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Perceptions and practices of rice farmers in the lowland areas of Diplahan, Zamboanga Sibugay, Mindanao, Philippines

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Abstract

The study aimed to ascertain the current perceptions and practices of local rice farmers in the municipality of Diplahan, Zamboanga Sibugay. It was also conducted in order to know the issues and concerns of farmers by looking into their management practices that include seed and seedling transplanting, fertilizer application, pesticide application, tillage and non-tillage cultivation. The research was carried out in ten barangays in the said municipality. Personal interviews (PI) were conducted with 150 local farmers in the study to collect information for perceptions and practices using a guide questionnaire that was translated into Cebuano to facilitate a better understanding among the farmers. The study results showed that rice production in Diplahan has fallen below the minimum required yield to achieve rice self-sufficiency due to the numerous issues regarding rice crop management in both irrigated and non-irrigated farmlands. The study found that farmers continued to rely on existing local knowledge gained from families, experience, and co-farmers, despite there are already existing programs and seminars on the proper farm management conducted by the Department of Agriculture. Many of them believed merely on luck. Moreover, more appropriate farming practices were not implemented due to poverty and other economic issues. Lastly, problems in rice crop management such as nutrient application, pest recognition, pesticides, herbicides, and insecticides applications by local farmers emerge in the study.

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Introduction

Rice is the most widely grown crop in the Philippines, accounting for roughly 30% of total agricultural area harvested (Dawe, 2003). It is grown in a variety of ecosystems throughout the country, including irrigated lowland, rainfed lowland, upland, and adverse (cool-elevated, saline-prone, and zinc-deficient soils environments) (IRRI, 1991; FAO, 1992). Aside from being a staple food, rice and its production provide an important source of employment and livelihood in the Philippines' rural areas (Laborte *et al.*, 2015). Rice farming provides more than half of the household income for two million families. Furthermore, millions of landless farm workers and tens of thousands of merchants rely on rice for a living (Bordey, 2010).

Rice farming, on the other hand, is under threat from a variety of environmental factors (IPCC, 2001; Fand *et al.*, 2012; Hope, 2009; IRRI, 2006; Karuppaiah and Sujayanad, 2012; Mubaya *et al.*, 2010; Mitin, 2009, and Wassmann and Dobermann, 2007), due to the changing intensity and duration of rainy season in the Philippines, as well as pest outbreaks (Yasin, 2011; Dengiz, 2013). Rice production practices in the Philippines are constantly changing in order to cope with changing climate and other issues (McCarl, 2006; Ceesay, 2004). This includes changes in technologies and programs to meet the challenges and needs of Filipino farmers and the entire population (Mitin, 2009). This is deemed most pressing due to continuing population growth and the demand for rice. The use of modern high-yielding varieties, as well as nutrient, pest and disease, and water management, are all technologies that directly contribute to higher yield (Bautista and Javier, 2008).

While rice productivity has increased over the years, full self-sufficiency has yet to be achieved, despite technological advances in rice science and the promotion of improved technologies and practices to Filipino farmers (Bautista and Javier, 2008). This can be attributed to farmers' poor management practices, which are largely based on their perceived beliefs and attitudes toward damage and control, rather than the use of modern management practices suited to a specific variety and environmental climatic conditions (Minh *et al.*, 2014; Mitin, 2009; Heong and escalada, 1999; Heong *et al.*, 2001). With this, there is a need to assess current practices and perceptions of local farmers as one of the essential inputs in the formulation of a rice crop management plan. There is also a need to integrate local and technical knowledge so that farmers can easily adopt more appropriate farming practices.

In the province of Zamboanga Sibugay, the municipality of Diplahan is considered to be a major contributor to the province rice supply. However, it has been shown to produce less in all previous cropping seasons. Thus, this study sought to fill the gap by documenting those farmers' perceptions and practices particularly in seed and seedling transplanting, fertilizer application, pesticide application, tillage and non-tillage cultivation in the second cropping period of the year 2020 that affect rice production management that lead to improper practices. With this, the study will serve as a baseline to document farmers' perceptions on the production practices of the rice crop.

Materials and methods

This study was conducted in the municipality of Diplahan, Zamboanga Sibugay, Philippines (Fig. 1). It is a landlocked municipality in the coastal province of Zamboanga Sibugay. The municipality has a land area of 255.51 km² distributed among 22 villages which constitute 7.08% of Zamboanga Sibugay's total area. The municipality of Diplahan is one of the major rice producers in the province of Zamboanga Sibugay which also covers a wide array of river basin which support the water system of the agriculture areas specifically rice production.

Respondents of the Study

The respondents of the study were the local farmers residing from the selected villages in the municipality. A sample size of 150 was fixed for the study. Considering the numerous quantity of farmers' population in the municipality, random

simple sampling of 150 farmers which divided evenly into ten (10) villages (Guinoman, Ditay, Natan, Sampoli- A, Balangao, Paradise, Pilar, Luop, Lubing, and Tinongtongan) was done. The selection of the respondents was based on the recommendations of the village officials, *purok* presidents and municipal agriculturist who were familiar in the area.

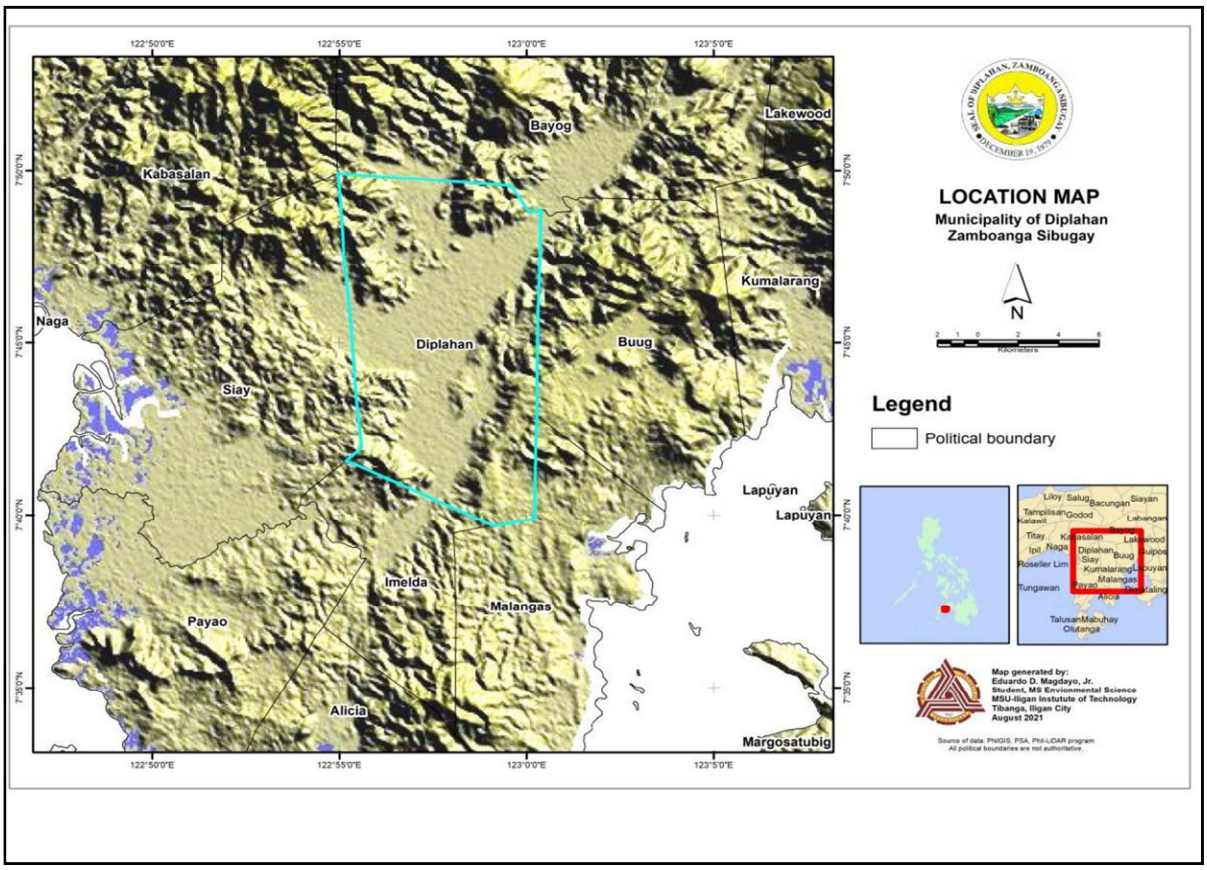

Fig. 1. Map of the municipality of Diplahan, Zamboanga Sibugay, the sampling site of the study.

Data Collection

An interview was undertaken among the respondents of the study using a guide questionnaire. The questionnaire was adopted from the study of Yagos and Demayo, 2014; and Ashgar *et al.*, 2013 with minor revisions. The questionnaire was divided into two parts. The first part was focused on determining farmers' profile, while the second part was on determining farmers' perception on rice production management practices. The final version of the questionnaire used to gather information was translated into Cebuano, the local language, to facilitate a better understanding of the farmers. Personal interview (PI) was carried out to enable information sharing, analysis, and action among the rice farmers. The collection of data for the farmers' perceptions on rice production management was conducted mainly through a survey with the aid of a guide questionnaire. Additional information was gathered through conducting Personal Interview (PI). Data mining was also done for gathering secondary data using the internet, journals, reports, and other publications.

Data Analysis

The data gathered from the survey were encoded and interpreted using the descriptive statistical tool to describe farmer's responses to the perceptions and farming practices.

Results and discussions

Socio-demographic profile of the respondents

The results of the survey show that the majority of the farmers surveyed in irrigated and non-irrigated areas

were male, married and belonged to the Roman Catholic religion. Male farmers dominated because communities believe that growing rice requires physical strength. It can also be seen that most of the farmers were Ilonggo.

In terms of age, most of the respondents were in the middle ages between 36 and 55. Most of the respondents have completed secondary education and few have completed tertiary education. Some farmers did not graduate from college during their time due to graduation from high school is considered sufficient, and their parents immediately encouraged them to work on the farm to support the family. The results also showed that most of the farmers surveyed have 16-30 years farming experience, which led them to believe that their farming experience made them more than capable of growing rice (Table 1).

Table 1. General profile of the respondents.

Variables	Percentage (%)	
	Irrigated	Non-irrigated
Sex		
Male	61	31
Female	75	25
Civil Status		
Single	5	4
Married	87	88
Separated	1	2
Widowed	7	6
Religion		
Roman Catholic	73	61
Others	27	39
Ethnicity		
Bisaya/Cebuano	31	24
Boholano	3	19
Ilonggo	57	52
Subanen	6	1
Others	3	4
Age		
15-35	9	17
36-55	51	55
56 above	40	28
Educational attainment		
No education	0	1
Elementary level	25	33
Elementary graduate	8	8
High School level	27	35
High School graduate	15	11
College level	13	11
College graduate	12	1
Number of years in farming		
1-15	28	28
16-30	36	45
31-45	24	22
46 above	12	5

The majority of the respondents were heavily reliant on rice farming as their primary source of income (Table 2), with farming accounting for 76-100 percent of their household income share. The findings also revealed that the majority of farmers earn less than PhP 5,000.00/month, which are considered poor because they do not exceed the minimum income requirement based on the Philippine living standard of PhP 7,337.00/month for a family of five to meet their basic food needs. Findings revealed that 43% of farmers in irrigated and 51% in non-irrigated area obtain their funding from their own budget (Fig.2). Farmers have been using the profits from previous cropping periods to meet the needs of current farming cultivation expenses, while avoiding debt and loans from cooperatives and middlemen. Additionally, findings showed that 21% of farmers in irrigated area and 18% in non-irrigated area were continued to borrow from cooperatives to obtain financing.

Table 2. Socio-economic profile of the respondents.

Variables	Percentage (%)	
	Irrigated	Non-irrigated
Household Size		
Less than 5 members	57	48
5-10 members	39	51
10 members above	4	1
Source of Income		
Farming	97	99
Others	3	1
Household income share		
Up to 25%	3	1
26-50%	10	0
51-75%	36	39
76-100%	51	60
Monthly income		
Less than 5000	48	51
5001-10000	36	43
10001-15000	10	5

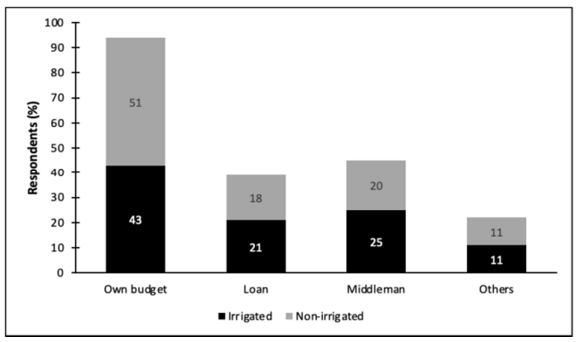

Fig. 2. Source of budget for farming in irrigated and non-irrigated farmlands.

Farmers' perceptions and practices on seeds and seedlings transplanting

Farmers in both irrigated and non-irrigated areas have beliefs that influence their decision-making regarding rice farming management practices (Table 3). Among the farmers surveyed, 43% hold the opinion that planting high seed rates will not result in a high yield because, according to their observations, it will only cause seed crowding and the plant will be unable to produce more tillers. On the other hand, 32% of the farmers believe that planting high seed rates results in high production because they think that if you plant more, you will harvest more. This finding is in consistent with the findings of Yagos and Demayo study, 2015. The majority of farmers (38%) were unaware that high seed rates in direct seeding practices would be prone to insect infestations; they suspect that insects were always present in the area and that they existed seasonally regardless of the quantity of seed broadcasted. According to their beliefs, humans have no control over insect infestations. Many farmers have always relied on good fortune. Even farmers who had been educated through an information drive organized by the municipal agriculture office still adhere on luck to run their farms (Yagos and Demayo, 2015).

Many farmers (47%) also have an idea that transplanting seedlings over wider distances would not increase yield. They claimed that if you sow the seed over a longer distance, only a few plants will occupy the area, resulting in a low yield. Other farmers (39%) prefer planting at a greater distance because they figure. out that planting at a greater distance makes the plant healthier, that it tillers more vigorously because the roots are more widely dispersed, and that planting at a greater distance helps to regulate the presence of insects in the area because they are exposed to direct sunlight. There were also those who strictly follow the standard protocol in rice farming, especially in seed plantation, but this is done on a case-by-case basis depending on soil quality, seed variety, and economics, as only a few can afford the high cost of seeds. The majority of farmers interviewed in the area (56%) were not convinced that transplanting taller seedlings will result in faster growth. They argue that transplanting taller and older seedlings deprived its ability to grow and tiller more because they were old enough, farmers favour to plant smaller seedlings that are less than 25 days old because they are easier to transplant. On the other hand, some farmers (39%) prefer to transplant taller seedlings, they have found that taller seedlings can grow faster when transplanted because they are already taller than younger seedlings and are strong enough to withstand the attack of the golden apple snail.

When it comes to yield, the majority of farmers (56%) have considered new rice varieties are better because it produces a higher yield than traditional rice varieties. However, farmers also believed that using a new rice variety would necessitate a higher rate of fertilizer inputs due to its susceptibility to damage.

Table 3. Perception statements on seed and seedling transplanting.

Perception Statements	Agree (%)	Disagree (%)	Not sure (%)
High seed rates give high yield.	32	43	25
High seed rates will result in more insect problems	36	38	26
Transplanting seedlings in wider distance will increase yield.	39	47	14
Transplanting taller seedlings will grow faster.	39	56	5
New rice varieties have the same yield with the traditional variety.	35	56	9
New rice variety is prone to damage and needs more fertilizers.	75	17	8

*n = 150

Farmers' perceptions and practices on fertilizer application

Farmers apply fertilizer to increase rice production. According to the survey results, all farmers used inorganic fertilizers. Only a few of them used both organic and inorganic fertilizer simultaneously. Farmers were unsure of the efficacy of sole organic application, so they supplemented it with synthetic fertilizer. The fertilizers farmers commonly used were urea (14-0-0), complete (14-14-14), ammonium

phosphate (16-20-0) and potassium chloride or muriate of potash (0-0-60). The rates of fertilizer applied varied from one farmer to another.

Findings revealed that 63% of the respondents believed the high input of fertilizer will produce healthier crops and have more filled grains (Table 4). According to their reasoning the application of high fertilizer inputs will result to a high production as they perceived that plants require high amount of fertilizer. Some farmers argue that, in the current situation, it is impossible to plant rice and expect a high yield without fertilizer, and that it is preferable to use more fertilizer. Only few farmers (28%) have knowledge on the effect of too much fertilizer application on rice. They were aware that excessive fertilizer application does not guarantee a high production rate because it results in many empty grains. Aside from that, excessive use of inorganic fertilizers, can cause nutrient imbalances and lower pest resistance (Altieri and Nicholls, 2003). Majority of the farmers (55%) realize that applying excessive fertilizers will result to pest infestation and increase disease incidence. It is estimated that approximately 60% of applied fertilizers are left behind as residues, polluting underground water, rivers, and lakes, as well as altering soil microbial ecology by affecting the diversity of soil microflora and fauna (Heong and Escalada, 2005).

While the majority of farmers (58%) were aware of the negative effects of excessive fertilizer application to the soil, they continue to use it because according to them it can help them generate a higher yield. Farmers also believe that applying a large amount of fertilizer is necessary nowadays; they think that plants are heavily reliant on a large amount of fertilizer, and the level of yield is linked to the amount of fertilizers applied. Results also showed that majority of the farmers (46%) find inorganic fertilizer better as compared to organic fertilizers. They find it more convenient because it is easy to use and is readily available in the market, which is why many farmers now prefer to use inorganic fertilizers (Table 4). During the survey, farmers were asked about the use of organic fertilizer in the next five years in order to avoid using synthetic fertilizers and to change their practices in restoring soil fertility in their farmlands. Through their responses, it will be impossible for them to use only pure organic fertilizers in next five years because they prefer the effect of synthetic fertilizers, and some farmers are afraid to do so because they are unsure of the results (Fig. 3). They have a limited understanding of the advantages of organic farming. According to one farmer, using pure organic fertilizers nowadays is pointless because most farmers use synthetic fertilizers, and because farmers use water from the neighboring field most of the time, and if the adjacent area used synthetic fertilizers, those who use organic will still be affected due to the water used.

Table 4. Perception statements on fertilizer rate application.

Perception Statements	Agree (%)	Disagree (%)	Not sure (%)
High input rate of fertilizer will:			
Produce healthier crops and more filled grains	63	28	9
Increase diseases/insects problem	55	31	13
Harm and degrade the quality of the soil	58	29	13
Result in higher yield	64	25	11
High fertilizer rate is necessary nowadays	79	15	7
Organic is better than inorganic fertilizer	33	46	21

*n = 150

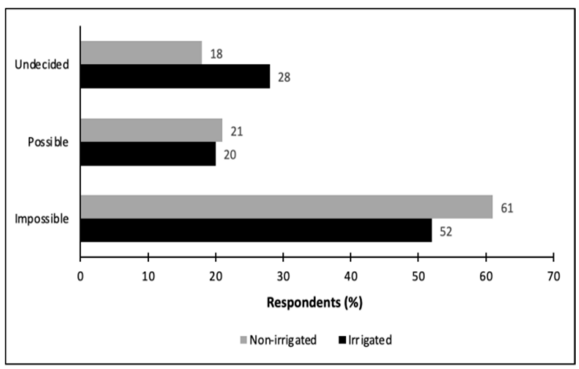

Fig. 3. The possibility of pure organic fertilizer being used in farming in next five years.

Farmers' perceptions and practices on pest management

During the survey interview, farmers were asked if there had been any changes in the amount of pesticides used in the previous five years. The majority of respondents (64%) said there had been no change, while 31% said there had been an increase in pesticide usage because pests and insects had developed resistance and were immune to the effects of pesticides, so farmers needed to double their pesticide usage, and 5% said there had been a decrease (Fig. 4). Based on the findings, farmers were so dependent on pesticides as their primary pest control method. Thus, pesticides have dominated the pest management practices of rice farmers. And when the farmers increase the use of pesticides it will pose a serious threat to farmers' health, environment, and biodiversity in the rice crop ecosystem (Berg, 2001).

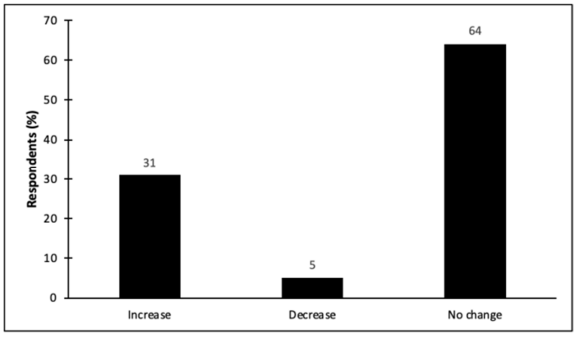

Fig. 4. Changes in pesticides during the last five years.

Farmers' practices on pesticides application

The proper application of pesticides at the right time is vital to a successful pest control program. This practice will lower the cost of pesticides and their implementation, as well as protect the environment from poisonous pesticides that are applied ineffectively and at inappropriate times (Ashgar *et al.*, 2013). It is clear in Fig. 5, that only a small fraction (4%) of farmers were not using insecticides. But majority of the farmers (70%) applied insecticides just after seeing the presence of pest and 21% on calendar/crop-stage base or routine wise schedule because farmers innately prefer the simpler crop stage-based insecticide approach. These findings were supported with the study of Berg (2001). And only 5% of the farmers used insecticides after seeing the symptoms of the damage (Fig. 5). As most farmers, who were mostly concerned about yield losses that could occur as a result of pest insect attack, they applied unnecessary insecticides by simply looking for insect pest/damage or on a routine basis, which is in accordance with the findings of Heong *et al.*, (1995). Farmers observed these pest insects or their damage not through proper pest scouting methods, but by monitoring them while weeding, during irrigation and fertilizer application, and walking on the rice field bunds. This finding is supported with those of Asghar *et al.*, (2013).

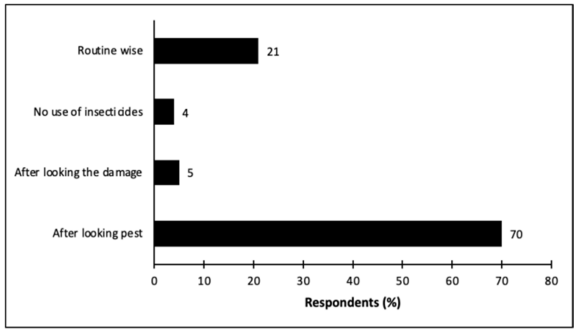

Fig. 5. Farmers' response on when to apply insecticides in their ricefields.

Farmers' perception statements on pesticides application

Pesticides are widely used by rice farmers to control pests and diseases (Pingali & Rola, 1993), a practice that is no longer uncommon among farmers. Farmers believe that pesticides are an effective method of pest control and that pesticides are just "medicine" used to treat crops that had been harmed by pests (Parveen, 2010). According to the findings (Table 5), the majority of farmers (91%) interviewed were aware of the harmful effects of pesticides on their health; however, many farmers did not wear protective equipment when applying pesticides for the simple reason that it was a burden and not comfortable. And the majority of respondents sprayed chemicals three to five times per month, either by themselves or by hired workers. Furthermore, the farmers primarily used hand sprayers. The spraying methods they used are linked to a high risk of contamination and exposure (Pingali and Roger, 1995). Farmers were aware that using pesticides will destroy the pests'

natural enemies, yet they still consider pesticides as the most effective method of pest control (Parveen, 2001). Farmers surmise that using chemical pesticides would not completely eliminate pests in the area, it might only create pest resistance, and pests exist all year round and that they have no control over the situation. And the reason why farmers continue to use pesticides is in order to lessen the occurrence of pests and prevent yield losses. Farmers also argue that it was impossible to plant rice without the use of pesticides, especially now that pests are definitely rampant and needs to be controlled. Other factors also that farmers prefer to use pesticides because they are less expensive and easier to apply than natural pest control methods.

While farmers have developed methods for controlling pests and managing plant diseases, these agronomic practices have not provided an adequate and environmentally sustainable method of disease control. Farmers' perceptions of plant diseases may differ considerably from those of scientists (Thurston, 2019). According to the findings of this study, farmers' local knowledge can be substantial in some areas but largely insufficient in others. Farmers' perceptions of pests, available techniques, and resources must be reinforced in order to persuade them to adopt better crop and pest management practices. There is a need for a better assessment and understanding of farmers' current pest management practices, perceptions, and constraints in order to improve pest management decision making (Lim and Heong, 1984; Mumford and Norton 1984; Norton and Heong, 1988).

Table 5. Perception statements on pesticides application.

Perception Statements	Agree (%)	Disagree (%)	Not sure (%)
Insecticide spray will:			
Harm health	91	4	5
Kill natural enemies of pest.	78	11	11
Eliminate the pest in the area	21	69	10
Modern farmers use pesticides	91	3	6
Pesticides are cheaper and easy to apply	64	29	7

*n = 150

Farmers' perception statements on soil tillage

Farmers in both irrigated and non-irrigated areas have little awareness of tillage practices. The majority of the respondents (71%) said that tilling the soil would not harm soil quality (Table 6). This was in contrast to the findings of Derpsch *et al.* (2010), who found that any soil management practices imposed for the purpose of altering the heterogeneous body could result in either generous or harmful outcomes. This is supported by Ramos *et al.* (2011), that unsuitable management practices degrade soil health (depletion of organic matter and other nutrients) as well as crop productivity. Soil tillage is one of the main factors affecting soil properties and crop yield (Alam *et al.*, 2014). Tillage fractures the soil, disrupting soil structure and speeding up surface runoff and soil erosion (Al-Kaisa *et al.*, 2019). Despite this, farmers interviewed continued to claim that tillage cultivation will not remove topsoil due to erosion, and when asked why, they had no logical reasoning to back up their claim. Farmers also believe that using tillage cultivation will not reduce the inherent fertility of the soil.

In most cases, increased tillage levels or tillage periods resulted in soil carbon losses (Alam *et al.*, 2014). The majority of farmers (94%) pointed out that modern farmers use tillage cultivation methods because they argue it is impossible to grow rice without tillage, and they believe that tillage management will help them cultivate faster and produce more desirable yields. Furthermore, farmers in both irrigated and non-irrigated areas were aware of the high monetary cost of tillage cultivation, but they continued to use it because they think it is necessary and could reduce their effort in crop management.

Table 6. Perception of farmers on soil tillage.

Perception Statements	Agree (%)	Disagree (%)	Not sure (%)
Soil tillage will:			
Degrade the quality of the soil.	13	71	15
Remove topsoil by erosion.	41	43	15
Loss the inherent soil fertility.	26	57	17
Result to high fuel and labor cost	92	7	1
Modern farmers practice soil tillage	94	3	3

*n = 150

Farmers' perception statements on non-tillage of soil

Regardless of the above-mentioned issue with tillage cultivation, farmers in both irrigated and non-irrigated areas were still resistant to using zero tillage. They have their own arguments and beliefs that make it difficult for them to abstain from tilling the soil. For them it is extremely difficult to plant rice without the soil tillage, particularly in rain-fed areas where they must plow their soil and use mechanized tractors to suppress weeds and soften the soil prior to seedbed preparation. Nonetheless, farmers have good insights into non-tillage cultivation, and their responses were positive, despite the fact that they have not tried the mentioned practices.

Farmers agree that zero tillage will help lessen soil erosion (83%). This study's findings are consistent with Uri's study (1999), which found that no-till helps to reduce soil erosion. Reduced soil erosion caused by no-till will alleviate many off-site erosion-related issues, including water-use impairment. Moreover, zero tillage helps lessen moisture loss (75%), reduce fuel, labour and equipment cost (94%), improve soil structure (71%), and increase the amount and variety of life in and on the soil (91%) (Table 7). Despite these perceptions, farmers still prefer to till the soil as they believe that it is also difficult for them to cultivate without tillage. Weeds will thrive dramatically, and without tillage, it will be difficult to suppress weeds, necessitating the application of large amounts of herbicides to control weeds.

Table 7. Perceptions of farmers on non-tillage of the soil.

Perception Statements	Agree (%)	Disagree (%)	Not sure (%)
Non-tillage will:			
Help to lessen soil erosion	83	2	15
Help to lessen soil moisture loss.	75	4	21
Reduce fuel, labour and equipment cost.	94	3	3
Improve soil structure.	78	5	17
Increase the amount and variety of life in and on the soil.	91	2	7

*n = 150

Conclusion

Farmers are the primary actors in agriculture, and their knowledge should be regarded as one of the most valuable assets in the pursuit of sustainability. The objectives of this study were to investigate how farmers' perceptions, local knowledge, and practices influence their decisions regarding rice crop management. It was evident in the study that farmers continued to rely on existing local knowledge acquired from families, experience, and co-farmers, despite there are already existing programs and seminars on the proper farm management conducted by the Department of Agriculture. The study found several farmers' instincts, beliefs, and perceptions that are not technically in line with good crop management. Many of them believed merely on luck and because of poverty and other economic issues, more appropriate farming practices were not implemented. Lastly, problems in rice crop production such as nutrient and pest management practices, which are based on local farmers' perception, emerge in the study.

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