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Economic Performance on Postharvest Practices among Lowland Rice Farmers in Lanao Del Sur, ARMM, Philippines

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Abstract
Farming is an extensive cultivation of plants to yield food, feed, or fiber; to provide medicinal or industrial ingredients; or to grow ornamental products. This study sought to determine the economic performance of postharvest practices among lowland rice farmers in Lanao del Sur, ARMM, Philippines. Two hundred (200) randomly selected lowland rice farmers from the municipalities of Ramain, Buadiposo-Buntong, Bubong, and Mulondo, all Lanao del Sur participated this survey research. Results revealed that farmers have less threshing and drying practices. Majority used mechanical threshing and solar drying; never practice storage and milling. Postharvest problems are: lack of awareness and appropriate technologies, lack of capital and incentives for quality products; too much broken straw on oscillating screen, grain blown over the wing board, high investment cost, unfavorable weather conditions, inefficient one-pass method, lack of electric power/fuel, drying, milling, and storage methods. Furthermore, educational attainment, yield, annual gross income, transportation cost, and extension contacts have significant influence to threshing practices. Family size, farm size, yield, annual gross income and credit availability had significant influence. Family size, tenure status and annual gross income showed significant influence to storage. The losses, cost, output recovery, and time spent were significantly different for threshing while drying; only output recovery has no significant difference. As such, farmers form cooperative and purchase facilities to improve postharvest practices, and get financial assistance from government and private institutions to improve crop yield.

Keywords: Economics, performance on Postharvest; Lowland rice farmers, Meranao

Introduction

Farming is mankind's most important activity. Management of farms has therefore always been critically important for the production of food, fibre and fuel (Kemp et al., 2004). Rice (*Oriza spp.*) after wheat is the most widely cultivated cereal in the world and it is the most important food crop for almost half of the world's population (IRRI, 2009).It is consumed by over half of the world population. The total world production of unmilled rice (paddy) is around 592 million tons (based on the average production for 2000 and 2001). Ninety percent of this total is grown in developing countries, mostly in Asia, while Latin America and Africa produce 3.8 and 2.8 percent, respectively (FAOSTAT, 2001). Rice is often the main source of employment, income and nutrition in many poor, food insecure regions of the world. In South Asia, where 530 million

people live on less than US $1 a day, calories supplied by rice account for about 60-70% of total food intake.

Rice cultivation is the principal activity and source of income for about 100 million households in Asia and Africa. Post-harvest and transformation activities generated by rice production also employ a large share of the total labour force in Southeast Asia. Several countries are also highly dependent on rice as a source of foreign exchange earnings and government revenue (FAO, 2004). It is estimated that by 2025, 10 billion people will depend on rice as a main food and the demand may reach about 880 metric tons. Many Asian countries and international institutions agree to the strengthening of national programmes for policy and financial support to research, seed production and extension of hybrid rice (FAO, 2001).

The maximization of benefits from rice production requires crop quality management along the so-called postharvest chain operations that include threshing, drying, storage and milling. While much has been done to increase crop yields through improved cultural and management practices, little attention is given to postharvest operations. Considerable losses were incurred after harvest than losses before harvest. Pava and Abellanosa (1987) cited that the major causes of postharvest losses were grouped into the following: (1) biological and microbiological consumption or damage done by insects, mites, rodents, birds, and by microbes such as molds and bacteria; (2) chemical and biochemical – undesirable reactions between chemical compounds that are present in the food such as fat oxidation, and a number of enzyme activated reactions substance such as pesticide; (3) mechanical – spillage, abrasion, bruising, excessive polishing, peeling or trimming and puncturing of containers; (4) physical – excessive or insufficient heat or cold, and improper atmosphere; and (5) physiological – sprouting of grains caused by respiration and transpiration.

Rice producers can significantly increase their income from their rice crops if they can reduce physical losses throughout the post-harvest chain, store their rice until they can get a better price in the off season and produce better quality in which most markets translate into a higher price. Postharvest losses in food crops occurring during harvesting, threshing, drying, processing, storage and transportation have been estimated to claim between 30 and 40% of all food crops in developing countries.

Lanao del Sur as the locale of the study has a cool and pleasant climate which is distinguished by an even distribution of rainfall throughout the year which is very suitable for lowland rice production; it is observed that during crop season rice production has its potential. However, there are problems during postharvest critical operations such as harvesting, threshing, drying, storage, and milling hardly which result to reduction of yield or supply due to losses. It is for this reason that the study on economic performance of postharvest practices among lowland rice farmers in Lanao del Sur is conducted.

Objectives of the Study

The main objective of this study was to assess the economic performance of postharvest practices among lowland rice farmers in Lanao del Sur, ARMM, Philippines. The study aimed to:

1. present the demographic and socio-economic profile of the respondents;
2. determine lowland rice farmers perception towards the different postharvest practices or operation;
3. determine the perception of the respondents towards the problems indicated in postharvest practices or operation in terms of:
    a. lack of awareness/resistance to change,
    b. lack of capital/operating cost,

c. lack of incentives for better product quality, and
d. lack of appropriate technologies and infrastructures;

4. ascertain lowland rice farmers perceptions towards specific problems indicated in each postharvest practices;
5. identify the factors that significantly influence the postharvest practices of farmers; and
6. identify the significant difference in the economic performance of postharvest practices adopted by lowland rice farmers in terms of losses, output recovery, time spent, and cost.

Conceptual Framework

Mostly, Filipinos are rice eaters. The essentially rice consumers position of the vast majority of Filipinos has eclipsed the complex ties that bind the cultivator to the rice crop. In a culture where the symbolic value of rice has undergone historic marginalization, consumers are alienated from the dynamics of production, and treat rice as a mere commodity. In farming, postharvest operations must be given adequate attention since the quality and quantity of the product is highly dependent on product handling until the same reaches the point of consumption. It is interesting to know how the lowland rice farmers handle their product.

The postharvest research paradigm in Figure 1 shows the interplay between the independent variables and the dependent variables. The independent variables include the Demographic factors such as sex, age, education attainment, family size, and socio-economic factors which include farming experience, tenurial status, farm size, yield, annual gross income, transportation cost, credit availability, extension contact, membership in an organization. The intervening variables are postharvest practices that include threshing (Hampasan, Trampling and Mechanical thresher), Drying (Solar/Conventional drying and Mechanical drying), the storage: (Farm level storage and Off-farm level storage) and lastly the milling: (Mortar & pestle, Kiskisan, and Cono rice mill). Figure 1 below shows the research paradigm wherein the dependent variables include the economic performance caused by losses, time spent, cost and output recovery.

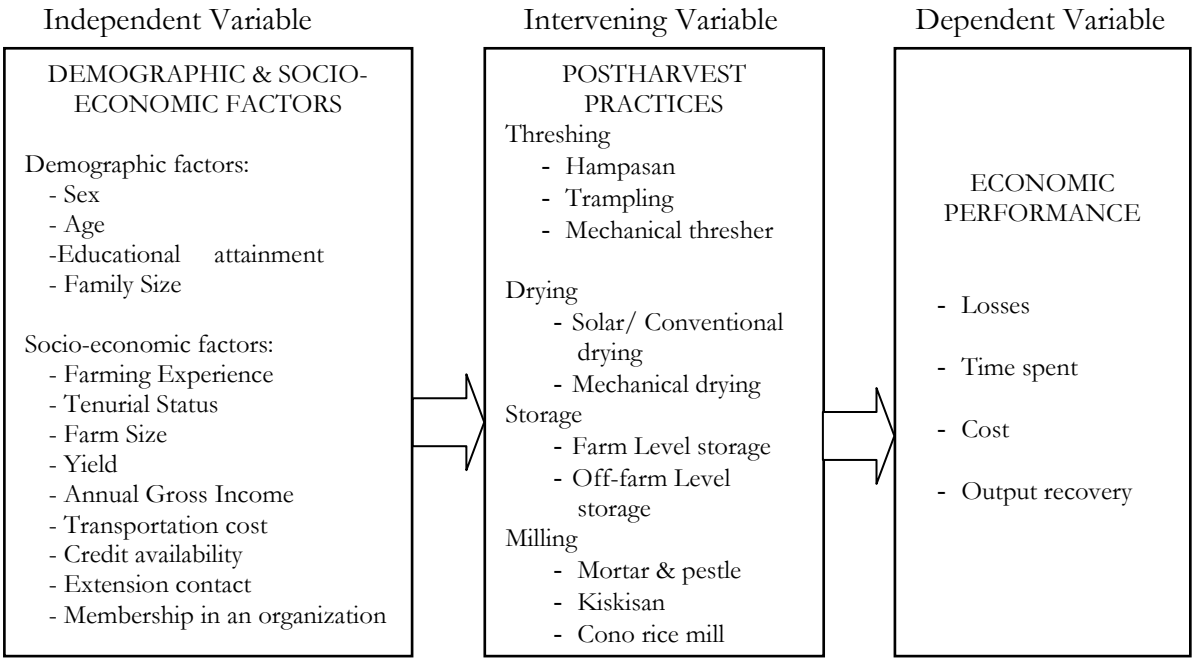

Figure 1. Schematic diagram of the Study

Methods

Research Locale and Participants of the Study

The study was conducted at Lanao del Sur, Autonomous Region of Muslim Mindanao (ARMM), Philippines, particularly in the four (4) municipalities in Lanao del Sur engaged in lowland farming, namely: Ramain, BuadipusoBuntong, Bubong, and Mulondo. The selection of these municipalities was based on the following reasons/or factors: farmers in these municipalities were commonly engaged in lowland rice production; there is a stable peace and order; and these places are accessible to the researcher. The Province of Lanao del Sur, is a province of the Philippines located in the Autonomous Region in Muslim Mindanao (ARMM). The capital is the Islamic City of Marawi and it is bordered by Lanao del Norte in the North, Bukidnon in the East, and Maguindanao and Cotabato in the South. On the Southwest lies Illana Bay, and arm of the Moro Gulf. Found in the interior of Lanao del Sur is Lanap Lake, the largest lake in Mindanao.

A total of 200 lowland rice farmers were taken as respondents coming from four (4) municipalities of Lanao del Sur, namely: Ramain, Buadipuso Buntong, Bubong, and Mulondo. The distribution of respondents by municipalities is shown in Table 1.

Table 1. Distribution of the respondents of the study

MUNICIPALITY	TOTAL POPULATION	SAMPLE	PERCENTAGE %
Remain	100	50	25%
BuadipusoBuntong	106	51	25.5%
Bubong	89	47	23.5%
Mulondo	107	52	26.%
Total	402	200	100%

As shown in Table 1, there were a total population of 402 in the four municipalities. Lists of qualified farmers from the selected municipalities were obtained from the DA/ MAO in Ramain, BuadipusoBuntong, Bubong, and Mulondo. Since the study only employed 200 respondents, the researcher made used simple random sampling design in selecting the respondents. In determining the desired number of the respondents, a formula of Slovin (1980) as cited by Carabelle (2004) was used in this study.

The formula is as follows:

$$N / (1 + N e^2)$$

where: N = total size of the population
n = size of sample
e = margin of error (0.1)

Research Instruments and Data Gathering Procedure

Structured questionnaires were used by the researcher in data gathering. A pre – survey was conducted on the first week of February 2014 to determine the appropriateness of the questionnaire content and add-on those questions that were not included during the first draft of the questionnaires. For the convenience of the respondents, the questions written in English were translated orally into the vernacular dialect (Meranao) to facilitate proper communication and comprehension.

The data collected were the demographic and socio-economic background of the farmer-respondents which includes age, sex, educational attainment, family size, farming experience, tenurial status, farm size, yield, transportation cost, credit availability, extension contact, etc. the following data were also included: perception of the respondents towards the different postharvest practices; perceptions towards the problems identified; the factors influencing the farmer's choice in postharvest practices; and lastly, the economic performance of postharvest practices in terms of cost, losses, output recovery, and time spent.

Data Analysis

Descriptive statistics such as relative frequency, percentage, standard deviation, simple and weighted mean was used in data analysis. Chi-square was also used to identify the factors that significantly influence the postharvest practices of farmers. Moreover, for the comparison on the performance of postharvest practices adopted by lowland rice farmers in terms of output recovery, time spent, cost, and losses, the data were analyzed using t-test.

The farmers' perceptions on the different postharvest practices were measured in a 5-point scaling as follows:

Scale	Range	Qualitative Description
5	4.20-5.00	Highly Practiced
4	3.40-4.19	Practiced
3	2.60-3.39	Moderately Practiced
2	1.80-2.59	Less Practiced
1	1.00-1.79	Never Practiced

Where:

- *Highly Practiced means that the lowland rice farmers always used the type of practice.*
- *Practiced means that the lowland rice farmers commonly used the type of practice.*
- *Moderately Practiced means that the lowland rice farmers fairly used the type of practice.*
- *Less Practiced means that the lowland rice farmers sometimes used the type of practice.*
- *Never Practiced means that the lowland rice farmers certainly not used the type of practice.*

Perceptions towards the problems on postharvest was measured in a 5-point scaling as follows:

Scale	Range	Qualitative Description
5	4.20-5.00	Very Major Problem
4	3.40-4.19	Major Problem
3	2.60-3.39	Moderate Problem
2	1.80-2.59	Minor Problem
1	1.00-1.79	Not a problem

Where:

- *Very Major Problem means that the lowland rice farmer considers it as extreme or main problem which is hard to deal with.*
- *Major Problem means that the lowland rice farmer considers it as foremost or main problem.*
- *Moderate Problem means that the lowland rice farmers consider it as fair or tolerable problem.*
- *Minor Problem means that the lowland rice farmers consider it as slight or lesser problem.*
- *Not a Problem means that the lowland rice farmers consider it as not or never a problem.*

For threshing and drying practices:

A) average output recovery of one type was compared with the output recovery of the other type of practice;

B) average time was the time spent for each practice and was compared with the other type of practice;
C) average cost incurred for one type was compared with the other type of practice; and
D) average losses for one time were compared with the other type of practice.

For milling, the data gathered were analyzed using descriptive statistics since the respondents practiced the same type of milling operations.

Results and Discussion

Demographic and Socio-Economic Profile of Farmers

Rice farmers' demographic and socio-economic characteristics include sex, age, educational attainment, family size, farming experience, tenurial status, farm size, yield, annual gross income, credit availability, extension contact, transportation cost, and membership in an organization. The distribution of respondents according to these variables is shown in Table 2 shows that all respondents (100%) are males. This implies that males dominated the population of lowland rice farmers in Lanao del Sur, a fact that was actually expected because in Maranao culture, women are not allowed to go on farming; by nature male is the provider for family's needs while the female's role is for household chores.

Table 2. Demographic and socio-economic profile of the lowland rice farmer-respondents in Lanao del Sur, ARMM

VARIABLES	FREQUENCY (N=200)	PERCENTAGE (%)
Sex		
Female	0	0
Male	200	100
Age		
18-28 years old	49	24.5
29-39 years old	45	22.5
40-50 years old	74	37
51-61 years old	23	11.5
62-72 years old	9	4.5
Average = 39 years old		
Youngest = 18 years old		
Oldest = 67 years old		
Educational Attainment		
Elementary	72	36
High School	94	47
College Level	28	14
College Graduate	6	3
Family Size		
1-5	101	50.5
6-10	50	25
11-15	49	24.5
Average = 6 members		
Farming Experience (years)		
1-10	58	29

VARIABLES	FREQUENCY (N=200)	PERCENTAGE (%)
11-20	75	37.5
21-30	55	27.5
31-50	12	6
Average = 12 years		
Tenurial Status		
Owner cultivator	94	47
Amortizing owner	46	23
Rental	60	30
Farm Size (hectare)		
≤ 1	50	25
1.1 – 3.0	147	73
3.1 -5.0	3	2
Average = 2 hectares		
Yield (kilograms)		
≤ 2,000	3	1.5
2,001-4,000	47	23.5
4,001-6,000	84	42
6,001-8,000	61	30.5
8,001-10,000	5	2.5
Average = 4, 500 Kg		
Annual Gross Income (Php)		
≤ 20,000	10	5
20,001-40,000	28	14
40,001-60,000	69	34.5
60,001-80,000	74	37
80,001-100,000	19	9.5
Average = Php65,000.00		
Credit Availability		
No	178	89
Yes	22	11
Extension Contact		
Fellow farmers	147	73.5
DA's Extension worker	10	5
Extension worker SUC	32	16
Agricultural dealers	6	3
Local buyers/traders	5	2.5
Transportation cost (Php/sack)		
20.00-25.00	84	42
26.00-30.00	68	34
31.00-35.00	48	24

VARIABLES	FREQUENCY (N=200)	PERCENTAGE (%)
Average = Php23.00/sack		
Member in an Organization		
No	156	78
Yes	44	22

The study revealed that the highest frequency of age falls from the age bracket 40-50 years of age which comprised 74 respondents (37%). Almost one-fourth (24.5%) of them belong to 18-28 years old and less than 5% belong to 62 years and above. The oldest lowland rice farmer respondent was 67 and the youngest was 18 years old.

Most of the lowland rice farmers (47%) attained high school and 3% graduated from college. This implies that rice farmers are more likely to take strategies to improve economic performance of postharvest practices. Kilpatrick (1997) disclosed that education enhances farmer's ability and willingness to make successful changes to their farm.

It was found out that a little more than one-half of the respondents (50.5%) have a family size of 1-5, followed by family size of 6-10 members (24%) and 11-15 members (24.5%). The result was expected because Maranao culture preferred many members of the family for "paramihannglahi" and for helpers in rice farming. It was also expected since they do not practice family planning because it is prohibited in Islam religion.Ali (2003) stated that for traditional Maranaos, having plenty of children in the family is a blessing as well as an opportunity to achieve economic success, since there are more producers of economic goods and services in the family. Unlike today, having many children in the family means more consumers in the family rather than producers. At this point in time, only rich can afford to support many children considering the rising cost of living in our modern society. The Maranao believes that every member of the family not only the head must o utilize his/her knowledge, skills, and abilities in earning
It was observed that almost half of the respondents (47%) were owners of the land they cultivated. More than one-fourth of the respondents (30%) rented land they cultivated, followed by 23% were amortizing owner. None of the respondents involved into mortgage. This implies that farmers who own the land are more innovative than tenants and leaseholders because landowners can go with the risk of investing something whether labor or cash. This finding supports study of Caraballe (2004) and Bautista (1993) that landowner farmers are prone to adopt new technology compared to tenants. There were (37.5%) respondents that had been in the rice farming for 11-20 years followed 1-10 years farming experience (29%), 21-30 years (27.5%), and only 6% have engaged in rice farming for 31-50 years. This finding implies that with the length of experience on rice farming, it is expected that farmers are knowledgeable and skilled in different postharvest practices. This finding supports the notion that experience is the best teacher and the length of time spent in farming affects the adoption of technology (Ebd-Ella cited by Intong, 1996).

Majority (73.5%) of the lowland rice farmers have farm sizes of 1.1 to 3.0 hectares. A fourth (25%) had farm size less than 1 hectare and only three respondents (1.5%) have 3.1 to 5 hectares. The study revealed the average yield per hectare was 4000 cavans (kilograms) or 80 sacks per 50 kilograms. Majority (42%) has an average yield of 4000-6000 kilograms. The least yield is less than or equal to 2000 kilograms where there are 1.5% of the respondents. Based on the findings, it is no surprise that the average yield of lowland rice farmers falls on the range 4000-6000 cavans because it was previously found that more or less fixed hectarage for rice

production, the average yield per hectare should be 3 to 5 tons in the irrigated and rainfed areas, respectively (PRRPO, 2005).
Thirty-seven (37%) have an annual gross income ranging from 60,000-80,000. Only ten or 5% have reported a gross income of less than or equal to 20,000. The average annual gross income was ₱ 63,000.00.

The transportation cost of rice products to nearest market outlets shows that most of the respondents (42%) have a transport cost of 20 to 25 pesos which is also the cheapest transportation cost. Only one-fourth (24%) of the respondents have a transportation cost of 31-35 pesos which is also the most expensive transportation cost.
Majority (89%) of the lowland rice farmers in the Lanao del Sur have have not availed of any credit or financial assistance from their postharvest production and only 11% positively responded that they avail of financial assistance or loan from their postharvest production but such loan is a credit from their friends or relatives, and not from any lending institution. The finding implies that the lowland rice farmers of Lanao del Sur has no access to any credit institution. According to Nhelmachena and Hassan (2007), access to affordable credit increases financial resources of farmers and their ability to meet transaction costs associated with various adaptations that they might want to take.
Many farmers (73.5%) of the respondents rely on their fellow farmers as a source of information about postharvest operation/technology. This was followed by extension worker from SUC (16%); DA's extension worker (5%) and the least source of information that lowland rice farmers were the local buyers which has only 2.5%. The finding coincided with the study of Dela Cruz (1994) that the farmers' main source of information with regards to postharvest is their fellow farmers.

Perceptions of Respondents by Type and Extent of Postharvest Practice among Lowland Rice Farmers

Table 3. Perceptions of lowland rice farmer-respondents by type and extent of postharvest practices

Postharvest Practices	**Never Practiced**		**Less Practiced**		**Moderately Practiced**		**Practiced**		**Highly Practiced**		**Total**		**Mean**	**Qualitative Description**
	F	%	F	%	F	%	F	%	F	%	F	%		
Threshing:														
Hampasan	200	100	0	0	0	0	0	0	0	0	200	100	1.0	NP
Trampling	124	62	10	5	24	12	42	21	0	0	200	100	1.92	LP
Mechanical	76	38	6	3	8	4	24	12	86	43	200	100	3.19	MP
Average:													2.04	LP
Drying:														
Solar	89	44.5	6	3	9	4.5	18	9	78	39	200	100	2.95	MP
Mechanical	194	97	0	0	0	0	6	3	0	0	200	100	1.12	NP
Average:													2.03	LP
Storage:														
Farm level	58	29	85	42.5	54	27	3	1.5	0	0	200	100	2.01	LP
Off-farm	200	100	0	0	0	0	0	0	0	0	200	100	1.0	NP
Average:													1.51	NP
Milling:														
Mortar & pestle	200	100	0	0	0	0	0	0	0	0	200	100	1.0	NP
Kiskisan	107	53.5	3	1.5	37	18.5	11	5.5	42	21	200	100	2.39	LP
Cono	200	100	0	0	0	0	0	0	0	0	200	100	1.0	NP
Average:													1.46	NP

The farmers do threshing manually (hampasan and trampling) and mechanically. It was found out that 100% of the respondents never practiced hampasan, less practiced trampling and moderately practiced mechanical thresher. Lowland rice farmers in Lanao del Sur both practiced trampling and mechanical thresher. They revealed that they make use of trampling if small amount of paddy is to be threshed. They usually threshed the paddy by using their underfoot but if large amount of paddy is to be threshed, they prefer to use mechanical thresher because according to them it is not laborious.
Drying has also two types or method and these are solar or sun drying and mechanical drying. As revealed in the table, on the average, solar drying is moderately practiced by the respondents compared to mechanical drying where only 6 out of 200 respondents practiced it but on the average mechanical drying is not practiced. The finding implies that majority of lowland rice farmers rely on sun drying of threshed paddy.

Lowland rice farmers of Lanao del Sur usually dried their threshed paddy by putting and spreading the threshed paddy in a tarpaulin sheet on the road or concrete pavement of a basketball court under the sun and manually raked it several times a day to ensure uniform drying to prevent deterioration. They added that sun drying is cheaper and did not need special skills or expertise.

For storage, 100% of the respondents never practiced off-farm level storage (storing paddy or milled rice in a private or government warehouses) but less practiced farm storage (storing paddy or milled rice for consumption or retain paddy as seed for planting in the next season). Lowland rice farmers in Lanao del Sur usually do not practiced storage because according to them they chose to sell their produce directly to have cash on hand and buy the needs of their family. They revealed that storing rice is very critical for them considering that they lack the facilities that will prevent deterioration of paddy and pest attack that will bring a big loss for them. That is why they prefer to sell it. They added that if in case they will store accordingly, it is intended only for consumption or to be used as seeds for the next cropping.

In milling the respondents never practiced mortar and pestle and cono rice mill but there are 134 out of 200 respondents practiced kiskisan for milling, while 66 respondents never practiced all the said types or methods of milling. They prefer to sell it to rice miller that offers them higher income than milling it through kiskisan that will bring only 50-60% output recovery. Lowland rice farmers in Lanao del Sur usually milled their produce in kiskisan because it is the only available method. The findings imply that lowland rice farmers in Lanao del Sur is dependent only on kiskisan or one pass mill.This suggests that lowland rice farmers in Lanao del Sur should adopt cono rice mill or modern rice mill.

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Perceptions of Respondents towards the Problems on Postharvest Practices

Perceptions of respondents towards the problems on postharvest practices are shown in Table 4. As shown in the table, lack of capital to pay for postharvest practices and credit unavailability are the major problems of the individual/poor farmers. This is not surprising. The fact that lowland rice farmers in Lanao del Sur have not availed of any financial or credit assistance for their postharvest operation, no doubt that they consider lack of capital as their main problem. Accordingly, they stress that if there is available capital then they can buy postharvest facilities but still they suffer on the payment of the high interest and the high power cost in using the facility.

In terms of lack of awareness/resistance to change, the respondents consider it as a moderate problem. The need to educate the end users is also another problem, since most lowland rice farmers obtained a high school level of education, so it is expected that they need to be educated and be aware of those technologies promoted by the government and need to have an aggressive extension program. They learned postharvest technology only from their fellow farmers so if they are properly informed by these extension workers and these co-lowland rice farmers to make themselves ready for change and improvement.

Table 4. Perceptions of respondents towards the problems on postharvest practices of lowland rice farmers in Lanao del Sur, ARMM.

PROBLEMS	Np		Mip		Mop		Mjp		Vmp		Total		Mean	Sd	Qualitative Description
	F	%	F	%	F	%	F	%	F	%	F	%			
Lack Of Capital:															
A. Individual/ Poor Farmers Cannot Afford To Buy Postharvest Facilities.	21	11	8	4	28	14	64	32	79	39.5	200	100	3.86	30.1	Mjp
B. Credit/ Financing Not Readily Available.	13	6.5	12	6	25	13	85	43	65	32.5	200	100	3.89	33.1	Mjp
C. High Interest Rates	0	0	0	0	38	19	84	42	78	39	200	100	4.2	25	Vmp
D. High Energy/Power Cost	0	0	4	2	42	21	62	31	92	46	200	100	4.21	36.9	Vmp
Average:													4.04	31.3	Mjp
Lack Of Awareness/ Resistance:															
A. Need To Have An Aggressive Extension Program As In The Production Phase	18	9	39	20	47	24	44	22	52	26	200	100	3.37	13.2	Mop
B. Need For Government To Initiate/Assist Promotion Of Technologies	28	14	58	29	56	28	32	16	26	13	200	100	2.85	15.7	Mop
C. Need To Educate The End-Users	0	0	13	3.5	95	48	74	37	18	9	200	100	3.49	40.8	Mjp
Average:													3.24	23.2	Mop
Lack of Technologies:															
a. Difficulty in operation, repair and maintenance	15	7.5	30	15	**79**	**40**	48	24	28	14	200	100	3.22	24.8	MOP
b. Mismatch of capacity	11	5.5	37	19	62	31	**62**	**31**	28	14	200	100	3.3	22.1	MOP
c. Lack of capacity during peak of harvest	5	2.5	14	7	**58**	**29**	75	38	48	24	200	100	3.74	29.6	MJP
d. Poor or absence of road system in the rural	**82**	**41**	74	37	43	22	0	0	0	0	200	100	1.8	20.6	NP
Average:													**3.02**	**24.3**	**MOP**

Legend:

Scale	Range	Qualitative Description	
5	4.20-5.00	Very major problem	(VMP)
4	3.40-4.19	Major problem	(MJP)
3	2.60-3.39	Moderate problem	(MOP)
2	1.80-2.59	Minor problem	(MIP)
1	1.00-1.79	Not a problem	(NP)

With regards to the problem on lack of technologies, it was revealed that 39% ($\bar{x} = 3.22$) of the respondents view difficulty in operations, repair and maintenance a problem, 31% ($\bar{x} = 3.30$) consider mismatch capacity as a moderate problem while 29% ($\bar{x} = 3.74$) of the respondents consider lack of capacity during peak harvest as a problem. Poor or absence of road system in the rural areas is never considered a problem. Therefore, the findings imply that lack of technologies is a moderate problem in the lowland rice farmers in the province of Lanao del Sur.

Perceptions of Respondents towards the Specific Problems on Postharvest Practices

As for the specific problems in each postharvest operation, it was found out in the study that with regards to the problem on threshing, the respondents, on average ($\bar{x} = 3.65$), consider threshing as a major problem. Almost half (47.5%) of the respondents consider too much broken straw on oscillating screen as a major problem, 42.5% consider grain being blown over the wind board as a major problem and 33% consider dirty grain as a moderate problem on threshing as one of the postharvest operations in lowland rice farming.

As found out in the study, the respondents used mechanical thresher which suggests that these farmers must be trained and informed on proper usage of these mechanical thresher to avoid the mentioned problems and economic losses may be eliminated, if not minimized. The respondents consider high investment cost and unfavorable weather condition as a major problem. Out of the 200 respondents, 96 and 67 respectively say it is a major problem.

In addition, milling as a postharvest practice is also done by the lowland rice farmers and they consider it as one of the major problems. The lowland rice farmers in Lanao del Sur used to mill their paddy using kiskisan or one-pass mill and they consider it as a very big problem because accordingly, high breakage occurs especially if the paddy is not well-dried giving them low recovery of grains. Another problem encountered by the lowland rice farmers is there is no electric power/fuel and the technology is costly. If there is no electric power, they cannot mill their rice.

Moreover, the lowland rice farmers in Lanao del Sur consider storage as a major problem because they lack storage facilities that would maintain the quality of the produce. Consequently, high investment cost is a major problem because the farmers cannot afford to buy storage facilities since these are expensive and they lack capital.

Table 5. Distribution of respondents on the extent of the identified specific problems on postharvest practices among 200 lowland rice farmers in Lanao del Sur, ARMM

PROBLEMS	NP		MIP		MOP		MJP		VMP		TOTAL		Mean	SD	Qualitative Description
	F	%	F	%	F	%	F	%	F	%	F	%			
Threshing:															
a. Too much broken straw on oscillating screen	0	0	0	0	55	27.5	**95**	**47.5**	50	25	200	100	3.98	24.66	MJP
b. Grain being blown over by the wind board	0	0	25	12.5	51	25.5	**85**	**42.5**	39	19.5	200	100	3.69	25.64	MJP
c. Dirty grain	11	5.5	37	18.5	62	31	**66**	**33**	24	12	200	100	3.28	23.8	MOP
Average:													**3.65**	**24.7**	**MJP**
Drying:															
a. High investment cost	0	0	0	0	47	23.5	**96**	**48**	57	28.5	200	100	4.05	25.89	MJP
b. Unfavorable weather condition	4	2	32	16	53	26.5	**67**	**33.5**	44	22	200	100	3.58	23.84	MJP
Average:													**3.83**	**24.9**	**MJP**
Milling:															
a. Inefficient one-pass	0	0	0	0	39	19.5	**88**	**44**	73	36.5	200	100	4.17	25.11	VMP
b. No electric power/fuel	4	2	32	16	53	26.5	**67**	**33.5**	44	22	200	100	3.58	23.84	MJP
c. Costly	32	16	60	30	**64**	**32**	30	15	14	7	200	100	2.67	21.31	**MOP**
Average:													**3.47**	**23.4**	**MJP**
Storage:															
a. High investment cost	0	0	19	9.5	**88**	**44**	83	41.5	10	5	200	100	3.42	41.21	MJP
b. Unfavorable climate	6	3	21	10.5	74	34	**80**	**40**	19	9.5	200	100	3.43	34.33	MJP
Average:													**3.43**	**37.8**	**MJP**

Legend:

Scale	Range	Qualitative Description	
5	4.20-5.00	Very major problem	(VMP)
4	3.40-4.19	Major problem	(MJP)
3	2.60-3.39	Moderate problem	(MOP)
2	1.80-2.59	Minor problem	(MIP)
1	1.00-1.79	Not a problem	(NP)

Factors Influencing the Farmers Choice on Postharvest Practices

Factors influencing the farmers' choice on postharvest practices are shown in Table 6. According to the results, it was found out that educational attainment, annual gross income, transportation cost and extension contact have significant relationship to threshing. Lowland rice farmers' educational attainment is only high school level, which implies that the farmers has a greater chance of adopting or learning improvement strategies in their postharvest practices particularly in threshing.

According to Maddison (2006), educated and experienced farmers are more knowledgeable and informed about agronomic practices and therefore can take an adaptation measure in response to the effects of change. Bordey (2004) found out also that farmers with at least secondary level of education have greater probability of hybrid rice continuous adoption. This was contradicted by Torregoza (2000), who pointed out that educational attainment played no significant influence on farmer's decision to adopt new technology because it is the nature of innovation being considered. According to Rustia and Talaima (as cited by Carabelle, 2004), education is not an adoption factor.

Table 6. Factors affecting farmers' choice of threshing, drying and storage practices among 200 lowland rice farmers in Lanao del Sur, ARMM

Independent variable	THRESHING		DRYING		STORAGE	
	p-value	Chi-square	p-value	Chi-square	p-value	Chi-square
Sex	0.315	2.186	0.665	0.506	0.810	0.421
Age	0.866	30.329	0.105	51.486	0.932	62.059
Educational attainment	0.013	10.855**	0.765	1.151	0.776	3.256
Family size	0.428	1.699	0.028	11.699**	0.023	11.045**
Farm size	0.120	4.241	0.043	5.858**	0.478	3.500
Farming experience	0.458	2.596	0.458	2.596	0.299	7.247
Tenurial status	0.524	1.292	0.370	1.988	0.00	20.156**
Yield	0.029	10.803**	0.022	11.432**	0.970	2.311
Annual gross income	0.043	9.157**	0.026	11.045**	0.013	10.855**
Transportation cost	0.006	10.753**	0.031	0.533	0.395	4.083
Credit availability	0.426	0.205	0.006	11.393**	0.734	0.620
Extension contact	0.019	11.730**	0.138	6.952	0.990	1.642
Member in an organization	0.194	1.105	0.194	1.105	0.827	0.380

Yield is another factor that has significant relationship to threshing. As found in the study, the respondents' average yield per hectare is 4,500 kilograms and they both practiced trampling and mechanical threshing. This means that higher yield is gained because of the availability of mechanical thresher where the farmers can be able to thresh the paddy in a short period of time. The use of agricultural machinery substantially reduces the amount of human labor needed for raising crops. The average amount of labor required per hectare to produce and harvest rice, corn and other crops has fallen to less than a fourth of what was required only a few decades ago, hence mechanization has enabled the small percentage on farms to produce enough yield (Microsoft Encarta [DVD], 2009). Transportation cost is a factor to be considered in threshing practiced.

Contact to extension workers is another factor that has significant relationship in threshing. It implies that farmers' contact to extension workers from DA or SUC enables them to gather more information in improving their postharvest practices especially in minimizing the economic losses incurred. As found out in the study, lowland rice farmers are not members of any

organization; in fact, their sources of information with regards to postharvest practices or technology are their fellow farmers. Hence, if these farmers will be able to have extension contact, then there is possible improvement in their threshing practices. According to De Guzman (as cited by Damag, 2003), the local government units particularly the Department of Agriculture provides service delivery system to the people specifically the agricultural sector as embodied in the Local Government Code (LGC) of 1991 (RA 7160). According to Rogers (1995), mass media such as TV, radio and newspaper is considered a more effective way to generate awareness of the innovation; whereas, interpersonal communication is considered more effective in influencing individual's decision to adopt.

In addition, for drying practices, the factors that have significant relationship were family size, farm size, yield, annual gross income and credit availability. Family size influenced drying practices because expenditures by farmers are for family living and for production of goods (Microsoft Encarta [DVD], 2009); a lesser family size would mean a higher income for the farmers to spend on buying mechanical drying facilities. Farm size is also an important factor to be considered in drying. As observed in the study, the average farm size of the lowland rice farmers in Lanao del Sur is two hectares and the maximum farm size of four hectares. These imply that lowland rice farmers have sufficient farm size in producing rice and drying their produce and likely willing to adopt strategies in improving their postharvest practices particularly in drying. The result agrees with Palero (2005) that farm size is significantly associated with farmers' extent of adoption of total quality and productivity management. Estigoy as cited by Laurente (2004), found significant relationship between the adoption of innovation and farm size. The study of Laureto (1997) showed that farm size is significantly related to the adoption of modern technologies. Aguanta (2008) stresses that Maranao rice farmers' practices are significantly influenced by farm size and appropriateness of MSB strategies. On contrary, Deressa et al. (2010) stresses that farm size negatively affects the use of one, or a combination of identified coping strategies by farmers. Also, yield is an important factor. Lowland rice farmers' average yield per hectare is 4,500 kilograms which means that these farmers can dry their produce either through sun drying or mechanical drying.

Annual gross income is significantly related to drying practice as well as credit availability. The average gross income of the lowland rice farmers per hectare was ₱65,000 and their lone source of income is farming. They have not availed of any financial assistance for their postharvest production. The findings imply that lowland rice farmers in Lanao del Sur are willing to adopt new strategies or purchase drying facilities if their income is sufficient. If not, loans or financial assistance could help them much better to buy mechanical dryer as substitute to solar drying. It can be noted that these farmers rely mainly on sun drying, so if the weather condition is not good then these farmers will not be bothered if they have a mechanical dryer. Ramos (1994) said that the flow of income may reckon daily, weekly, monthly, or yearly. A community where the economic level is subsistent, agricultural change is unlikely to occur. If the family income is considerably lower, it may then proceed to become a member of an organization to avail of modern technology and have greater yields in production (Solidan as cited by Palero, 2005). The study of Bautista (1993) cited that family income in DFS is affected by the wet and dry season making these two seasons a predictor of annual income.

Furthermore, in terms of storage, family size, tenurial status, and annual gross income are factors to be considered in storage practices. A large family size would influence the farmers' income; this obliged farmers to defer means of improving their properties and facilities (Microsoft Encarta [DVD], 2009). Most of the lowland rice farmers cultivate their own land which means that make their own decisions to adopt for the improvement of their storage practice, implying that there is a possibility that the farmer-respondents may decide converting portion of their land

to be used as their storage for their paddy. However, as found in this study, the farmers actually less practiced storage due to lack of storage facilities. Kemp et al. (2004) stated that the land and its related resources for one's basic needs serve as the source of the world's accumulated wealth. Salva (1990) observed too that owners are more prone to make decision to adopt new practices, while non-owners obtain permission first before trial or use of innovation. Annual income is an important factor to storage because those with higher income would possibly purchase storage facilities like "silo" in storing their paddy or milled rice. For milling, there is only one type of method used and that is kiskisan or one pass mill.

Economic Performance of Postharvest Practices

Threshing

As shown in Table 7, majority (62%) of the respondents used mechanical type of threshing while 38% used trampling type of threshing. It implies that both trampling and mechanical thresher was practiced by the lowland rice farmers in Lanao del Sur.

Table 7. Threshing practices of lowland rice farmers in Lanao del Sur, ARMM

TYPE OF THRESHING	FREQUENCY	PERCENTAGE (%)
Trampling	76	38
Mechanical thresher	124	62
Total	200	100%

Table 8 shows that the economic performance of threshing a sack or 50 kilogram of paddy in terms of time spent was 7.0 minutes in mechanical threshing while 50 minutes in trampling. The finding implies that trampling spent much time due to its laborious method compared to mechanical threshing. The cost spent per sack of paddy in mechanical threshing was ₱22.00 compared to trampling which was ₱56.00 per sack. Out of 50 kilograms, the output recovery for using mechanical thresher was 45.3 kilograms while there is a greater output recovery in trampling which is 48.2 kilograms. As for the losses, mechanical thresher incurred 8.36% loss higher compared to trampling that incurred only 2.66%. The results imply that there is a significant difference between mechanical and trampling in terms of cost, time spent, output recovery and losses.

Table 8. Economic performance of threshing practices by lowland rice farmers in terms of losses, output recovery, time spent, and cost in Lanao del Sur, ARMM

INDICATORS	THRESHING		Difference	t-test
	Mechanical Thresher	Trampling		
Time spent (min)	7.0	50	43	-161.45**
Cost (P/sack)	22	56	34	-160.79**
Output Recovery(kg)	45.3	48.2	2.9	-60.01**
Losses (%)	8.36	2.66	5.7	57.37**

** Significant at 0.05 level

Lowland rice farmers in Lanao del Sur prefer to use mechanical thresher even if it gives higher loss and low output recovery. The result of the study agrees with Basavaraja et al. (2007) that

grain losses during threshing activity were estimated to be 0.52kg/q in rice. The threshing losses were mainly in the form of broken grains, which were slightly higher, when produce was threshed by machine as compared to manual threshing. However, a majority of the producers preferred power thresher due to their cost and time advantages. Ramos (1994) found that threshing by using treading or trampling caused 3.6% losses. Besides, it increased the presence of mud balls and the broken percentage of the milled rice. Patil and Basappa (2005) added that an average total losses during the threshing was 0.18 quintals per farm or 0.07 quintals per ha, which was to the tune of 11.92% of the total at field level, or farm level. This is because majority of farmers threshed their produced by power thresher. The losses during threshing in terms of broken grains, scattering of grains out of threshing yard, grains left over in the thresher were higher when produce was threshed by machine. But due to cost and time advantage, majority of the producers preferred to thresh their produce by mechanical thresher. The higher losses were compensated through the reduction in labor cost and time. Guisse (2010) stressed that threshing losses were also higher (6.14%) when threshing was done using the "bambam" (a big locally made wooden box) than when the bag beating method (2.45%).

In many countries in Asia and Africa, the crop is threshed by being trodden underfoot (by human or animals); the output is 30-50 kg of grain per hour. The same method, using a mechanical thresher the output is a few hundred kg per hour (FAO, 2007). With regards to cost, threshing service fees normally varies with regions of the country. In Central Luzon, for example, threshing fees are normally in kind (paddy) which is 6% of the total amount of threshed paddy (PRRPO, 2005).

Drying

Table 9 reveals that out of 200 respondents, there were only 117 of them who practiced drying either through mechanical or solar drying. A little more than one-half (55.5%) of the respondents prefer solar drying while only 3% used mechanical drying. The rest of the respondents (41.5%) did not practice drying; they directly sell their produce to traders or millers for the reason that they needed immediate cash and they have inadequate facilities to practice milling and storage. The finding implies that lowland rice farmers in Lanao del Sur preferred to use solar drying in drying paddy.

Table 9. Drying practices of lowland rice farmers in Lanao del Sur, ARMM

TYPE OF DRYING	FREQUENCY	PERCENTAGE (%)
Mechanical	6	3
Solar drying	111	55.5
No answer	83	41.5
Total	200	100%

Table 10 shows the economic performance of drying practices of a 50 kg or sack of paddy. In terms of time spent, sun drying of paddy spent eight hours and 51 minutes while mechanical drying spent only of two hours and 50 minutes. Lowland rice farmers in Lanao del Sur mainly rely on sun drying for it is cheaper and does not need expertise. They usually put their paddy and spread it in a sheet of tarpaulin on a concrete pavement under the sun and occasionally stirred it to have uniform drying. As found in the study, there were six respondents who used mechanical dryer because for them, it eliminates the problems associated with sun drying and it offers more advantage of timeliness in the drying operation aside from maintaining the quality of grain and

control in drying process. The result implies that there was a significant relationship in terms of time spent at 0.05 level between sun drying and mechanical drying. They usually do this for about 8-24 hours depending on the weather condition. The result agrees with the Philippine Recommends for Rice Postproduction Operation (2005) stating that about eight hours is required to dry wet paddy from 24% to 14%.

Table 10. Economic performance of drying practices by lowland rice farmers in terms of losses, output recovery, time spent, and cost in Lanao del Sur, ARMM

INDICATORS	THRESHING		Difference	t-test
	Sun drying	Mechanical		
Time spent (min)	8.51	2.50	6.01	17.8**
Cost (P/sack)	10.00	100.00	90.00	29.60**
Output Recovery(kg)	46.19	47.33	1.14	1.18
Losses (%)	3.17	4.39	1.22	2.48**

** Significant at 0.05 level

In terms of cost, cost incurred in mechanical and solar drying a 50 kg or sack of paddy was ₱100.00 and ₱10.00 per sack respectively, it implies that mechanical drying of paddy incurred high cost compared to sun drying. Several studies have been conducted to determine the operating cost of mechanical heating system. As cited in the Philippine Recommends for Rice Postproduction Operation (2005) and in the study of Tumambing (1984), there is an average drying cost of ₱6.00/cavan for rice-hull mechanical dryers. This is very high compared with the cost of sun drying of ₱ 1.50/cavan (Villaruel and Cardino, 1984).

The output recovery performance of the two methods or types of drying was found that out of 50 kilograms, 48 kilograms was the output recovery for mechanical drying and 47 kilograms were recovered using the sun drying type. Thus, there was no significant difference between the performance of the respondents who used mechanical and solar type of drying in terms of output recovery.

As for the performance of drying in terms of losses, it was shown that there was 4.39% loss for solar drying and 3.17% loss for mechanical drying. This means that greater loss is incurred in using solar drying compared to mechanical drying and by using critical regions $t<-1.96$ or $t>1.96$ the t-test value of the study was 2.48 which implies that that there was a significant difference between the performance of the respondents who used mechanical and solar type of drying in terms of losses. The National Postharvest Institute for Research and Extension (NAPHIRE, 2003) rice postharvest loss assessment studies reported that the average magnitude of losses attributed to drying is about 6.5% of its potential yield. Some 30% of the total postharvest losses were attributed to drying alone. According to Basavaraja et al. (2007), the losses due to drying operation in grains were estimated to be 0.80 kilogram per quintal in rice and 0.66 kilogram per quintal in wheat. These were mainly due to use of traditional methods of drying by the farmers. It was also indicated in the study of De la Cruz (1994) that there was a statistically significant difference in losses between amacan and concrete pavement at 0.01 levels. This indicates that the use of concrete pavement incurs more losses than conventional type. Patil and Basappa (2005) added that the drying loss was 13.91%. This was mainly because most of the farmers adopted manual method of drying and most of the farmers spread out the grains on the country yard, tarpaulins which cause loss due to birds, rodents and animals.

Storage

Table 11. Storage practices of lowland rice farmers in Lanao del Sur, ARMM

TYPE OF STORAGE	FREQUENCY	PERCENTAGE (%)
Farm storage	142	71
Neither nor farm or off-farm	58	29
Total	200	100%

In addition, based on the study, storage is less practiced by these farmers as they chose to sell their produce directly to have cash on hand and buy the needs of the family. They also revealed that storing paddy is very critical for them for they lack storage facilities that may prevent deterioration of paddy and pests attack that may bring a big loss for them. They added that if in case they will store accordingly, it is intended only for consumption or for seeds in the next cropping. They usually put their paddy in a sack and store them in a vacant space in their house. As for the duration of storage, the respondents answered differently but the longest length of storage is 1-2 weeks, but as much as possible they immediately sell their paddy due to their need of cash, lack of storage facilities and lack of capital for building storage facilities. Aside from these reasons, they are afraid that their stored paddy will be lost because of fire, bad weather, theft or attack by a pest or rat or spillage. These were the reasons why no economic performance computations was done for drying in terms of cost, loss, time spent and output recovery.
According to the Philippine Recommends for Rice Postproduction Operations (PRRPO, 2005), storage facilities of farmers in farm level were sacks, container types such as wooden boxes, cans, granaries, bamboo baskets and volcani cubes. Grains in sack are usually placed directly on the floor, on wooden boxes or in open sheds, or under the house. In the Philippines, 60% of the total stack is stored in the farm level while the rest are stored in private and government warehouses. A study conducted in Luzon showed that farmers lose an average of 0.6 kg/bag inside granaries as a result of spillage and 0.4 kg/bag due to rodent attack (Ebron et al., 1978).

Milling

Table 12 reveals that out of 200 respondents, there were only 93 or 46.5% of the respondents who use mechanical type of milling specifically the kiskisan or one pass mill and the rest of the respondents did not practice milling since they directly sell their produce to the traders or rice millers.

Table 12. Milling practices of lowland rice farmers in Lanao del Sur, ARMM

TYPE OF STORAGE	FREQUENCY	PERCENTAGE (%)
Kiskisan or one-pass mill	93	46.5
No answer	107	53.5
Total	200	100%

The average time spent in milling a 50 kg produce is 26.77 minutes per sack and the cost incurred was 2.42 per kilograms. In terms of output recovery, 29.4 kilograms was recovered while the losses were 20.5%. The results of the study agree with PhilRice Production Training Manual (2007) stating that the popular kiskisan has a milling recovery of only 60-62% out of a

potential 72%. Losses in the milling process were due either to inherent poor technical performance of milling machinery, or operator ineptitude, resulting in poor milling yields (De Padua, 1999). Peutyet al. (1994) reported that paddy drying conditions affected the rice breakage during the milling process so that rice breakage rapidly increased with the decreasing moisture content of paddy. The difference between paddy temperature and milling environment temperature decreased the performance of rice milling system. They also found that relative humidity of milling environment had significant effect on milling system yield.

Table 13. Economic performance of milling practices using "kiskisan" or one pass milling

INDICATORS	MEAN	STANDARD DEVIATION
Time spent (min)	26.77	5.78
Cost (P/sack)	2.42	1.44
Output Recovery(kg)	29.40	2.96
Losses (%)	20.50	2.96

** Significant at 0.05 level

Conclusions

Lowland rice farmers in Lanao del Sur are dominated by males, aged 40-50 years old, attained high school level, belong to a family of one to five members, with 11-20 years of farming experience who cultivate their own land with an average farm size of 2 hectares, yield of 4,500 kilograms and average gross income of ₱ 65,000.00. The farmers have not availed of credit assistance, and are not members of any organization. They rely on their fellow farmers as a source of information and transport their produce to the nearest market which cost ₱20-25/sack.

On the average, lowland rice farmers in Lanao del Sur less practiced threshing, less practiced drying, never practiced storage, and never practiced milling. The farmers have never practice storage and milling because they prefer to sell their produce after drying. As to the perceptions of lowland rice farmers in Lanao del Sur towards the problems on postharvest practices, lack of capital was considered to be a major problem. Meanwhile, lack of awareness/resistance and lack of technologies are considered as moderate problems. On the average, lowland rice farmers considered threshing, drying, milling and storage as major problems. Specifically, the following problems on postharvest practices were perceived as major problems: too much broken straw on oscillating screen; grain being blown over by the wind board; high investment cost; unfavorable weather condition; inefficient one-pass; and lack of electric power/fuel.

Educational attainment, yield, annual gross income, transportation cost, and extension contact are significantly associated with threshing. If farmers are educated and supported by extension workers from DA or SUC, they are more knowledgeable and have more information in improving their postharvest practices. Meanwhile, lower transportation cost and the availability of mechanical thresher result to a higher yield and higher annual gross income. In addition, family size, farm size, yield, annual gross income and credit availability influence drying, because the availability of credit and sufficient income will help the farmers to adopt new strategies or facilities for drying. Meanwhile, family size, tenurial status, and annual gross income affect storage because those with higher income may purchase the appropriate storage facilities.

There is a significant difference between the economic performance of the respondents in terms of losses, cost, output recovery, and time spent for threshing while for drying only output recovery has no significant difference. Thus, lowland rice farmers choose the type of postharvest practice that gives them high output recovery, low cost and losses incurred. With this, if farmers can form their cooperative they will be able to purchase facilities that will improve their postharvest practices.

Recommendations

Based on the results, it is recommended that the government may consider vigorously promoting extension programs to upgrade the skills of the lowland rice farmers in the province of Lanao del Sur. While it is true that existing extension programs of the government is centered on grain production, the province is still behind with respect to the objectives and goals of the Department of Agriculture for sustainable agriculture in the key grain producing areas.

Also, since one major problem of the farmers is the lack of capital/operating cost, it is recommended that the government would strive to provide financial assistance to these lowland rice farmers to improve their postharvest facilities and operations, and to reduce postharvest losses of rice at the farm level. If not, the farmers themselves should organize themselves to form a cooperative. Seminars and trainings are also recommended with regard to postharvest operations in order to eliminate if not minimize losses and obtain greater output and income for the farmers.

The DA may also consider to strengthen its efforts in promoting farm level adaptation strategies and providing technologies to improve postharvest practices that could eliminate if not reduce or minimize of losses in rice production. Access to extension services ensures that farmers have the necessary information that is helpful in decisions and the means to take up important adaptation strategies. Thus, provision of extension support/programs from concerned institutions is deemed urgent in order to hasten adaptation is imperative. It is in this aspect that the academe, particularly Mindanao State University in Marawi City, could play a vital role in the agricultural aspect of the province by enhancing its extension programs in collaboration with the local government and non-government agricultural organizations.

Credit can increase financial resources of farmers and their ability to meet transaction cost incurred in taking various strategies. For instance, availability of credit will enable farmers to finance farm inputs like fertilizer and quality seeds. In this light, affordable financial assistance from government and private institutions is recommended. It is finally recommended that a replication of this study could be undertaken to include province-wide investigations in order to come up with a comparative analysis and to validate further results of this study.

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