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Assessment of Variants of Organic-Based Rice Production Systems in Negros Occidental, Philippines

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A survey was conducted to determine information needs and assess variants of organic rice-based production among rice farmers in Negros Occidental, Philippines. Survey data were gathered from 199 out of 400 identified organic rice practitioners in the province, which accounts for a > 95% confidence level and 5% of margin of error. Among the respondents, only 20.1% had organic certification from third-party representatives, and 42.2% can be classified under a low-input farming system. Some (21.1%) were in transition for certification or were farmers intending to go into organic certification with third-party representatives. The remaining (16.6%) used organic inputs but were not certified nor in transition for certification. Results also showed that farmers' access to information and technologies was mainly from trainings and seminars facilitated by different organizations through their associations and cooperatives. Many of the farmers had practices based on cultural management, and their organic inputs were farm-produced. The average yield of organic farming systems of farmers in Negros Occidental ranged from 2.76 to 3.21 t/ha. The average net income of farmers was PhP 29 649.32. Well-informed farmers, active farmer associations, and available support from different organizations were among the identified elements of continued organic rice production of farmers in the province. Some of the constraints were low productivity and profit in organic rice farming and problems with market availability.

Keywords: organic agriculture, organic rice farming, rice-based production, third-party certification

INTRODUCTION

The practice of organic farming can be traced back to a group of pioneers in the 1920s who wanted to develop an alternative production method that considers both the existing ecological systems and the well-being of the people (Speiser et al. 2006). Most of the driving forces behind organic agriculture were the non-government organizations (NGOs), private sectors, and local farmer cooperatives that recognized its importance (Maghirang et al. 2011). Before the Green Revolution, Filipinos managed their rice production through their experiences and direct observations (Baustista and Javier 2005). In 1951, chemical fertilizers were introduced, coupled with better rice varieties and irrigation. During the Green Revolution, rice production increased in the Philippines and Asia primarily because of the adoption of modern high-yielding varieties and commercial fertilizers. However, for centuries and before the invention of chemical fertilizers, Asian rice farmers maintained relatively high yields using mineral nutrients produced on the farm (Watanabe et al. 1992). Even without fertilizer, wetland rice yields in the tropics are higher than yields of cereals grown on dryland, partly due to biological nitrogen-fixing (BNF) agents indigenous in flooded soils. Extensive use of insecticides was commonly practiced and even calendar spraying was recommended through the Masagana 99 rice program in the 1970s (Baustista and Javier 2005). Chemical herbicides sprayed before or after weed emergence became common, particularly in direct-seeded fields since the introduction of high-yielding varieties (HYVs) in the 1970s. The harmful effects of chemicals on the environment and human health prompted scientists to develop Integrated Pest Management that controls only harmful insects. Before the 1960s, farmers grew traditional varieties that were often heterogeneous mixtures and that were selected with resistance to insect pests and diseases. Indigenous practices such as the application of concoctions of botanical and inorganic pesticides, removal of infected plants, and practice of various rituals for repelling pests were practiced. Organic agriculture became part of the government policy in the 1990s, brought about by serious environmental problems afflicting the country caused by several series of commercialization, modernization, and industrialization for agriculture conducted in the 1980s to satisfy the domestic demand for food (Maohong 2018).

In 2009, the reported organic production in the Philippines was 52 546 ha, employing around 70 000 producers or farmers all over the country (Maghirang et al. 2011). In 2010, the Organic Agriculture Act or Republic Act (RA) 10068 was enacted in the Philippines to develop and promote organic agriculture in the country. The provisions include research, development, and extension of appropriate, sustainable environment and gender-friendly organic agriculture. Since then, several programs emphasizing the importance and promotion of organic agriculture to local farmers had been implemented. The RA 10068 defines the term 'organic' as a particular farming and processing system and describes it synonymously to 'biological' or 'ecological'. All agricultural systems that promote ecologically sound, socially acceptable, economically viable, and technically feasible production comprise organic agriculture. The law also established a comprehensive National Organic Agriculture Program (NOAP) as a guide in implementing Organic Agriculture (OA) activities. According to Maghirang et al. (2011), organic agriculture was viewed as an additional option to conventional agriculture to feed the world. It was one of the livelihood options being offered to farmers in 2020. In 2019, the Philippines ranked 33rd worldwide with 218 570 ha of organic agricultural land (Willer and Lernoud 2019).

The NOAP cited Western Visayas for being at the top of organic agriculture in 2019 (Momblan 2019). According to previous records, Negros Island Sustainable Agriculture and Rural Development Foundation, Inc., or NISARD was founded in 2005 and became the prime mover in promoting organic agriculture development in Negros Island (Maghirang et al. 2011). The mission of NISARD was to make Negros Island the organic food island of Asia by advocating and promoting organic agriculture across the area. This resulted in the creation of various associations such as the Negros Island Organic Fertilizer Producers Association (NIOFRA), Organic Coffee Producers Association, Negros Muscovado Industry Association (NOMIA), Negros Organic Rice Industry Association (NORIA), and others. Likewise, the local governments and the Department of Agriculture - Regional Field Office (DA-RFO) VI have been active in promoting organic agriculture in Western Visayas (Region VI). In 2008, the local government of Negros Occidental formed an organic agriculture management committee together with Negros Oriental to promote Negros Island as the Organic Food Bowl of Asia (Novenario 2018). Secondary data obtained from DA-RFO VI reported 589 organic rice farmers and 527.49 ha total organic rice area in the region in 2020 with Negros Occidental having the highest number of organic rice practitioners and the largest organic rice area among the provinces in the region. These organic rice farmers include farmers with organic certification from third-party representatives, non-certified organic classified in transition for certification or farmers to go into organic certification with third-party representatives or used organic inputs but were not certified nor in transition for certification, and under low-input farming or those who apply synthetic fertilizer or use pesticides in lesser amounts together with organic inputs. However, farmers who are engaged in Organic Agriculture, even farmers practicing organic-based farming systems in rice, were still estimated at less than 1% of the total rice farmers in the province. To determine variables and identify challenging issues faced by farmers classified under organic-based rice production systems in Negros Occidental, a survey was conducted. Information on rice farmers' existing knowledge and practices under organic rice-based farming systems was also gathered. This information is important in identifying priority interventions for better project design and knowledge sharing that may strengthen government capacity in continuing the development and promotion of organic agriculture not only in Negros Occidental but also throughout the country.

MATERIALS AND METHODS

The study was conducted from January to December 2021 in 22 municipalities and cities of Negros Occidental, Philippines. The DA-RFO VI provided a list of organic rice farmers in the province, which consisted of 400 farmers in total. Only farmers who were still producing rice under organic rice-based production systems or who produced rice under the said system in the year 2020 were interviewed. These included: (1) farmers with organic certification from third-party representatives, e.g. certified by Negros Island Certification Services, Inc. (NICERT) or the Organic Certification Center of the Philippines (OCCP); non-certified organic classified (2) or in conversion as defined by the PNSOA or farmers that gradually reducing the use of chemical inputs to become organic eventually; (3) used organic inputs but were not certified nor in transition for certification; and (4) under low-input farming or those who apply synthetic fertilizer or use pesticides in lesser amounts together with organic inputs. Data were gathered through a survey of 199 out of 400 farmers; this accounted for a > 95% confidence level and 5% margin of error. The sample size was calculated using the formula:

$$n' = n/(1+((z^2 x \hat{p}(1-\hat{p})/(\mathcal{E}^2 N)));$$

where z is the z score, Ɛ is the margin of error set as 5%, N is the population size, and p̂ is the population proportion set as 50%.

A research-made instrument was adopted during the conduct of the survey containing sections on (1) farmer profile, (2) rice farm information, (3) farm assets, (4) crop management strategies, (5) rice productivity, and (6) farmer's perception on organic farming. Descriptive statistics such as frequency counts, totals, and percentages were used to describe survey data. Box plot analysis was used to describe the yield data. For production costs, gross and net income, minimum, maximum, and average values were used to describe the data.

RESULTS & DISCUSSION

Personal and Household Characteristics

Majority of the 199 respondents are male (73.4%), and the rest are female (26.6%) **(Table 1).** Almost all of them are either regarded as old (46.7%) or classified as senior citizens (34.7%), and few are middle-aged (18.6%). Most of them are married (79.4%), some are single (10.6%) and widowed (9.0%), and very few are separated (1.0%). More than two-fifths of the respondents reached secondary education (43.2%), one-third had reached college (33.2%), almost one-fourth had an elementary education (23.1%), and only one had no formal education.

More than half of the respondents have 4 – 6 family members (53.8%), some have only 1 – 3 members (31.7%), and a few have 7 or more (14.6%) family members **(Table 2).** More than three-fourths have 1 – 3 male family members (77.4%), almost one-fifth have 4 – 6 male members (19.1%), a few with more than 7 (1.5%), and very few with no male family members (2.0%) in the household. Most of the households have 1 – 3 female members (80.9%), some have 4 – 6 female members (11.1%), a few with no female (7.5%) family members, and one respondent with more than seven female members. A dependent family member is defined as a child, spouse, parent, or certain other relative who derives all or a major amount of necessary financial support from the farmer respondent. More than half of the respondents have 1 – 3 male dependents (59.8%), one-third have no male dependents (33.7%), and very few have more than three male dependents (6.5%). Almost two-thirds have 1 – 3 female dependents (65.3%). Less than one-third have no female dependent (29.6%), and very few have more than 3 female dependents (5.0%). In most households (71.9%), the husband decides on the rice varieties to be used **(Table 3).** Less than half of the respondents have family members who help in all the farming activities (46.2%). The majority are children who help in farming activities (57.6 – 69.4%), including crop establishment, nutrient management, pest management, and harvesting and post-harvesting activities. Regarding the decision on nutrient management, for the majority, the husband also decides on the type, source, and amount of fertilizer to be used (76.4%).

Filipino rice farmers are aging, and most of the parent farmers do not want their children to be rice farmers because of the physical, psychological, and financial difficulties they encounter (Palis 2020). Agricultural development policies should be designed to encourage youth to be involved in agricultural development programs (Nhat Lam Duyen et al. 2020). Similarly, the farmer respondents in this study are generally old. Even so, more than half of the respondents have children who help them in almost all farm operations. These children look at it as their way of contributing to their households. With this kind of perspective, it is easier to encourage them to be involved in agricultural development programs. Farmers interviewed are mostly married, with 1 – 3 male and female dependents, and with family members, the children, who help in farming activities. The children of farmers should be encouraged to pursue courses related to agriculture. After graduation as extension workers in the province, for example, the Negros Occidental Scholarship Program offered to college students in agriculture-related courses, which greatly promoted agriculture to students and increased the number of agriculture professionals in the province. Young people without formal education should be encouraged to take up vocational courses related to agriculture to be prepared to be self-employed farmers or agribusiness persons. These vocational courses are already available in the province through farm schools offered by private and government schools, i.e., the Cansilayan Farm School, under the Department of Education (DepEd), situated in Murcia, Negros Occidental.

Table 1. Personal characteristics of the respondents.

Variable	Frequency	Percentage (%)
Sex	**n=199**	
Male	146	73.4
Female	53	26.6
Total	199	100.0
Age	**n=199**	
Middle-aged (22–45)	37	18.6
Old (46-60)	93	46.7
Senior citizen (61 above)	69	34.7
Total	199	100.0
Civil Status	**n=199**	
Single	21	10.6
Married	158	79.4
Widow/widower	18	9.0
Separated	2	1.0
Total	199	100.0
Educational Attainment	**n=199**	
No education/ no schooling	1	0.5
Elementary	46	23.1
Secondary	86	43.2
Tertiary/College	66	33.2
Total	199	100.0

Table 2. Household size and sex-disaggregated data on the classification of household members of the respondents.

Variable	Frequency (n=199)	Percentage (%)
No. of household members		
1–3	63	31.7
4-6	107	53.8
7 and above	29	14.6
Total	199	100.0
No. of male household members		
None	4	2.0
1-3	154	77.4
4-6	38	19.1
7 and above	3	1.5
Total	199	100.0
No. of female household members		
None	15	7.5
1-3	161	80.9
4-6	22	11.1
7 and above	1	0.5
Total	199	100.0
No. of male dependents		
None	67	33.7
1-3	119	59.8
4-6	12	6.0
7 and above	1	0.5
Total	199	100.0
No. of female dependents		
None	59	29.6
1-3	130	65.3
4-6	9	4.5
7 and above	1	0.5
Total	199	100.0

The provisions of RA 10068 apply to the development and promotion of organic agriculture, which include research, development, and extension of appropriate, sustainable environment and gender-friendly organic agriculture. To promote equitable resources, information, and power in the agri-food system, the roles and benefits of men, women, and youth are also considered (CGIAR 2015; Nhat Lam Duyen et al. 2020). Women are not represented well enough in organic rice farming, where their income-earning opportunities are relatively high. Female members of the household do not participate in farming activities well except for pest management, in which the wife mainly prepares concoctions and plant extracts. Women also have little engagement in decision-making regarding the management practices to be implemented in the rice farms, for example, regarding the rice varieties to be used and nutrient management to be implemented, which may be because of the subjective norm that men are the head of the household and women only need to do household chores. Women can be major contributors to organic rice production, for example, in preparing organic inputs such as concoctions for foliar organic fertilizers and pesticides. Women's participation in agriculture should be encouraged, for example, by raising awareness about women's ability and suitability to make decisions in rice farming. Women should also be involved in training and discussions and make the activities available to them; for example, being more flexible in their schedule for the conduct of seminars and training on profitable activities such as marketing their prepared organic inputs, the concoctions, and vermicompost as income-earning opportunities both within and outside households, as these inputs have high demand not only in rice but also in other crops.

Access to Technologies and Information

Majority of the respondents (77.9%) have ≤ 10 yrs of experience in organic rice farming (Table 4). Most of the respondents (92.5%) are members of an organization. More than half of those who are members of an organization (52.5%) are affiliated with an organic farmer association. Other affiliations of the respondents are seed growers and free farmers associations (21.2%), irrigators service cooperatives (20.1%), farmers credit cooperatives (17.9%), and guardian and other civic organizations (10.9%). Most of the membership benefits (78.8%) are seeds, either of rice or other crops. The majority also avail of a training series through their organizations (67.4%). More than half (52.2%) have membership benefits of marketing their harvested crop, especially organic products, including rice and using the farm machines owned by the organization with reduced costs (51.1%). Other membership benefits include free certification subsidy for organic rice produced (9.2%), cash incentives, loans, or insurance, especially during calamities (9.8%), agricultural inputs such as irrigation, and both organic and inorganic fertilizers (44.6%), and livelihood projects (2.7%). Most of them have attended seminars or training related to rice (86.4%), with the majority focusing on the topics of organic rice production (68.6%). The reason for the majority of attending seminars or training was to learn new technologies (89.5%). More than half of those who did not attend seminars or training answered that they had no time, or unavailable during the conduct of training (51.9%) and were attending to other important businesses (18.5%). Some of them mentioned that no training was conducted in their area (29.6%). When the respondents were asked if they were visited by the LGU technicians in their Barangay, most of them answered YES (88.9%). and a few said NO (11.1%). With regard to the frequency of visits of the LGU technicians, most of them answered always (66.7%), some sometimes (25.4%), and few rare (7.9%).

Experiences, knowledge, and training of farmers had contributed significantly to the continued organic rice production in Negros Occidental. For organic farming experiences, the majority have less than 10 yr of experience. Fifty-five farmers or almost 30% had started organic rice production during the active promotion of the LGU of Negros Occidental from 2015 to 2017, and 80% of them were still

Table 3. Participation of family members in farming activities.

Particulars	Frequency	Percentage (%)
Who decides the rice varieties to be planted?	**n=199**	
Husband	143	71.90
Wife	31	15.60
Both husband and wife	15	7.50
Children	4	2.00
Landowner	6	3.00
If the family members help in land preparation activities?	**n=199**	
YES	92	46.20
NO	107	53.80
Who helps in the land preparation activities?	**n=92**	
Children	53	57.60
Wife/ husband	21	22.80
Other family members	18	19.60
If the family members help in crop establishment activities?	**n=199**	
YES	86	43.20
NO	113	56.80
Who helps in crop establishment activities?	**n=86**	
Children	59	68.60
Wife/ husband	28	32.60
Other family members	19	22.10
Who makes decisions regarding nutrient management?	**n=199**	
Husband	152	76.40
Wife	25	12.60
Both husband and wife	10	5.00
Children	7	3.50
Landowner	5	2.50
If the family members help in nutrient management activities?	**n=199**	
YES	62	31.20
NO	137	68.80
Who helps in nutrient management activities?	**n=62**	
Children	43	69.40
Wife/husband	17	27.40
Other family members	9	14.50
If the family members help in pest management activities?	**n=199**	
YES	85	42.70
NO	114	57.30
Who helps in pest management activities?	**n=85**	
Children	54	63.53
Wife/husband	31	36.47
Other family members	15	17.65
If the family members help in harvesting and post-harvesting activities?	**n=199**	
YES	97	48.70
NO	102	51.30
Who helps in the harvesting and post-harvesting activities?	**n=97**	
Children	61	62.89
Wife/husband	20	20.62
Other family members	34	35.05

Table 4. Years of experience, organizational affiliation, membership benefits, and access to rice-related information and technologies of the respondents.

Variable	Frequency	Percentage (%)
Years of experience in organic rice farming	**n=199**	
≤10	155	77.9
11–20	32	16.1
21–30	9	4.5
>30	3	1.5
Organizational membership	**n=199**	
YES	184	92.5
NO	15	7.5
Type of organizations affiliated	**n=184**	
Organic farmer association	96	52.5
Seed growers and free farmers association	39	21.2
Irrigators service cooperative	37	20.1
Farmers credit cooperative	33	17.9
Others (guardians and other civic organizations)	20	10.9
Membership benefits	**n=184**	
Seeds (rice and other crops)	145	78.8
Training	124	67.4
Market	96	52.2
Machinery	94	51.1
Free certification subsidy	17	9.2
Others		
Cash incentives, loans, or insurance	18	9.8
Agri-inputs e.g., fertilizer, irrigation	82	44.6
Livelihood projects	5	2.7
Attendance to seminars/training related to rice	**n=199**	
YES	172	86.4
NO	72	13.6
Focus/ topics of the seminars/ training attended	**n=172**	
Organic rice production	118	68.6
Inbred rice production/ PalayCheck	99	57.6
Pest management	76	44.2
Nutrient management	70	40.7
Hybrid rice production	22	12.8
Other rice-based technologies		
Other crops (vegetables, coffee, etc.)	67	39.0
Poultry and livestock	8	4.7
Other organic agriculture-related	5	2.9
topics, e.g., SRI, vermicomposting, mushroom production, etc.	14	8.1
Reasons for attending seminars or training	**n=172**	
Learn new technologies	154	89.5
Increase harvest	27	15.7
Avail of freebies	7	4.1
Share learnings with other farmers	14	8.1
Others	43	25.0
Reasons for not attending seminars or training	**n=27**	
No time or not available	14	51.9
No training conducted	8	29.6
Attend to other important business	5	18.5
Familiar/ already knew the topic	1	3.7
Visits by LGU technicians in the Barangay	**n=199**	
YES	177	88.9
NO	22	11.1
Frequency of visits	**n=177**	
Always	118	66.7
Sometimes	45	25.4
Rare	14	7.9

organic rice practitioners in 2021. Farmers with more than 20 yr of experience are mostly farmer leaders advocating for organic agriculture in the province. Most farmer respondents are also members of organizations, with half of them affiliated with organic farmer associations convened by the LGU and NGOs. With these organic farmer associations, farmer members are easily organized for training focused on organic rice production and diversified rice-based farming systems. The majority attend these training courses to learn new technologies. In addition, organic rice farmers have no difficulty in learning these technologies, as they at least achieved a secondary level of education. Almost half of the farmers prepare the organic inputs for their organic rice farms, i.e., the vermicompost and organic concoctions which they also learned from training.

Economic Profile

In a study by Albert et al. (2018), the different Philippine income classes were presented. Based on their classification, families were clustered according to their monthly income: (1) less than PhP 9 520 are poor; (2) between PhP 9 520 – 19 040 are low-income; (3) between PhP 19 040 – 38 080 are low-middle-income; (4) PhP 38 080 – 66 640 are middle-income; (5) between PhP 66 640 – 114 240 are upper-middle-income; (6) between PhP114 240 – 190 400 are upper-income (but not rich); and (7) at least PhP 190 400 are rich. The estimated poverty threshold of the Philippine Statistic Authority (PSA) in 2021 is PhP 12 082, which means families earning PhP 12 082 and below are clustered as poor in income (PSA 2021). Most of the respondents are classified as poor (64.3%) based on their monthly income (Table 5). Some of them are classified as low-income but not poor (22.6%) and the remaining are from the lower-middle to upper-middle class (13.0%). The major source of income for the majority is rice farming (77.9%). More than one-fourth of them embark on vegetable farming (27.6%) and poultry or livestock production (28.1%). Almost one-fourth are either employed (24.1%), self-employed or with business (20.6%) or with other sources of income such as pension or monthly allowance from their children (23.6%). Few of them have engaged in sugarcane production (10.1%) and other agricultural products (7.5%).

More than half of the respondents (54.3%) own the land they are cultivating (Table 6). Almost one-third of them (32.7%) have other arrangements such as the land being owned by a family member, under a certificate of land ownership award (CLOA), tenants with a percent share, or classified as forest land. Few have rented the rice fields (4.0%) and have both owned, rented, and with other arrangements (10.0%). For the farm assets, almost half of the respondents own either 1 or 2 carabaos (49.2%), and a few of them own three or more

Table 5. Monthly family income and major sources of income of the respondents.

Variable	Frequency	Percentage (%)
Monthly income classification	**n=199**	
Poor (PhP 9520 and below)	128	64.3
Low-income but not poor (PhP 9 560 - 19 040)	45	22.6
Lower middle (PhP 19 040–38 080)	18	9.0
Middle (PhP 38 080–66 640)	7	3.5
Upper middle (PhP 66 640–114 240)	1	0.5
Total	199	100.0
Major sources of income	**n=199**	
Rice farming	155	77.9
Poultry/livestock production	56	28.1
Vegetable farming	55	27.6
Salary Employment	48	24.1
Self-employed/business	41	20.6
Sugarcane production	20	10.1
Other agricultural products	15	7.5
Others	47	23.6

Table 6. Status of land cultivated with rice and farm assets of the respondents.

Variable	Frequency	Percentage (%)
Status of land cultivated	**n=199**	
Owned	108	54.3
Rented	8	4.0
Other arrangements	65	32.7
Both owned and rented	8	4.0
Both owned and with other arrangements	9	4.5
Both rented and with other arrangements	1	0.5
Total	199	100.0
Farm assets	**n=199**	
Carabao	78	39.2
None	78	39.2
1 – 2	98	49.2
3 – 5	21	10.6
6 – 10	2	1.0
Total	199	100.0
Hand tractor		
None	125	62.8
1 – 2	72	36.2
3 – 5	1	0.5
6 – 10	1	0.5
Total	199	100.0
Thresher		
None	154	77.4
1 – 2	45	22.6
Total	199	100.0
Water pump		
None	176	88.4
1 – 2	22	11.1
3 – 5	1	0.5
Total	199	100.0
Rice mill		
None	197	99.0
1 – 2	2	1.0
Total	199	100.0

carabaos (11.6%). More than one-third of the respondents own at least one hand tractor (36.2%), and only two respondents own more than 3 hand tractors. Less than one-fourth of them own threshers (22.6%), and a few of them own water pumps (11.1%). Two of the respondents are rice mill owners.

Organic crops, including rice, are generally produced by small-scale farmers under more diversified farming systems and integrated with farm animals such as pigs, goats, carabaos, cows, chickens, or ducks (Maghirang et al. 2011). Similarly, the major sources of income for organic rice farmers in the province include vegetables, sugarcane, poultry, and livestock production, among others. The majority have been cultivating other crops and animals under organic systems. Despite this, the monthly income classification of most organic farmers is poor or with a monthly income of PhP 9 520.00 and below. Developing organic rice farming into a lucrative livelihood can help ensure good income for farmers, and adding value to every step, from varietal development to market linkages, will benefit farmers in the long term. One advantage is that most of the farmers either already own the land or were beneficiaries of the Comprehensive Agrarian Reform Program (CARP) and received certificates of land ownership award (CLOA). With the CARP being implemented in the province, most of the farmers became owner-operators which eliminated the costs from land rents. The costs of land rent in organic rice production will substantially negatively affect the net income or the profits of the farmers. However, there are only a few organic farmers in the province who rent land for cultivation.

Farm Profiles and Characteristics

Among the respondents, only 20.1% have organic certification from third-party representatives (Table 7). Almost half (42.2%) are classified under low-input farming or those who apply synthetic fertilizer or use pesticides in lesser amounts together with organic inputs. These farmers apply pesticides (either molluscicide or insecticide) only once. For their fertilizer application, they apply 1 – 2 bags of inorganic fertilizers—urea (46-0-0), ammonium phosphate (16-20-0), or complete fertilizer (14-14-14). Some (21.1%) are in transition for certification while the remaining (16.6%) use organic inputs but are not certified and are not in transition for certification. Most farmers in the transition phase are already using fully organic inputs for at least 2 yr and are only waiting for their certification from OCCP. Of the certified organic, two-thirds (67.5%) are NICERT, while one-third (32.5%) are certified by the OCCP. The classification of the remaining respondents as organic practitioners was through the local government units or LGU (30.3%), farmer associations (43.1%) such as the case of Negros Island Organic Practitioners Association (NIOPA) and Mailum Organic Village Association (MOVA), and non-government organizations or NGO (26.6%)—the Family Farms Inc. (FFI), for example. Almost three-fourths of the respondents (72.9%) also cultivate other crops and animals under an organic system.

With regard to the respondents certified by a third-party representative, almost all (95.0%) of the respondents required a length of conversion of 3 yr (Table 8). The two respondents were required to have none or less than 2 yr for a conversion period since they have used organic inputs before. For the respondents with the internal control system, more than half of them stated that no conversion period (51.4%) was required from them. More than one-third answered 3 yr (34.9%) while a few answered less than 2 yr (4.6%) and 5 yr (9.2%). Three-fourths of the respondents (80.5%) were required to have buffer zones 2 m and below while the remaining (19.4%) were required to have buffer zones of 3 m or more length. Less than half of the respondents with buffer zones planted crop barriers (44.3%). Some of them planted citronella (*Cymbopogon nardus*), cosmos (*Tagetes erecta*), or lemongrass (*Cymbopogon citratus*) to serve as repellants for insect pests. Other respondents planted legumes—for example, madre de cacao (*Gliridia sepium*) to be used as biofertilizers, other crops such as taro, vegetables, or banana as sources of food, or Napier grass (*Pennisetum purpureum*) as a source of feeds for livestock. However, some also planted rice and separated it from the organic rice produced during harvest to be used as payment for harvesting and threshing. More than one-third of the respondents (38.2%) had filter ponds. Almost half of the respondents with filter ponds (47.4%) had an area of less than 25 m^2, while the others had 25 m^2 or more area of filter ponds (52.6%). More than half of them (61.8%) had a depth of filter ponds of 1 m and above.

Table 7. Type of organic rice farm of the respondents.

Variable	Frequency	Percentage (%)
Classification	**n=199**	
Certified organic	40	20.1
Non-certified organic	75	37.7
Low-input farming	84	42.2
Total	199	100.0
Type of non-certified organic		
Transitioning	42	21.1
Total use of organic inputs	33	16.6
Certification agencies		
Third-party representative	**n=40**	
OCCP	13	32.5
NICERT	27	67.5
Internal control system	**n=109**	
LGU	33	30.3
Farmer association	47	43.1
NGO	29	26.6
Other crops and animals cultivated as organic	**n=199**	
YES	145	72.9
NO	54	27.1
Total	199	100.0

Table 8. Knowledge of the respondents to certification requirements.

Variable	Frequency	Percentage (%)
Length of conversion		
Third-party representative	**n=40**	
None	1	2.5
Less than 2 yr	1	2.5
3 yr	38	95.0
Internal control system	**n=109**	
None	56	51.4
Less than 2 yr	5	4.6
3 yr	38	34.9
5 yr	10	9.2
Length of clear boundary or buffer zones	**n=149**	
2 m and below	120	80.5
3 – 5 m	9	6
more than 5 m	20	13.4
Used of crop barrier in the clear boundary	**n=149**	
YES	66	44.3
NO	83	55.7
Plants used as crop barrier		
Madre de cacao (*Gliridia sepium*)	18	27.3
Lemongrass (*Cymbopogon citratus*)	9	13.6
Cosmos (*Tagetes erecta*)	5	7.6
Citronella (*Cymbopogon nardus*)	5	7.6
Other crops		
Banana and other fruit trees	11	16.7
Taro and other vegetables	9	13.6
Napier grass (*Pennisetum purpureum*)	4	6.1
Availability of filter pond	**n=199**	
YES	76	38.2
NO	123	61.8
Total	199	100
Area of filter pond	**n=76**	
less than 25 m^2	36	47.4
25 – 50 m^2	15	19.7
more than 50 m^2	25	32.9
Depth of filter pond	**n=76**	
less than 1 m	29	38.2
1 m and above	47	61.8
Plants used in the filter ponds	**n=76**	
Kangkong	52	68.4
Gabi	41	53.9
Other macrophytes	9	11.8
Weeds	8	10.5
Other use	9	11.8

Other macrophytes were used by some such as water lily (*Pistia stratiotes*), water hyacinth (*Eichhornia crassipes*), and lotus (*Nymphaea* sp.). Some allow weeds to grow such as grasses and broad leaves to filter the water that enters the organic rice fields. Others also used the filter pond as fishponds.

Most of the respondents (86.9%) answered that before conversion to organic rice farming, the land was used for conventional rice production (Table 9). In terms of the location of the organic rice farm, more than one-third (34.7%) have farms isolated from other farms. Majority of the respondents' organic rice farms (62.5%) are the first to receive water from the source since the sources of irrigation are natural streams with small water-impounding systems or rainfed. Only a few use national irrigation systems (18.1%) or communal irrigation systems (9.0%). More than half of the respondents also have sufficient water supply (55.3%).

Table 9. Other variables related to certification requirements by the respondents.

Variable	Frequency (n=199)	Percentage (%)
Land history of organic rice farm before conversion		
Conventional rice production	173	86.9
Corn/ sugarcane production	11	5.5
Idle land/ use of organic inputs in rice	7	3.5
Low input system in rice	5	2.5
Other crops e.g., peanuts and high-value crops	3	1.5
Grand Total	199	100.0
Are organic rice farms isolated from other farms?		
YES	69	34.7
NO	130	65.3
Total	199	100.0
If organic rice farms first receive water from the source?		
YES	125	62.8
NO	74	37.2
Total	199	100.0
Source of irrigation		
Natural streams	97	48.7
Others (rainfed)	43	21.6
National irrigation system	36	18.1
Small water impounding system	24	12.1
Communal irrigation system	18	9.0
Sufficiency of water supply in the area		
Sufficient	110	55.3
Limited	89	44.7
Total	199	100.0

In the Philippine National Standards of Organic Agriculture (PNSOA), the use of manufactured fertilizers, pesticides, and genetically modified organisms is prohibited. Organic certification is based on the minimum standards set by the International Federation of Organic Agriculture Movements (IFOAM) or the PNSOA. In Negros Occidental, two agencies certified organic rice products of the farmers—the OCCP and NICERT. To meet the set requirements for the organic certification process, a substantial fee and extensive record-keeping were involved. According to farmers with organic certification, the DA-RFO VI subsidized the certification fee of organic rice practitioners through the Office of Provincial Agriculture and the farmer associations or cooperatives. Some organic rice farmers through their associations or cooperatives were under a contract arrangement with the NGOs or private sectors that subsidized their certification fee. Aside from the third-party certification agencies, the LGU, farmer associations or cooperatives, and the NGOs had their internal control system that also follows the minimum standard set by PNSOA. Some of these farmers were in transition or waiting for final evaluation by their association or cooperative to be endorsed for certification. Other farmers used organic inputs only in their rice farms but did not have the intention to undergo certification, mainly because they were not aware of the certification process. In general, the existing variations of organic rice production in Negros Occidental consist of the following organic rice-based production systems: certified organic, in transition or in conversion as defined by PNSOA, non-certified organic, and low-input farming systems.

The Accredited Core Participatory Guarantee Systems (PGS) Group refers to a core group authorized by the Bureau of Agriculture and Fisheries Standards of the DA to certify other farmers. A few respondents mentioned costly certification as one of the disadvantages of organic farming. With the PGS recognition by law through the approval of RA 11511 by the senate in December 2020, organic farmers will be able to receive training and certification for their organic produce without incurring heavy costs (Assaël n.d.). PGS are locally focused quality assurance systems that recognize the role of small farmers in ensuring safe, affordable, and accessible food. PGS certifies producers based on the active participation of stakeholders and is built on a foundation of trust, social networks, and knowledge exchange. The IFOAM is the leader in promoting the concept of PGS as one of the most promising tools for developing local organic markets. Several organic farmer associations through the help of the LGUs and NGOs in the province were beyond ready for certification because of the internal control systems they were implementing with their members that also follow the minimum standard set by PNSOA. For example, NIOPA has prepared its members through its internal control system (ICS) patterned after the Philippine National Standard (PNS). Likewise, farmers are knowledgeable enough about the certification requirements in general.

Rice Production Practices

Varieties. Many of the respondents (68.3%) use certified or registered seeds in their rice farms (Table 10). Some use good seeds (46.2%), while a few use hybrid seeds (7.0%), with majority of the seeds provided by the government (66.8%). Over one-third of the respondents buy seeds from seed growers or agricultural stores (39.2%). Over one-fourth of the respondents use their seed stock (25.6%), while less than one-fourth of them exchange seeds with other farmers (22.1%). More than half of the farmer respondents (52.8%) use NSIC Rc216. 'Black Rice' and NSIC Rc222 ranked second with less than one-fourth of the respondents are using these varieties (23.6%). This is followed by 'Red Rice', PSB Rc10, and NSIC Rc226, respectively. Hybrid rice and MASIPAG lines are also used by some of the respondents. These include NSIC Rc124H, NSIC Rc132H, NSIC Rc180H, NSIC Rc206H, NSIC Rc322H, and

Table 10. Varieties and seed class/type used by farmer respondents.

Variable		Frequency	Percentage (%)
Seed class/type		**n=199**	
Certified/ registered seeds		136	68.3
Good seeds		92	46.2
Hybrid		14	7.0
Source of seeds		**n=199**	
Own seed stock		51	25.6
Exchanged from other farmers		44	22.1
Government		133	66.8
Seed growers/ bought from agricultural stores		78	39.2
Others e.g., donated by NGO		2	1.0
Rank	**Varieties used**	**n=199**	
1	NSIC Rc216	105	52.8
2.5	Black Rice	47	23.6
2.5	NSIC Rc222	47	23.6
4	Red Rice	35	17.6
5	PSB Rc10	33	16.6
6	NSIC Rc226	28	14.1
7.5	Hybrid Rice	27	13.6
7.5	Red 64	27	13.6
9	PSB Rc18	19	9.5
10.5	MASIPAG Lines	18	9.0
10.5	NSIC Rc480 (GSR 8)	18	9.0
Reasons for choosing the varieties		**n=199**	
Eating quality		62	31.2
Availability		59	29.6
Yield		58	29.1
Pest resistance		32	16.1
Higher price or market		26	13.1
Consumer preference		25	12.6
Others		66	33.2

NSIC Rc384H for hybrid rice. The other traditional variety used by farmers is the Red 64. PSB Rc18 and NSIC Rc480 were the other high-yielding varieties (HYVs) used by some of the respondents. The farmer respondents chose these varieties due to a number of reasons: the quality of the food (31.2%), availability (29.6%), and yield (29.1%), respectively. Others (33.2%) included adaptability to seasonal change, environment (i.e., organic system), and maturity.

Cropping system. Almost three-fourths of the respondents (74.9%) have 2 crops per year (Table 11), while some have 3 crops per year (12.1%) and 5 crops for 2 yr (8.5%). A few (4.5%) have only 1 crop per year. Most of the respondents have an irrigated type of rice ecosystem (71.4%). Some answered rainfed (27.1%), and very few have an upland ecosystem (1.5%). Less than half of the respondents practice crop rotation (43.2%). The most common type of other crop planted was legumes (68.6%), namely mung bean, peanut, and string beans. Almost one-fourth of farmer respondents plant vegetables (23.3%) while others plant corn (11.6%), watermelon (4.7%), and sweet potato (3.5%). These crops are planted on the rice field during the fallow period or when water is limited to plant rice.

Land preparation. Most of the respondents conduct plowing, rotavation, harrowing, and leveling for land preparation activities (Table 12). The majority plow once (71.6%), some twice (23.9%), and a few plow thrice (4.5%). Similar results were observed for rotavation and harrowing, while all the respondents implement only 1 pass for leveling. Majority use animals as the source of power for plowing (84.7%) (i.e., carabaos). Some use turtle tillers (9.1%), while the remaining use either of the two (6.3%). For rotavation, harrowing, and leveling, the majority use turtle tillers instead of carabaos, but some still use carabao, and a few use either of the 2.

Crop establishment. Only a few of the respondents (9.0%) use organic seed treatments (Table 13). These seed treatments include soaking seeds in seaweed extract, indigenous microorganisms (IMO) mixed with fermented plant juice (FPJ), FPJ alone, fermented amino acids (FAA), or commercially available effective microorganisms (EM). The crop establishment method used by the majority is transplanting (70.9%), followed by direct seeding (17.6%), and either transplanting or direct seeding (11.6%). For direct seeding, majority use the wet direct method (96.6%), and very few perform the dry direct method (6.9%). The seeding rate of some respondents who perform direct seeding is 60–100 kg/ha (41.4%), while some are either below 60 kg/ha (29.3%) or more than 100 kg/ha (29.3%). More than half of the respondents who conduct transplanting have a seeding rate of 20 – 40 kg/ha (54.3%); one-fourth with a seeding rate of 41 – 80 kg/ha (25.0%), and a

Table 11. Cropping system of the respondents.

Variable	Frequency	Percentage (%)
Number of the cropping season	**n=199**	
1 crop per year	9	4.5
2 crops per year	149	74.9
3 crops per year	24	12.1
5 crops for 2 yr	17	8.5
Total	199	100.0
Type of rice ecosystem	**n=199**	
Irrigated	142	71.4
Rainfed	54	27.1
Upland	3	1.5
Total	199	100.0
Practice crop rotation	**n=199**	
YES	86	43.2
NO	113	56.8
Total	199	100.0
Other crops planted	**n=86**	
Legumes	59	68.6
Vegetables	20	23.3
Corn	10	11.6
Watermelon	4	4.7
Sweet potato	3	3.5

Table 12. Land preparation activities of the respondents.

Variable	Frequency	Percentage (%)
Plowing	**n=176**	
No. of pass		
1	126	71.6
2	42	23.9
3	8	4.5
Sources of power		
Animal	149	84.7
Machine	16	9.1
Both	11	6.3
Rotavation	**n=149**	
No. of pass		
1	96	64.4
2	48	32.2
3	5	3.4
Sources of power		
Animal	22	14.8
Machine	125	83.9
Both	2	1.3
Harrowing	**n=135**	
No. of pass		
1	86	63.7
2	42	31.1
3	7	5.2
Sources of power		
Animal	20	14.8
Machine	111	82.2
Both	4	3.0
Leveling	**n=199**	
No. of pass		
1	199	100.0
Sources of power		
Animal	1	9.0
Machine	168	84.4
Both	13	6.5

Table 13. Variables related to crop establishment activities of the respondents.

Variable	Frequency	Percentage (%)
Use organic seed treatments	**n=199**	
YES	18	9.0
NO	181	91.0
Total	199	100.0
The crop establishment method used	**n=199**	
Direct seeding	35	17.6
Transplanting	141	70.9
Both	23	11.6
Total	199	100.0
Type of direct seeding	**n=58**	
Dry direct	4	6.9
Wet direct	56	96.6
Seeding rate (kg/ha)		
Direct seeding	**n=58**	
20 – 59	17	29.3
60 – 80	17	29.3
81 – 100	7	12.1
more than 100	17	29.3
Transplanting	**n=164**	
less than 20	8	4.9
20 – 40	89	54.3
41 – 80	41	25.0
more than 80	26	15.9

Table 14. Variables related to crop establishment for transplanted rice.

Variable	Frequency	Percentage (%)
The type of seedbed used	**n=164**	
Wet seedbed	117	71.3
Dapog	59	36.0
Application of organic inputs in the seedbed	**n=164**	
YES	105	64.0
NO	59	36.0
Total	164	100.0
The type of organic input used in the seedbed	**n=164**	
Rice waste products	71	30.2
Vermicompost	40	17.0
Commercially available products	38	16.2
Concoctions	31	13.2
Manure	20	8.5
Bokashi	14	6.0
Compost	12	5.1
Sugarcane waste products	8	3.4
Other	1	0.4
Age of the seedling during transplanting	**n=164**	
8–12 DAS	20	12.2
13–17 DAS	58	35.4
18–21 DAS	68	41.5
22 DAS and above	27	16.5
Planting distance	**n=164**	
≤15 x ≤15 cm	32	19.5
15 x 20 cm	21	12.8
20 x 20 cm	77	47.0
20 x ≥25 cm	26	15.9
30 x 30 cm	4	2.4
Others	2	1.2

few with more than 80 kg/ha (15.9%) and less than 20 kg/ha (4.9%). For transplanted rice, majority (71.3%) of the farmers use wet seedbeds, and the remaining (36.0%) use *dapog* (Table 14). More than half (64.0%) apply organic inputs in the seedbed mainly for nutrient application or soil conditioner, while some are for pest control. Less than one-third (30.2%) use rice waste products such as compost from rice straw and rice hulls or carbonized rice hulls. Some use vermicompost (17.0%), commercially available products applied as basal or foliar (16.2%), and organic concoctions (13.2%) such as FAA, FPJ, fermented fruit juice (FFJ), organic herbal nutrients (OHN), seaweed extract, and IMO. A few use carabao, cow, or pig manure, or chicken dung and bokashi, compost, and guano, while very few use sugarcane-waste products namely mud press, molasses, and bagasse ash. Almost half (41.5%) transplant their rice seedlings 18–21 d after sowing (DAS). More than one-third (35.4%) transplant the seedlings at 13 – 17 DAS, and the remaining transplant their seedlings earlier (12.2%) or later (16.5%). Almost half (47.0%) use a planting distance of 20 x 20 cm. The others use more than or equal to 15 cm (19.5%) or 20–25 cm spacings for either side (15.9%), while very few use 30 x 30 cm or more (3.6%).

Nutrient management. More than one-fourth (26.0%) of the respondents use commercially available organic products applied as basal or foliar and used as fertilizers or soil conditioners (Table 15). Over one-fifth of the farmer respondents use organic concoctions (20.9%) and rice waste products (20.4%). Commercially available products (40.0%), followed by concoctions (35.0%), vermicompost and vermitea (32.5%), and rice waste products (30.0%) are commonly used by organic rice practitioners with third-party certification. Similarly, these 4 organic nutrient inputs are commonly used by non-certified and in transition category of farmers. However, rice waste products are the most common nutrient inputs for those non-certified (45.5%), while commercially available products are the most common for those in transition (42.9%). Organic concoctions include FAA, FPJ, FFJ, seaweed extract, IMO, calcium phosphate (calphos), and lactic acid bacterial serum (LABS). Rice waste products include rice straws and rice hulls in the form of composts and carbonized rice hulls. FAA is prepared by farmers as fish or golden apple snail (*Pomacea canaliculata*) fermented to sugar or molasses at 1:1 (w/w) for 1–2 wk of fermentation. Banana shoots or stalks, leaves of madre de cacao (*Gliricidia sepium*), and kangkong (*Ipomoea aquatica*) are the commonly used substrates for FPJ, fermented to sugar or

Table 15. Variables related to nutrient management of the respondents.

Variable	General		Certified Organic		Non-certified Organic		In Transition	
	Frequency (n = 199)	Percentage (%)	Frequency (n = 40)	Percentage (%)	Frequency (n = 33)	Percentage (%)	Frequency (n = 42)	Percentage (%)
Type of organic input used for nutrient management								
Rice waste products	115	20.4	12	30.0	15	45.5	17	40.5
Vermicompost, vermitea	66	11.7	13	32.5	8	24.2	12	28.6
Commercially available products	147	26.0	16	40.0	7	21.2	18	42.9
Concoctions	118	20.9	14	35.0	10	30.3	10	23.8
Manure	43	7.6	7	17.5	6	18.2	4	9.5
Bokashi	21	3.7	6	15.0	5	15.2	9	21.4
Compost	21	3.7	1	2.5	4	12.1	3	7.1
Green manure	10	1.8	2	5.0	3	9.1	2	4.8
Sugarcane waste products	18	3.2	0	0	0	0	3	7.1
Other	6	1.1	0	0	0	0	4	9.5

molasses at 1:1 (w/w) for 1–2 wk. A similar fermentation process is used for FFJ using ripe banana, pineapple, and papaya fruits as substrates. Seaweed extract prepared by farmers use fresh seaweeds and are fermented to molasses at 1:1 (w/w) for 1 – 2 wk. For IMO, yellow or white molds are grown from cooked rice placed under the hay of rice straw, dried banana, or bamboo leaves for 1 wk. The rice with molds is added to molasses at 1:1 (w/w) and allowed to ferment for 30 d. Bones and eggshells are added with vinegar and let sit for 14 – 21 d to prepare calphos used by farmers. LABS is prepared by farmers using buttermilk from rice wash and milk added to molasses at 1:1 (w/w) for 30 d of fermentation. These organic concoctions are diluted at 155 mL per 16 L or 1 tank load of water and sprayed onto the rice plant. Some of the farmers also use vermicompost and vermitea. Some respondents use manure, bokashi, compost, and sugarcane waste products. The manures used by farmers are from carabao, goat, cow, pig, and chicken. Bokashi is prepared by farmers using a mixture of mud press, animal manure, mill ash, rice bran, and rock phosphate. The sugarcane waste products include mud presses, molasses, and bagasse ash. A few implemented green manuring using madre de cacao (*Gliricidia sepium*), ipil-ipil (*Leucaena leucocephala*), and mung bean (*Vigna radiata*), while a few use guano and dolomite.

Pest management. Many of the respondents mentioned rice bugs (86.9%) as their main insect pest problem (Table 16). More than one-third have stemborer problems (35.7%) in their rice farms and more than one-fourth have problems with hoppers (27.6%). A few have problems with leaf folders (17.6%) and other defoliators and very few experience infestation of rice black bugs (8.5%) and armyworms (2.5%). For disease problems, a few of the respondents have experienced rice blast or neck rot (15.6%), rice tungro disease (15.6%), and bacterial leaf blight (15.1%). Very few experienced brown spot (3.5%) and sheath blight or sheath rot (2.0%). Grasses are the main weed problem of the majority (84.9%). Some respondents also have problems with sedges (44.2%) and broad leaves (39.7%). More than half of the respondents experience problems with golden apple snails or GAS (64.8%) and rodents (61.3%), while more than one-third experience problems with birds (36.7%).

More than one-third of the respondents use attractants (37.2%), i.e., crushed GAS, dead animals, and urine for rice bugs (Table 17). A few use OHN (13.6%) and plant extracts (6.5%) in controlling insect pests. Very few use repellants (2.5%), such as planting in peripheries or smoking of fields, use of biological agents (2.0%), namely *Trichogramma* and *Beauveria*, and use of light traps (1.5%). Other cultural management practices (10.1%) are manual picking of insects, water management, maintaining sanitation in the field, and synchronous planting. Management of diseases by a few include the use of commercially available products (7.5%), removal of infected plants (6.0%), use of IMO, LABS, and vermitea (3.5%), water management (3.0%) in controlling rice blast, use of OHN (2.0%), and use of resistant varieties (2.0%). For weed management, almost three-fourths practice manual hand weeding (72.9%), more than half properly implement water management (53.3%), and very few use rotary weeders (2.0%). For the management of GAS, some employ handpicking of snails (42.2%), and a few use duck ranging (8.5%), water management (6.0%), and use of rice hull or vermicast (3.0%) to immobilize or infect the snails. The use of traps or bait (11.1%), field sanitation (7.0%), and trap crops (0.5%) were the practices mentioned by a few farmers to manage rat problems. To manage bird problems, some respondents mentioned scaring birds away using sounds (5.5%) and scarecrows (3.5%). A few of the respondents also mentioned synchronous planting (2.0%) to avoid rat and bird problems in their fields.

Table 16. Pest problems encountered by the respondents.

Variable	Frequency (n = 199)	Percentage (%)
Insect pest problems		
Rice bug	173	86.9
Stemborer	71	35.7
Brown planthopper/green leafhopper/white-back planthopper	55	27.6
Leaf folder	35	17.6
Other defoliators	21	10.6
Rice black bug	17	8.5
Armyworm	5	2.5
Disease problems		
Rice blast, neck rot	31	15.6
Rice tungro disease	31	15.6
Bacterial leaf blight	30	15.1
Brown spot	7	3.5
Sheath blight, sheath rot	4	2.0
Weed problems		
Grasses	169	84.9
Sedges	88	44.2
Broadleaves	79	39.7
Other pest problems		
Snails (GAS)	129	64.8
Rodents	122	61.3
Birds	73	36.7

Harvest and postharvest. Manual harvesting is performed by almost all the respondents (94.0%) while a few use machines (6.0%) such as combine harvesters and reapers (Table 18). For threshing, majority use a thresher (94.5%), and very few manually thresh their rice (5.5%). The source of power for hauling is dependent on the location of the farm away from the main road. Three-fourths of the respondents only require manual labor (75.4%), almost one-fourth require carabaos (23.6%), and 2 of the respondents use tractors to haul their threshed rice. Only a few of the respondents have access to the flatbed dryer (4.3%) for drying their rice. Likewise, a few of the respondents perform manual milling (8.0%) of their rice.

Although existing studies already support the use of many of the organic-based crop management practices implemented by farmers, these strategies need to be tested further. For example, nutrient management practices such as the combined use of vermicompost, FAA, FPJ, and FFJ should be validated. The processes and mixing ratios of different fermented extracts for application during the vegetative and flowering stages of the plants were already reported by Porciuncula and Romero (2018). These nutrient inputs were promoted by the Department of Agriculture - Agricultural Training Institute (DA-ATI) and the Technical Education and Skills Development Authority (TESDA), and were mainly used for high-valued crops (Sakimin et al. 2017; Adajar and Taer 2021). If the nutrient inputs mentioned earlier are found to be effective or contribute to sustaining or increasing the yield of rice, these can be produced as an alternate source of nutrients for organic rice and can be promoted for use by other farmers.

Table 17. Pest management practices of the respondents.

Variable	Frequency (n = 199)	Percentage (%)
Management of insect pest problems		
Use of attractants e.g., crushed GAS, dead animals, and urine for rice bugs	74	37.2
Use of concoction: Oriental Herbal Nutrient (OHN)	27	13.6
Use of botanical or plant extracts	13	6.5
Use of repellants e.g., planting of repellant plants in the field or smoking of fields	5	2.5
Use of biological agents e.g., *Trichogramma* and *Beauveria*	4	2.0
Use of light traps	3	1.5
Other cultural managements: manual hand picking, water management for stemborer, field sanitation, and synchronous planting	20	10.1
Management of diseases		
Use of commercially available products	15	7.5
Removal of infected plants	12	6.0
Use of IMO, LABS, vermitea	7	3.5
Water management e.g., in controlling rice blast	6	3.0
Use of concoction: Oriental Herbal Nutrient (OHN)	4	2.0
Use of resistant varieties	4	2.0
Management of weeds		
Manual hand weeding	145	72.9
Water management	106	53.3
Use of rotary weeder	4	2.0
Management of other pest problems		
Golden apple snails or invasive snails		
Handpicking of snails	84	42.2
Ranging of ducks	17	8.5
Water management	12	6.0
Use of rice hull or vermicast for immobilizing snails	6	3.0
Rats		
Use of traps or bait	22	11.1
Field sanitation	14	7.0
Use of trap crops	1	0.5
Synchronous planting	4	2.0
Birds		
Scaring away birds using sounds	11	5.5
Use of scarecrow for birds	7	3.5
Synchronous planting	4	2.0

Cost of Production

For land preparation, the labor source of more than half of the respondents (54.5 – 73.8%) who perform plowing, rotavation, harrowing, and leveling is rented, hired, or borrowed with direct cost from the farmers (Table 19). For canal and dike repair and maintenance, more than half of the respondents are also hired for their labor (56.1 - 67.6%). For the material source of the organic inputs for seed treatments, seedbed,

Table 18. Harvesting and post-harvesting activities of the respondents.

Activities	Sources of power	Frequency	Percentage (%)
Harvesting (n = 199)	Person	187	94.0
	Machine	12	6.0
	Total	199	100.0
Threshing (n = 199)	Person	11	5.5
	Machine	188	94.5
	Total	199	100.0
Hauling (n = 199)	Person	150	75.4
	Animal	47	23.6
	Machine	2	1.0
	Total	199	100.0
Drying (n = 162)	Person	155	95.7
	Machine	7	4.3
	Total	162	100.0
Milling (n = 162)	Person	13	8.0
	Machine	149	92.0
	Total	162	100.0

and nutrient and pest management, most of the respondents prepare (44.4%) their inputs, some procure (38.9%), and a few receive donations (16.7%) from the LGU and DA. For the labor source in direct seeding, half of the respondents hire the labor, while the remaining half own it. The majority prepare their seedbed (70.1%) and some hire laborers (29.3%). In contrast, almost all the respondents prefer hiring for transplanting (90.9%). In harvesting and post-harvesting activities, majority hire labor using payment through percent sharing of rice produced except in drying and milling. For drying, more than half of the respondents (63.0%) prefer not hiring for labor. Almost all the respondents hire or rent labor (95.7%) in milling their rice, while very few own their labor (2.5%) for milling especially farmers residing in remote areas or owners of the rice mill.

The direct costs of the farmer respondents from land rental, land preparation, seed treatment, crop establishment, crop care and maintenance, harvesting, and post-harvesting activities are presented in Table 20. There is a significant difference between the respondents' minimum and maximum direct expenditures. Among the variables presented, land rent has the highest costs incurred, followed by harvesting and threshing, respectively. Milling is only done by almost all the respondents for their rice production for home consumption, and will incur the highest costs if all the farmers' produce are milled. In terms of crop establishment, transplanting is more expensive than direct seeding. The total cost of production, gross income, and net income also differ substantially. There are farmers with a negative net income, while others achieve an extremely high net income. On average, the net income of farmers practicing organic rice farming is only PhP 29 649.32 per cropping, equivalent to PhP 59 298.64 per year or a PhP 4 941.55

Table 19. Sources of labor and material for each activity of the respondents.

Farming Activities	Labor Source/ Material Source	Frequency	Percentage (%)
Land Preparation			
Plowing (n = 176)	Owned	48	27.3
	Rented/hired/borrowed	96	54.5
	Both owned and rented/hired	32	18.2
Rotavation (n = 149)	Owned	24	16.1
	Rented/hired/borrowed	110	73.8
	Both owned and rented/hired	15	10.1
Harrowing (n = 135)	Owned	24	17.8
	Rented/hired/borrowed	97	71.9
	Both owned and rented/hired	14	10.4
Leveling (n = 199)	Owned	74	37.2
	Rented/hired/borrowed	104	52.3
	Both owned and rented/hired	21	10.6
Canal maintenance (n = 180)	Owned	78	43.3
	Rented/hired/borrowed	101	56.1
	Both owned and rented/hired	1	0.6
Repair and maintenance of dikes (n = 185)	Owned	56	30.3
	Rented/hired/borrowed	125	67.6
	Both owned and rented/hired	4	2.2
Crop Establishment			
Seed treatments (n = 18)	Prepared	8	44.4
	Donated	3	16.7
	Procured	7	38.9
Organic inputs in the seedbed (n =105)	Prepared	55	52.4
	Donated	13	12.4
	Procured	45	42.9
Direct seeding (n = 18)	Owned	29	50.0
	Hired	29	50.0
	Both owned and hired	0	0
Seedbad Preparation (n = 164)	Owned	115	70.1
	Hired	48	29.3
	Both owned and hired	1	0.6
Transplanting (n = 164)	Owned	1	0.6
	Hired	149	90.9
	Both owned and hired	15	9.1
Crop Care and Maintenance			
Organic inputs for nutrient management (n = 199)	Prepared	91	45.7
	Donated	35	17.6
	Procured	123	61.8
Organic inputs for pest management (n = 199)	Prepared	81	40.7
	Donated	7	3.5
	Procured	41	20.6
Harvesting and postharvest activities			
Harvesting or reaping (n = 199)	Owned	15	7.5
	Rented/hired/borrowed	179	89.9
	Both owned and rented/hired	3	1.5
Threshing (n = 199)	Owned	6	3.0
	Rented/hired/borrowed	182	91.5
	Both owned and rented/hired	5	2.5
Hauling (n =199)	Owned	57	42.2
	Rented/hired/borrowed	127	94.1
	Both owned and rented/hired	1	0.7
Drying (n = 199)	Owned	102	63.0
	Rented/hired/borrowed	56	34.6
	Both owned and rented/hired	1	0.6
Milling (n = 199)	wned	4	2.5
	Rented/hired/borrowed	155	95.7
	Both owned and rented/hired	1	0.6

Table 20. Cost[1] and return analysis per hectare of the farmer respondents.

Variable	Frequency (n)	Min (PhP)	Max (PhP)	Average (PhP)
Land Rent	**14**	**1 333.33**	**11 880.00**	**6 650.54**
Land Preparation	**199**	**200.00**	**14 000.00**	**5 176.22**
a. Plowing	134	200.00	7 000.00	2 362.99
b. Harrowing	116	300.00	6 000.00	1 979.52
c. Rotavation	119	200.00	5 652.17	1 823.58
d. Levelling	125	200.00	3 809.52	863.12
e. Canal maintenance and repair of dikes and ditches	133	200.00	11 000.00	2 420.43
Seed Treatment	**8**	**10.00**	**900.00**	**311.88**
Crop Establishment				
a. Direct seeding	28	200.00	1 500.00	544.64
b. Transplanted				
b.1 Seedbed preparation	47	150.00	3 200.00	746.26
b.2 Transplanting	145	600.00	13 000.00	4 273.00
Crop Care and Maintenance				
a. Nutrient management	130	14.79	16 050.00	3 557.12
b. Pest management	51	45.00	10 000.00	1 351.31
Harvesting & Postharvest Activities		**2 531.25**	**39 314.35**	**14 410.60**
a. Harvesting or reaping[2]	190	820.46	14 920.48	5 546.04
b. Threshing[2]	189	487.69	17 069.06	5 330.52
c. Hauling	128	88.89	8 888.89	1 526.94
d. Drying	57	213.33	7 200.00	1 675.59
e. Milling[3]	150	2 531.25	39 314.35	14 459.63
Cost of Production[4*]	**199**	**4 243.61**	**58 267.83**	**23 792.07**
Gross Income[5*]	**199**	**6 885.00**	**157 781.25**	**53 441.39**
Net Income*	**199**	**- 14 952.67**	**129 828.13**	**29 649.32**

[1]Based on the direct costs of the farmer respondents.
[2]For some respondents, costs for harvesting and threshing are included in the cost of transplanting.
[3]At 50% milling recovery.
[4] minus cost of drying and milling.
[5]PhP 17.00/kg farmgate price.
**Bi-annual data or average prices and costs of 2 croppings of rice in a year.*

monthly contribution to the family income. There is no significant difference in the production cost between systems (Table 21). Certified organic has the highest average cost of production (PhP 27 063.76) and low-input farming has the lowest average cost of production (PhP 22 061.27). Similarly, certified organic has the highest average gross income (PhP 62 920.33) and net income (PhP 35 481.10), while low-input farming has the lowest average gross income (PhP 48 762.79) and net income (PhP 26 954.52).

With rice farming as the only major source of income at an average net income of PhP 29 649.32, organic rice farmers in the province are considered as poor. Land preparation as well as harvesting and post-harvesting activities are the field operations that contribute to high costs in production. Organic farmer associations and cooperatives should be equipped with farm machines, including milling facilities (e.g., the brown rice mill), to help farmers reduce their cost of production and add income to their associations or cooperatives.

Rice Productivity

Based on the conducted analysis, rice yields between production systems were not statistically different (*p*-value = 0.2950). Approximately half of the respondents across organic-based rice production system categories achieve a yield of 3 000 kg/ha and above (Fig. 1), and approximately 25% of the respondents achieve a yield of 2 000 kg/ha and below. However, approximately 10% of low-input farming systems yield an average of 1 000 kg/ha and below, while no farmer under the other three systems obtains a yield below 1 000 kg/ha. The mean yields of these 3 systems were higher than the low-input farming systems with less than 3 000 kg/ha mean yield. Approximately 35% of the certified organic obtains a yield of 3 000 – 4 365 kg/ha, while only 25% of the respondents achieve 2 948 – 3 834 kg/ha in the other 3 systems. Conversion to organic achieved the highest maximum yield (6 652 kg/ha), followed by non-certified organic (6 187 kg/ha), certified organic (5 625 kg/ha), and low-input farming systems (5 484 kg/ha), respectively.

Table 21. Cost of production, gross income, and net income per hectare of the farmer respondents classified under different organic-based production system.

Variable	Frequency (n)	Min (PhP)	Max (PhP)	Average (PhP)
Cost of Production[1*]				
Certified organic	40	10 072.69	54 480.00	27 063.76
Non-certified organic	33	7 060.47	45 251.63	22 597.94
In transition to organic	42	5 820.10	58 267.83	25 490.10
Low-input farming	84	4 243.61	48 952.50	22 061.27
Gross Income*				
Certified organic	40	22 500.00	112 500.00	62 920.33
Non-certified organic	33	22 669.50	157 781.25	54 229.54
In transition to organic	42	21 420.00	147 115.39	53 262.01
Low-input farming	84	6 885.00	93 234.38	48 762.79
Net Income*				
Certified organic	40	- 714.29	95 026.67	35 481.10
Non-certified organic	33	98.87	129 828.13	31 161.59
In transition to organic	42	5 933.33	95 596.15	27 259.22
Low-input farming	84	- 14 952.67	81 168.72	26 954.52

[1]Based on the direct costs of the farmer respondents.
**Bi-annual data or average prices and costs of 2 cropping of rice in a year.*

Almost 59.8% of the respondents allot more than 25% of their rice harvest for home consumption, and the remaining 40.2% only allot 25% or less (Table 22). More than two-fifths of the respondents (43.2%) sell their rice as fresh palay, while almost one-third (31.2%) sell it as milled rice and very few (4.5%) as seeds and as dry palay. The price of milled rice is higher than that of fresh palay. The price of organic rice as fresh palay is higher than that of regular rice, but the price of milled organic white rice is the same as regular rice. Only red rice and black rice have significantly higher prices for milled rice. Almost one-third of the organic practitioners sell their rice produced to private individuals (32.2%). Almost one-fifth sell their rice products to NGOs (17.6%) while the remaining farmer respondents sell their rice to traders or millers (13.6%), cooperatives or associations (10.1%), and the public market (1.5%). Most of the products with third-party certification were labeled as organic (73.2%).

One of the factors hindering the utilization of organic rice production practices as mentioned by Pantoja et al. (2016) is the farmers' perception that yield declines with their use. The four types of organic farming systems in Negros Occidental are reported to have grain yields of 3.21 t/ha for certified organic, 3.19 t/ha for non-certified organic, 3.20 t/ha for in transition to organic, and 2.76 t/ha for low-input farming systems. Nitrogen (N), phosphorus (P), and potassium (K) are important macronutrients for plant growth and development. These three elements are consumed in large quantities by rice crops every cropping season. However, the ratio of N, P, and K in organic materials does not usually match the ratio of supplemental N, P, and K needed by a rice crop. This may explain the low average grain yields achieved by farmers under organic rice-based farming systems in Negros Occidental. Organic materials such as rice straws, vermicompost, and manure are the main nutrient sources applied by organic rice practitioners in Negros Occidental. Likewise, farmers implementing the low-input farming system were classified in this type of setting. They use either synthetic pesticides or fertilizers in minimal amounts with total N, P, and K applied to the rice fields below the requirement of the rice plants. The majority of them use high-yielding varieties (HYVs) such as NSIC Rc216, NSIC Rc222, NSIC Rc226, and hybrid rice (e.g., the NSIC Rc124H with a yield potential of more than 8 ton/ha). According to data from the Philippine Information System (PRISM) of PhilRice, the overall performance of rice production in the province was 3.53 t/ha during the first semester and 4.24 t/ha during the second semester in the year 2021, which may also explain the low yield obtained by the farmers.

According to Maghirang et al. (2018), yield under organic conditions may be attributed to organic management alone without considering the genetic component of the yield. In a study by Badajos et al. (2017), in the majority of the 40 conventional varieties tested, higher yields were obtained

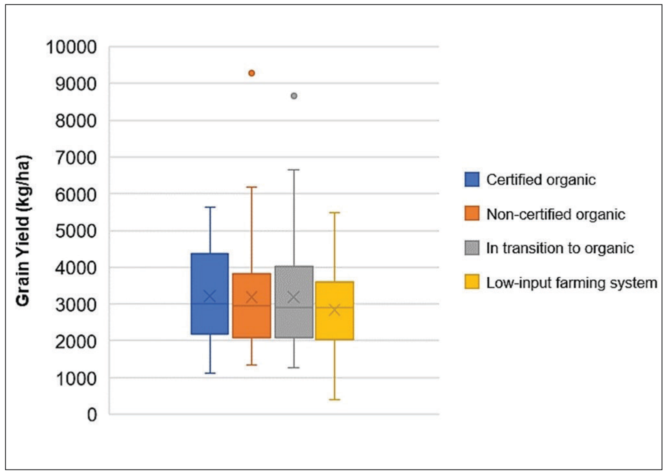

Fig. 1. Grain yield (kg/ha) of respondents with certified organic, non-certified organic, in transition to organic, and low-input farming systems.

Table 22. Variables related to rice sufficiency of the household respondents.

Variable	Frequency	Percentage (%)
The volume of rice harvest left for home consumption	**n=199**	
0 – 25%	80	40.2
26 – 50%	37	18.6
51 – 75%	13	6.5
75 – 100%	69	34.7
Total	199	100.00
The final product of rice sold	**n=199**	
Fresh palay	86	43.2
Milled rice	62	31.2
Seeds	9	4.5
Other rice products	2	1.0
	Price of rice products (PhP)	
Organic rice	**Fresh *palay***	**Milled rice**
White rice (n = 41)	20.00	41.00
Red rice (n = 17)	23.00	50.00
Black rice (n = 17)	24.00	80.00
Regular rice (n = 93)	14.00	42.00
Buyer of rice products	**n=199**	
Cooperatives/ associations	20	10.1
Traders/ millers	27	13.6
Public market	3	1.5
Private individuals	64	32.2
NGOs	35	17.6
Labeled as organic products	**n=41**	
YES	30	73.2
NO	11	26.8

under the organic system compared to the conventional system. Results from a study conducted by Manigbas et al. (2017) showed that conventional rice varieties grown organically differed in agronomic performance in each location, and that yield was higher during the wet season compared with the dry season. Research and development efforts focusing on both organic management and organic varieties to increase rice yield in organic systems will also increase the utilization of organic rice production practices. Another opportunity identified is the farmers' reasons for choosing the varieties to be planted. Although the differences between the percentage scores are almost the same, it is still important to note that farmers prefer eating quality over yield. Planting rice varieties with good eating quality and with yields comparable to those under the conventional system available will encourage farmers to practice organic rice production. This is true for some of the organic farmers in the province, especially for the farmer who achieved a net income of PhP 129 828.13. Some of the farmers reported a yield of more than 5 t/ha using only organic inputs. Rice varieties that perform well under organic conditions (i.e., the NSIC Rc354, NSIC Rc240, and NSIC Rc360 with yields of 6.1–6.2 t/ha (Bajados et al. 2017) should be made available to organic farmers. Likewise, pigmented rice varieties (i.e., NSIC Rc638, NSIC Rc640, NSIC Rc642, NSIC Rc644, NSIC Rc644, and NSIC Rc646) should be evaluated under the organic systems and made available to farmers as these are expected to have a premium price in the market.

Another type of farming system implemented in Negros Occidental is the low-input farming system, which is classified by Maghirang et al. (2011) under sustainable agriculture. Organic farming, green agriculture, conservation farming, natural farming, and ecological farming are examples of different production methods, systems, and approaches of sustainable agriculture that aim to meet the goals of profitability, stewardship, and quality of life. Organic agriculture is generally classified as sustainable agriculture, but organic practices may be incompatible with sustainability goals in certain situations. For example, organic products can also be unsustainable if produced in large scales. If so, the low-input farming system of some farmers in Negros Occidental can be more sustainable in producing food and maintaining the farm's productivity for generations. However, several organic rice practitioners in Negros Occidental achieve higher grain yields than low-input farming systems even on large scales. They have also converted back to the conventional system, and some organic farmers ready to be certified have switched to low-input farming systems to avail the fertilizer subsidy from the government. The DA distributed seeds and fertilizers for free to rice farmers through the Rice Competitiveness Enhancement Fund (DA Press Office 2020). This explains the high number of certified or registered seed users among the farmer respondents. However, this also negatively affected the assistance provided by the government to increase organic rice practitioners in the province. The assistance includes a free certification subsidy where farmers can comply with the certification requirements as endorsed by the LGUs or associations.

Farmer's Perception on Organic Farming

More than half of the respondents mentioned that organic farming is advantageous since it provides safe or chemical-free food (59.8%) and is suitable for the farmer's health (51.8%) (Table 23). More than one-third of the respondents mentioned less expenses (41.7%) when implementing the organic farming system, mainly because they do not need to buy inputs since these are readily available in the environment. The respondents also noted that organic farming keeps the soil healthy (23.1%), is environment-friendly (19.1%), helps increase income (12.1%), has a higher price (7.0%), has a good crop stand (6.0%), has readily available inputs (5.0%), and has a sure market (2.0%). More than one-third of the respondents (35.7%) mentioned a lesser yield or production as one of the disadvantages of the organic system. Some respondents also noted that organic farming is laborious (29.7%) and time-consuming (17.6%), and that organic inputs are not readily available (17.6%). A few also mentioned that organic inputs have a slower effect than inorganic fertilizers (9.6%) and that the price of organic rice is the same as regular rice (7.0%). Other disadvantages include

Table 23. Perception of the respondents on the advantages and disadvantages of organic farming.

Variables	Frequency (n = 199)	Percentage (%)
Advantages of organic farming		
Provides safe/chemical-free food	119	59.8
Good for the farmers' health	103	51.8
Lesser expenses	83	41.7
Makes the soil healthy	46	23.1
Environment friendly	38	19.1
Can help increase income	24	12.1
Higher price for organic rice	14	7.0
Good crop standing e.g., less pest infestation and higher yield	12	6.0
Readily available inputs	10	5.0
Sure market	4	2.0
Disadvantages of organic farming		
Results in lesser yield/production	70	35.2
Laborious	59	29.7
Time-consuming/ involves long process	35	17.6
Not readily available/ unavailable organic inputs and/or raw materials	35	17.6
Slower effect than inorganic fertilizers	19	9.6
Problem with the market or the same price as regular rice	14	7.0
Problem with pests	8	4.0
Costly certification	2	1.0
Health hazard (use of animal manure e.g., chicken dung)	2	1.0
No disadvantages	95	47.7

problems with pests (4.0%), costly certification (1.0%), and health hazards (1.0%). In line with this, efforts are being done to organize farmers and encourage them to engage in agri-entrepreneurship (i.e., the Rice Business Innovation Systems [RiceBIS] Community program of DA-PhilRice).

CONCLUSION AND RECOMMENDATIONS

Factors that influence organic rice production in Negros Occidental include the access and availability of information on organic-based technologies to farmers, the experiences, knowledge, and training of farmers, and the collective actions and support of the local government, non-government organizations (NGOs), private sectors, and local farmer associations and cooperatives. Farmers are discouraged from pursuing or continuing organic rice farming because of low productivity and profit under the organic farming system and the problems with marketing organic rice products. To address these challenges, several efforts are being done such as the recognition of Participatory Guarantee Systems (PGS) into law, the Republic Act 11511, for problems related to certification. Likewise, the Department of Agriculture - Agricultural Training Institute (DA-ATI), the Technical Education and Skills Development Authority (TESDA), and the Department of Education (DepEd) conduct training and vocational courses on available organic-based technologies. However, the results of this study show that with organic farming, rice grain yield and farmers' profits in the province are still low. Research and development efforts in organic rice production should focus on developing accessible rice varieties and technologies for increased yield and profit. Organizing farmers for agri-entrepreneurship and linking them to markets while making organic rice products a high-value production enterprise will improve the economic position of the organic farmers in Negros Occidental. Interventions can also be conducted for organic rice farmers who are ready to be certified under the PGS because of their existing management practices. More women may also turn the preparation of organic inputs into an income-earning opportunity, which may further encourage the adoption of organic rice production in the country.

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