through makeshift diversion canals made by the farmers themselves; in Manabo, an extensive communal irrigation system (CIS) irrigates almost the entire valley. However, during the period of this study, the Manabo irrigation system was badly damaged, depriving many farmers of water.

Yield, Paddy Price, and Gross Revenue

Figure 2 pictures the average yields across the three provinces. Camarines Sur registered a low yield of 3.70 t ha^{-1} with a dry equivalent at 14% MC of only

Table 3. Material input use in glutinous rice production, 2017.

Item	Camarines Sur (n=44)		Iloilo (n=28)		Abra (n=21)	
	Mean	sd	Mean	sd	Mean	sd
Seeds (kg ha^{-1})	109	24.43	68	28.26	71	29.67
Inorganic fertilizers (kg ha^{-1})						
Nitrogen	74	30.8	87	49.31	77	36.91
Phosphorous	11	5.49	11	7.7	20	6.87
Potassium	22	13.93	21	33.13	33	10.26
Pesticides (kg ai ha^{-1})						
Herbicide	0.36	0.35	0.65	0.7	0.34	0.23
Insecticide	0.23	0.31	0.37	0.31	0.08	0.07
Fungicide	0.28	0.09	0.03	0.09	0.06	0.25
Molluscicide	0.11	0.12	0.13	0.14	0.15	0.15
Rodenticide	0.02	0.05	0.02	0.11	0.08	0.15

Table 4. Labor use in glutinous rice production, 2017.

Item	Camarines Sur (n=44)		Iloilo (n=28)		Abra (n=21)	
	Mean	sd	Mean	sd	Mean	sd
Hired labor (md ha^{-1})						
Land preparation	13.15	9.3	8.36	6.74	7.37	7.03
Crop establishment	3.54	3.41	1.77	1.78	15.37	6.32
Crop care and maintenance	3.95	4.16	4.82	4.5	2.13	2.14
Harvesting and threshing	18.05	7.95	8.84	5.95	14.16	6.44
Post-harvest labor	6.2	5.12	2.62	2.32	2.51	1.82
OFE labor (md ha^{-1})						
Land preparation	2.38	2.54	4.04	5.07	6.62	6.04
Crop establishment	0.94	0.84	1.29	2.27	7.3	4.71
Crop care and maintenance	6.61	5.03	6.69	6.88	7.3	4.41
Harvesting and threshing	0.07	0.45	0.29	1.51	2.37	2.14
Postharvest	-	-	1.21	1.63	0.49	0.8
Total labor (md ha^{-1})	54.88	22.28	39.92	15.21	65.63	6.06

3.40 t ha^{-1}, an account of destructive typhoons. Fresh paddy was sold at 0.30 USD kg^{-1}. Yield and paddy price generated an average gross revenue of 1,125.28 USD ha^{-1}.

Iloilo's average yield was 4.0 t ha^{-1} with a dry equivalent of 3.6 t ha^{-1}, at par with the national average of 4.01 t ha^{-1} (Litonjua 2019). During the covered cropping season, pest and disease problems were encountered that could have pulled down the yield level. Volume harvested was sold at a price level of 0.30 USD kg^{-1} that earned a gross revenue of 1,175.22 USD ha^{-1}.

Abra registered a low average yield of 2.40 t ha^{-1} with a dry equivalent of 2.20 t ha^{-1} after typhoons hit the place. Prevalent fresh paddy price was 0.44 USD kg^{-1} that jacked up the farmers' average gross revenue to 1,048.50 USD ha^{-1}.

Input use and management practices

Seeds and Varieties

Different varieties of GR are being cultivated in the three provinces. For Camarines Sur, the dominant varieties are *Pulutan* (66%) and *Gurong-gurong* (23%), both maturing in 121 days. *Pulutan* is favored by farmers because of its high yield and resistance to pests and diseases. Other varieties are *Burdagul*, *Laguna*, and *R5*. Farmers set aside portion of their own use or for exchange. The seeds are direct-seeded on wet bed at a rate of 109 kg ha^{-1} (Table 3).

Almost all Iloilo farmers plant *Pilit* that matures in only 93 days. The farmers are no strangers to its tenderness, delicious taste, and high market demand. *Pilit red* and *Tapol* are the other GR varieties they cultivate. Seeds are commonly procured from co-farmers and are planted through manual wet direct seeding at a rate of 68 kg ha^{-1}.

Waray is second to no other variety in Abra with 91% of the farmers planting it despite its maturity of 140 days. They take pride in this heirloom variety, professing that it is unrivaled in terms of its stickiness and excellent eating quality. Moreover, it is hardy and resistant, being able to withstand strong winds, rains, and pests. This makes threshing more difficult because grains are firmly attached to the panicles. Maintaining the purity of *Waray* is a particular concern of *Tingguian* farmers. They 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. They randomly transplant 20-day-old seedlings at a seeding rate of 71 kg ha^{-1}.

Across the sites, GR farmers used only saved seeds. This practice sits well with the low volume of certified GR seeds in the market, despite having five modern GR varieties approved by the National Seed Industry Council (NSIC) for commercialization. Farmers hardly adopt these NSIC-approved varieties as they plant only a small portion of their land for home consumption. Since they do not consider GR as a commercial product, they have little economic

Table 5. Costs and returns of glutinous rice production, 2017.

ITEM	Camarines Sur (n=44)		Iloilo (n=28)		Abra (n=21)	
	Average	sd	Average	sd	Average	sd
Returns						
Yield (kg ha^{-1})	3,671	870	3,967	2,073	2,422	967
Paddy price (USD kg^{-1})	0.30	0.02	0.300	0.030	0.44	0.06
Gross revenue (USD ha^{-1})	1,125.28	294.7	1,175.22	738.52	1,048.50	443.62
Costs (USD ha^{-1})						
Seeds	59.46	21.88	31.44	18.44	34.68	17.31
Fertilizers	140.36	44.20	124.8	75.3	165.24	48.98
Chemicals	53.48	34.64	82.52	45.84	39.20	19.64
Non-chemical materials	0.98	5.59	3.54	5.49	0.22	1.05
Hired labor	309.72	93.09	421.84	329.89	230.64	128.38
Operator, family, & exchange (OFE) labor	50.28	36.75	72.9	65.22	101.36	76.02
Land rent	131.62	61.08	191.26	59.26	151.82	52.46
Interest on capital	43.78	31.18	22.26	23.37	16.54	8.17
Other costs*	84.84	23.01	71.28	36.39	106.9	49.04
Total paid-out cost (USD ha^{-1})	673.5	160.54	789.92	439.98	606	447.39
Total cost (USD ha^{-1})	874.5	177.59	1,021.82	448.17	846.46	445.06
Cost per unit (USD kg^{-1})	0.24	0.07	0.26	0.2	0.34	0.15
Net income from rice farming (USD ha^{-1})	250.78	238.04	153.4	183.96	201.86	182.39
Net returns over paid-out costs (USD ha^{-1})	451.78	287.39	385.3	325.97	442.48	254.57
Return on investment (%)	29	28	15	18	24	20

incentive to improve its production by using certified GR seeds. Bordey et al. (2016) reported that the use of certified seeds can enhance production by up to 10%.

Fertilizer and pesticide use

Table 3 details the material input use in glutinous rice production. Farmers have different farming practices resulting in wide variability of their input use. Camarines Sur farmers applied 74 kg Nitrogen (N), 11 kg Phosphorous (P), and 22 kg Potassium (K) ha^{-1} in three splits per season, which is at par with the national average of 2.67 splits per season (Bordey et al. 2016). Complete (14-14-14), urea (60-0-0), and ammonium phosphate (60-20-0) were the common fertilizer grades they used.

Iloilo farmers used both organic and inorganic nutrients, applying a high level of N at 87 kg ha^{-1}. This is one of the probable factors responsible for their high yield as Srisompun et al. (2013) found that proper use of fertilizers is significant in increasing the yield of GR. Fertilizers, mostly complete, urea, and ammonium phosphate, were applied three times per cropping season. Organic fertilizers used were animal manure, vermicompost, and decomposed leaves.

Farmers in Abra applied 77-20-33 kg NPK ha^{-1} thrice per cropping season. Most of them used complete, urea, and ammonium phosphate; others reported using organic fertilizers such as decomposed leaves and concoctions. Pesticide use is also shown in Table 3. Based on the reported pesticides used, weeds were the most common problem in Camarines Sur along with insects, rats, and fungi. Herbicides were applied one to two times per season at a rate of 0.36 kg active ingredient (ai) ha^{-1}. Fungicide and insecticide were also used as preventive measure with rates of 0.28 and 0.23 kg ai ha^{-1}. Certain farmers used molluscicides and rodenticides.

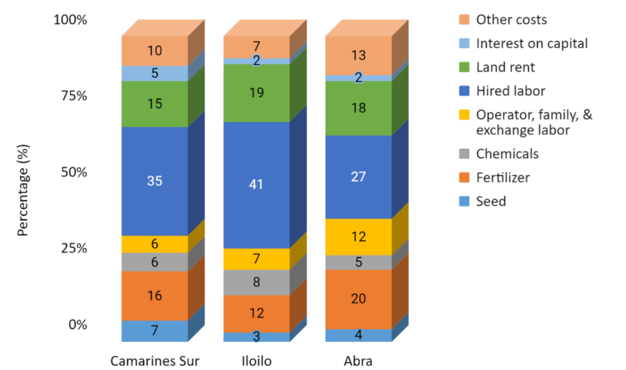

Figure 3. Cost shares (%) in glutinous rice production, 2017.

In Iloilo, insects and weeds are the major pests. Herbicides were applied once or twice per cropping season at 0.65 kg ai ha^{-1}; insecticides at 0.37 kg ai ha^{-1}. About 82% of them faced problems on pests and diseases such as rice bugs, leafhoppers, stem borers, among others. In Abra, only 28% of farmers reported infestation of rice bugs, leafhoppers, and stem borers. This explains why the province has the least application rate of pesticides. This result also supports their claim about the resistance of their *Waray* variety. Nonetheless, weeds and snails are still a problem. Herbicides were applied at only 0.34 kg ai ha^{-1}; molluscicides at only 0.15 kg ai ha^{-1}.

Labor use and mechanization

Rice production is generally labor-intensive, composed of hired and OFE labor (Moya et al. 2016). Hired laborers performed most of the farm activities, about 50% as reported by farmers in the study sites. Table 4 summarizes the labor requirements of GR production across all sites. Observed high variations in the results were due to different sources and types of power used by the farmers.

Total labor use in Camarines Sur was 55 man-days (md) ha^{-1}, with harvesting and threshing contributing the largest share. This implies that the use of manual harvesting and threshing is still predominant in GR farming. This could have been lessened through the use of a combine harvester. Arida et al. (2020) highlighted that the use of combine harvester can lower the labor use and costs for harvesting and threshing by 91% and 86%, respectively.

In Iloilo, 40 md ha^{-1} were devoted for the entire GR production. Both hired and OFE labors were used in the farm activities. Land preparation comprised the biggest percentage, trailed by crop care and maintenance. Manual harvesting and threshing were also large contributors to total labor use.

GR production in Abra is the most labor-intensive with an average of 66 md ha^{-1}. Notably, Abra also registered high md for crop establishment (22.67 md ha^{-1}) and this is because of their transplanting method. Inevitable manual harvesting due the area's terrain also contributed much to total labor use.

Cost and Profitability

Figure 3 shows the percentage share of each cost item while Table 5 presents both the actual and non-cash costs of GR production as well as profits earned. Estimated cost and profit values varied largely due to varying farming management and practices. Hired labor shared the largest cost at 35% in Camarines Sur. The non-cash costs considered were the opportunity cost for capital, land, and OFE labor. This eats up about 23% (Figure 3) of the total production cost of 874.5 USD ha^{-1}. Note that the increasing value of land in the sites is exhibited here through the cost of rent. This increasing value threatens the agriculture sector since farmers can be easier persuaded to sell their lands for non-agricultural purposes (Elauria, 2009; Kelly 1998; Bankoff, 1996).

As discussed in the earlier section, yield level and paddy prices in Camarines Sur resulted in an average gross revenue of 1,125.28 USD ha^{-1}. Subtracting the costs, farmers were able to generate a net income of 248.79 USD ha^{-1}. This venture is deemed profitable with a rate of return on investment (ROI) of 29% ha^{-1}.

In Iloilo, total production cost incurred was approximately P51,000 ha^{-1}, translating to a cost kg^{-1} paddy rice of 0.26 USD. Large contributors to the cost were hired labor (41%), land rent (19%), and fertilizer costs (12%). With these costs, and paddy prices and yield, farmers earned around 160.00 USD ha^{-1} with an ROI of 15%.

Farmers in Abra spent a total of 846.64 USD ha^{-1} for one cropping season. With the high labor use and high prevailing wages, labor contributed the biggest chunk, with non-cash costs sharing 28% of the total cost. One reason for this is the prevalence of OFE labor in this province. Average gross revenue minus total production cost, equals average profit of 201.86 USD ha^{-1} with an ROI of 24%.

To further enhance profitability, farmers may look into the GR varieties with best grain qualities. For example, the premium price of Abra's *Waray* is understandable since based on the grain quality evaluation of Romero et al. (2020), it is the best GR variety the country can offer. It has the lowest AC among their collected and studied local GR varieties. True-to-type GR only has 0-2% AC (Juliano, 1979). Also, *Waray* scored highly in terms of tenderness and opacity. On the other hand, *Gurong-gurong* of Camarines Sur was also cited for having low AC and good grades for opacity, and tenderness; *Pilit* of Iloilo had a high degree of opacity, stickiness, and tenderness. These traits are the significant ones for a glutinous type of rice. Other varieties worth mentioning for their overall good grain qualities are *Sinongsong-Malagkit* and *Miracle*, both from Oriental Mindoro. Future studies could focus on the production dynamics of these two varieties, which are touted as top local GR varieties together with *Waray*.

SUMMARY AND RECOMMENDATIONS

This paper assessed the profitability of GR production in the Philippines. Despite data variability owing to wide variations in GR-growing conditions, this paper still presented insights that could lead to enhancement of the GR industry in the country.

In general, GR farmers are in their middle age, married, have three children, at least reached high school, have many years of farming experience, own the land they till, and consider rice farming as their primary source of income. They have relatively large landholdings that are low in elevation, irrigated, and located near roads. A sizeable proportion of farmers in Camarines Sur and Abra are not members of any farming organization, unlike in Iloilo where almost all are members of FCA. However, just like in Abra, farmers in Iloilo are also not active in attending rice-related trainings. Notably, Abra farmers are also credit-dependent in their operations.

With the results of this study, it is clear that Filipino farmers can benefit from the high local demand for GR if there would be an enabling and conducive environment for import substitution. On one hand, the government through DA could help increase supply by including GR in their programs. For instance, the National Rice Program (NRP) and RCEF-Seed component have not yet included glutinous seeds in their seed distribution. In fact, certified GR seeds are not accessible to all farmers. The unavailability of certified seeds of modern/traditional glutinous varieties in the formal seed system contributes to the deterioration of quality of the locally produced GR. This could be addressed if DA through the Philippine Rice Research Institute (PhilRice) would increase the availability of foundation and registered seeds of modern glutinous varieties.

DA should also look into how they could shift the preference of local farmers from traditional low-yielding to modern high-yielding glutinous varieties. This alone could increase the supply of GR in the country. However, this step should be planned well so that traditional varieties would not disappear and will still be available for the use of future generations.

Breeding of superior varieties should also be considered. Varieties must possess the best traits of traditional ones.

Abra, which takes pride in the unrivaled qualities of its *Waray* variety, should develop its community seed bank (CSB) to increase the availability of its seeds (Miranda 2017). Also, to ensure its preservation, national seed banking should be welcomed by the locals. PhilRice could train the IP farmers to increase their capacity for seed banking (Miranda 2017). Moreover, this variety which was found to have an almost nil percentage of AC could be marketed as an "artisanal" product of the province. However, proper and truthful labeling of products should be established to rationalize better market pricing for the premium variety.

On the other hand, the government through the Department of Trade and Industry (DTI) and DA should not hesitate to spur the demand side by winning support for local produce. The Department of Science and Technology (DOST) together with DA could also modernize our equipment for glutinous flour milling. The output of our local flour mills is inferior to the produce of Thailand and Vietnam.

Moreover, since current production is labor-intensive, machinery should be promoted to farmers like the use of combine harvesters in Camarines Sur and Iloilo. Farmers should realize the advantages of their membership in organizations. FCAs are the primary beneficiaries of the machine and extension components of RCEF. Also, they should be taught about group marketing to have better bargaining power. They can register their cooperatives and acquire business permits so that they could directly and formally do business with institutional buyers, instead of contending with the market intermediaries. In the long run, the cooperatives can venture into seed growing, paddy/milled rice trading, financing, and marketing.

In fulfillment of its new paradigm, DA should promote the commercial-scale production of GR in the country and provide infrastructure and other forms of support. The growing local demand for the commodity is evident in the import volume of GR flour. The DA and its Research and Development (R&D) arms should further incentivize Filipino farmers into treading other pathways toward more competitive rice farming. The opportunities and benefits of the local market for GR and its products should not be reaped by the foreign nationals but by the Filipino farmers.

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