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Analysis of Profitability on Rice Storage by the Farmers in the Selected Areas of Ayeyarwaddy Region, Myanmar

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Identification of the post-harvest activities in rice farmers has been the focus of continuing study by agricultural economists. The intensification of rice production in Myanmar, especially in the Pyar Pon Township, Pyar Pon District, has led to many problems in the post-harvest phase, particularly in storage. This situation is further aggravated by the growing attention devoted to the maintenance of buffer stocks to continuously provide food security for the country. This study examines the profitability of rice storage by the farmers in Pyar Pon District, Myanmar. The partial budget analysis was used to determine the profitability of storing rice. It was proven that by season, the farmers with storage during the rainy season experienced more profitability from storing rice than the farmers who stored rice during both seasons considering that almost all of the rice stocked during the rainy season had better quality and the average volume of rice stored during the rainy season was higher than the average volume stored for both seasons combined. Based on storage duration, the farmers with at least five months of rice storage obtained an average additional profit of 76.08 thousand Kyats (US$93.35) per ton while those with three and four months of rice storage earned 18,700 Kyats (US$22.95) per ton. Additionally, based on comparison of t- test by mean profit, the best time to sell rice for farmers was at least five months after storage.

Key words: Partial Budget Analysis, Rice Storage, Storage Cost, Additional Profits, Pyar Pon District.

INTRODUCTION

The intensification of rice production in Myanmar, especially in the Pyar Pon Township, Pyar Pon District, has led to many problems in the post-harvest phase, particularly in terms of storage. This situation is further aggravated by the growing attention devoted to the maintenance of buffer stocks to continuously provide food security for the country. Furthermore, storage of seasonal or operational stocks is needed to meet seasonal demand and to stabilize prices which subsequently establishes a strategic or long-term reserve against crop failure.

Like most agricultural products, rice is harvested within a short period of time but is consumed all-year round. The majority of the farmers sell rough rice right after harvest time but they also store certain amounts for home consumption, seed purposes and labor wages. Only farmers with large farms and more capital usually store the paddy to sell when the price of rice becomes higher. Therefore, storage will be performed by a farmer only if there are enough incentives in doing it. That is, if there are relatively great price differences between the time of harvest and time of non-harvest.

Rice prices are influenced by the demand and supply situation during the harvest and non-harvest periods. The producers and consumers are faced with a situation wherein rice prices are low during the harvest periods and high during lean months when planting season begins. And since there is a continuous demand for rice all-year round, then a farmer who chooses to store during the months when there is plenty of harvest and sells when prices reach its peak during the non-harvest periods, earns adequate incentive for performing the storage activity. In effect, the farmers gain more benefits by storing some of their produce and procurements, respectively during the time of harvest and selling after sometime when market supply declines and prices are high. Rice-millers, processors, and retailers on the other hand, will benefit from a continuous supply of rice in the market.

This study aims to assess the profitability of storing rice by farmers based on seasons and storage lengths. Costs of storage and gross income of farmers who sell rice immediately and who stored rice, may be variably incurred and so the question of when to sell, when to buy, and when to store needs to be answered in order to gain the highest possible profit.

METHODOLOGY

The study was conducted in the villages of Tha Main Taw Khone Tan/Tein Khone and Maw Bi in Pyar Pon Township, Pyar Pon District, Ayeyarwaddy Region in Myanmar. The study sites were chosen for the following: (1) the villages were major rice-producing and rice-trading areas; (2) the community members from the villages have long-established traditions of rice cultivation; and (3) the farmers from the villages have well-established storage practices. Each group of farmers consisted of those who stored rice and those who did not. Enumerators collected the data from the households through stratified random sampling. Partial budgeting analysis was used to calculate the profitability of rice storage based on seasons and storage length.

Estimation of profitability of storing rice

The costs and benefits derived by farmers from rice storage were compared using the partial budgeting approach. Partial budgeting is a planning and decision-making framework used to compare the costs and benefits of alternatives faced by a farmer. It looks at those revenue and expense items that are affected by the proposed change. This method is used for choosing storing or selling immediately after harvest by comparing the additional profits of each option

(Compton, 1992; and Baldimino, 1996). Basically, a partial budget is made up of four components: two components identify changes in the operation that will increase profits (Total added return or TAR and Total reduced cost or TRC), and two components identify changes in the operation that will decrease profits (Total added cost or TAC and Total reduced return or TRR) (Robert, 2007; Billy *et al.*, 2006). Interpreting the results of a partial budget is very simple. If total gains exceed total losses, then the change being considered is likely to be positive in terms of profitability. According to Roth (2002), a basic outline of a partial budget would look something like this:

Total Gains (Positive effect): $TAR+TRC= P_{2j}Q_{2j} +r_{1j} X_{1j}$ (1)
Total Losses (Negative effect): $TRR+TAC= P_{1j} Q_{1j} +r_{2j} X_{2j}$ (2)
Added Profit (Difference): $(P_{2j}Q_{2j} +r_{1j} X_{1j})-(P_{1j} Q_{1j} +r_{2j} X_{2j})$ (3)

Where:
TAR = Total Added Return
TRC = Total Reduced Cost
TRR = Total Reduced Return
TAC = Total Added Cost

Total gain is the sum of total added return and total reduced cost. Total losses are the sum of total reduced return and total added cost. If total gains are greater than total losses, this will result in additional profit from storage.

In calculating returns of storage and the cost of storage in partial budgeting framework for farmers, volume of rice stored, price of rice before and after storage, hired labor, family labor, chemicals used, depreciation on warehouse, waterproof and lace, opportunity cost of capital, storage losses, and other expenses like maintenance, electric bill, sprayers and classifying costs, etc. were used.

Statistical test procedure

Statistical test was used to compare significant differences in indices among farmers with and without decision in performing rice storage and in mean profit of farmers' category in rice storage. It can be presented as follows:

Test of equality between two sample means of efficiency. The F value is computed by the following formula:

$$F = \frac{{S_1}^2}{{S_2}^2} = \frac{\sum(x_{1i}-\overline{x_1})^2/(n_1-1)}{\sum(x_{2i}-\overline{x_2})^2/(n_2-1)} \qquad (4)$$

where:
s_1^2 and s_2^2 are variances of efficiency indices of sample 1 and sample 2, respectively;
$\overline{x_1}$ and $\overline{x_2}$ are means of sample 1 and sample 2, respectively;
n_1 and n_2 are sizes of sample 1 and sample 2, respectively.

To test whether two sample means of efficiency indices are statistically different, F-distribution is applied to test the equality of the variances of two populations, namely, σ_1^2 and σ_2^2. The sample variances s_1^2 and s_2^2 corresponding sample size n_1 and n_2 are used in computation instead. The F value is then compared to the critical value at α significant level.

If the computed F value is greater than critical F value, the null hypothesis of $H_0: \sigma_1^2 = \sigma_2^2$ is rejected, otherwise accept H_0.

If the two populations have the same variance, the t-test will be used to test the difference between two sample means as follows:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{(n_1-1)S_1^2+((n_2-1)S_2^2}{(n_1+n_2-2)}\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}} \quad (5) \text{ with } (n_1 + n_2 - 1) \text{ as degrees of freedom}$$

If the two population variances are not equal, the following t-test is used:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}} \quad (6) \text{ with } n_0 \text{ as degree of freedom, where } n_0 = \min(n_1, n_2)$$

RESULTS AND DISCUSSION

Storage cost

Average storage cost farmers who stored paddy per year

The total cost incurred by 50 farmers in storing rice per year reached 974,770 Kyats (US$1196) per farm and 17,240 Kyats (US$21.15) per ton. Total cash cost accounted for 22.63% of the total storage cost while non-cash cost contributed 77.37% of the storage cost for rice.

Storage losses of rice due to spoilage and pilferage were very high which 42.04% of the total cost incurred was. This was followed by depreciation cost of warehouse (22.45%) and hired labor cost (17.38%). Family labor cost (7.55%), other costs (5%), consisting of electricity, building maintenance, sprayer, classifying expenses, depreciation of plastic sacks (3.91%), and waterproof (1.03%) were also important storage cost items. Storage rental fee and depreciation cost of lace for drying was the least cost items, with less than 1% of the storage cost.

Average storage cost of farmers who stored in rainy season per year

For the farmers who stored rice in the rainy season only, all of them used their own warehouses. The total non-cash cost spent by sample households was 536,940 Kyats (US$658.82) per farm and the total storage cost was 786,130 Kyats (US$964.58) per farm. On per ton basis, the total non-cash cost was 13,230 Kyats (US$16.23) and the total cost was 19,380 Kyats (US$23.78). The total cash costs were 249,190 Kyats (US$305.75) per farm and 6,140 Kyats (US$7.53) per ton.

Storage losses (45.69%) were also considered as the most important cost item, followed by hired labor cost (24.13%) and depreciation cost of warehouse (10.59%). Therefore, an increase in the cost of any of the three items would drastically increase the storage costs for rice. Family labor cost and others (including electricity, building maintenance, sprayers, classifying) accounted for 10.10% and 7.75% of total storage cost, respectively. Depreciation costs of plastic sacks, waterproofing and lace for drying were very minimal.

Average storage cost of farmers who stored in both seasons

For the farmers who stored rice on both wet and dry seasons, the total non-cash cost which amounted to 1,307,340 Kyats (US$1,604) per farm and 11,030 Kyats (US$13.53) per ton also surpassed the cash cost. It accounted for the biggest expenditure (89.25%) in storing rice by the sample farmers. The total cash cost was 157,490 Kyats (US$193.23) per farm and 1,330 Kyats (US$1.63) per ton, or 10.75% of total storage cost.

Due to having newly-built warehouses by some farmers affected by Nargis Cyclone, it is not surprising that depreciation cost of warehouses (41.31%) was the largest portion of the total storage cost. Other major expenses include storage losses (41.02%) and hired labor (9.09%). Therefore, an increase in the cost of any of the three items would drastically increase the storage costs for rice. Family labor cost, storage rental fee, depreciation on plastic sacks and other cost items were negligible.

Comparing the two groups, the storage cost for farmers who stored during both seasons was greater than the farmers who stored during the rainy season only, especially in terms of costs incurred from losses of rice and storing in new warehouses. Hired labor cost of farmers who stored during the rainy season was higher than those who stored on both seasons. This is because the farmers who stored rice during the rainy season have higher volume of produce because they are willing to invest in growing rice only during rainy season which requires more capital.

Average storage cost of 39 farmers who stored for at least 5 months

For the duration of storage, the storage costs incurred by farmers who stored rice for at least 5 months are 957,030 Kyats (US$1174.27) per farm and 17,239 Kyats (US$21.14) per ton. The total non-cash cost was 71.98% of total storage cost of the sampled households, which were 688,846 Kyats (US$845.20) per farm and 12,390 Kyats (US$15.20) per ton, respectively. The total cash cost was 28.02% of the total storage cost which were 268,190 Kyats (US$329.07) per farm and 4,830 Kyats (US$5.93) per ton, respectively. Storage loss of rice (45.23%) accounted for the bulk of the total storage cost, followed by hired labor (21.65%) and depreciation cost of warehouses (15.82%). Family labor cost, others (include electricity, building maintenance, sprayers, classifying), and depreciation on plastic sacks, waterproof and lace had minimal shares of total storage cost.

Average storage cost of 7 farmers who stored rice for three and four months

For the farmers that stored rice for 3 to 4 months, the total storage cost was less than those who stored for at least 5 months. The total non-cash cost was 91.34% of the total storage cost incurred by the sampled households, which were 639,910 Kyats (US$785.17) per farm and 7,190 Kyats (US$8.82) per ton, respectively. The total cash cost was 8.66% of total storage cost which were 60,640 Kyats (US$74.40) per farm and 680 Kyats (US$0.83) per ton, respectively. Storage loss of rice (70.53%) was the major cost item, followed by depreciation cost of warehouse (10.89%), and hired labor (7.09%). Therefore, a rise in the cost of any of three items would drastically increase the storage costs for rice. Family labor cost, depreciation of plastic sacks, storage rental fee, and other costs incurred (electricity, building maintenance, sprayers, classifying), as well as depreciation of lace and waterproofing were minimal.

Returns on rice storage

The rice farmers derived their income from storing rice for sometimes after harvest. Additional returns from rice storage are simply the differences in revenue between the farmers who sold rice immediately after harvest and the farmers who kept rice in storage. In estimating their annual additional returns, separate computations were done according to the categories of the farmers in the survey areas. The sum of the values obtained from each category determined the additional returns for one whole year as shown in Tables 1-5. Computations were also done on a per ton basis.

The additional gross returns by storage between the two groups of 20 farmers who sold rice immediately and 50 farmers who stored rice per year are 9,842,740 Kyats (US$12,076.98) per farm and 74,890 Kyats (US$9189) per ton. Based on seasons, for 11 farmers who sold rice immediately in rainy season and 40 farmers who stored rice in rainy season, the additional gross returns gained by storage is 5,982,240 Kyats (US$7,340.17)per farm and 40,980 Kyats (US$50.28) per ton while the additional gross returns gained by storage between nine farmers who sold rice immediately in both seasons and seven farmers who stored rice in both seasons is 18,686,120 Kyats (US$22,927.75)per farm and 30,870 Kyats (US$37.88)per ton.

Based on storage length of rice, the additional gross returns by storage between 20 farmers who sold rice immediately and 39 farmers who stored rice for at least five months is 10,123,920 Kyats (US$12,422) per farm and 94,070 Kyats (US$115.42)per ton. For 20 farmers who sold rice immediately and 7 farmers who stored rice for three and four months, the additional gross returns by storage is 14,959,600 Kyats (US$18,355.34) per farm and 26,630 Kyats (US$32.67) per ton.

Additional profit of farmers

To determine whether the farmers who stored rice gained profits or not, or simply stated, whether storing rice is more profitable than selling it immediately after harvest, partial budget analysis was used. The table is divided into four categories: added returns, added costs, reduced returns and reduced cost. The partial budget for farmers who stored rice was analyzed. The study revealed that on average, the income received by the farmers increased due to storage. Therefore, storing rice was profitable for farmers.

Subtracting the total losses (B) from the total gains (A) would determine the additional profit from rice storage. On average, the additional profit obtained by the farmers was 8,834,210 Kyats (US$10,839.52) per year per farm and 57.050 Kyats (US$70) per year per ton, respectively. For the farmers who stored rice during the rainy season, the additional profit was 5,157,410 Kyats (US$6,328.11) per farm and 20,650 Kyats (US$25.34) per ton. The additional profit for those who stored rice during both seasons was 17,196,080 Kyats (US$21,099.50) per farm and 18, 290 Kyats US$22.44) per ton, respectively.

Considering the duration of storage, the additional profit for farmers who stored rice for at least five months was 9,124,570 Kyats (US$11,195.80) per farm and 76,080 Kyats (US$93.35) per ton. For three and four month's duration of rice storage, additional profit obtained by farmers was 14,254,000 Kyats (US$17489.54) per farm and 18,700 Kyats (US$22.94) per ton each. The farmers with three and four months earned higher profits than the farmers with at least five months duration of storage because the former had higher average volumes of rice compared to the latter. However, on a per ton basis, the additional profit of the farmers with at least five months storage duration was greater than those with three and four months of storage.

T-test for farmers

T-test was done for comparing the mean profit of each category of farmers. The difference between the average profit of the farmers who stored rice and the farmers who sold their harvest immediately is statistically significant at 1% level. Based on season, the mean profit between farmers who stored during the rainy season and the farmers who sold their harvest immediately during the rainy season is also statistically significant at 1% level while the mean profit between the farmers who stored rice during both seasons and the farmers who sold rice immediately during both seasons is statistically significant at 5% level.

Based on the duration of rice storage, the average profit of farmers from storing for one to two months was less than the farmers who did not store rice. This was due to the poor quality of rice sold by the farmers who kept their harvest in storage for one to two months, as well as price instability at the time of selling. The mean profit between the farmers from rice storing for three to four months and the farmers who sold their harvest immediately is significant at 10% level while the different between the farmers with storage length of at least five months and the farmers who sold immediately after harvest is statistically significant at 1% level. Therefore, the best time to sell rice for farmers was after at least five months of storage.

According to the duration of storage, t- test was done for comparing average profit of the farmers in each storage length category. The average profit of farmers who stored rice for three to four months was greater than the farmers with one to two months of storage length showing that its difference is statistically significant at 5% level. And also the mean profit between the farmers who stored rice for at least five months and the farmers with one to two months of storage length, and the mean profit between the farmers who stored rice for at least five months and the farmers with three to four months of storage length are statistically significant at 1% level respectively. According to the results of t-test for each storage length category, the best time to sell rice for farmers was after at least five months of storage.

CONCLUSION AND RECOMMENDATIONS

The study was conducted primarily to assess the profitability of storing rice by the farmers; and suggest policy recommendations to improve the rice storage in research sites.

For the farmers who stored rice during the rainy season, storage costs were 19,380 Kyats (US$23.78) while the farmers who stored rice on both seasons incurred losses of only 12,360 Kyats (US$15.17). Storage cost during the rainy season was greater than during both seasons, indicating that there was more drying cost during the rainy season than for both seasons combined. The average volume of rice stored during the rainy season was higher than the average volume stored for both seasons combined. It was proven that the farmers with storage during the rainy season experienced more profitability from storing rice than the farmers who stored rice during both seasons considering that almost all of the rice stocked during the rainy season had better quality. According to the storage duration, storage costs for farmers who stored for at least five months were 17,230 Kyats (US$21.14) per ton while storage costs for farmers who stored for three and four months incurred 7,880 Kyats (US$9.67) per ton. On per ton basis, farmers with at least five months in rice storing gained were profitable than those with three to four months of storage.

The partial budget analysis revealed that according to the seasons, the average additional profits were 20,650 Kyats (US$25.34) per ton and 18,290 Kyats (US$22.44) per ton for farmers in rainy and both seasons, respectively. Based on storage duration, the farmers with at least five months of rice storage obtained an average additional profit of 76,080 Kyats (US$93.35) per ton while those with three to four months of rice storage earned 18,700 Kyats

(US$22.94) per ton. Additionally, based on comparison of t- test by mean profit, the best time to sell rice for farmers was at least five months after storage.

Given the above findings, the most relevant ingredients to ensuring increased rice storage are incentive public programs that can encourage rice farmers to engage in long-term rice storage. It is clear from this study that the farmers will store more rice until the end of non-harvest periods only in response to positive incentives or opportunities in storage. The success of rice storing for farmers will therefore require government programs that help farmers to overcome the constraints they face as well as creating incentives that will encourage them to change their current storage practices in order to improve their income as well as eliminating the rice availability-gap in the non-harvest periods.

While most of the interventional activities may be provided by local farmers themselves, there will be a need for a complementary role of the government. Access to the farmer's decision on rice storage, easy access to inventory capital, improvements in communication infrastructure to assist in effective dissemination of market information and predicting future prices and extension training are factors that national policies can play a key role in encouraging rice storage among farmers. Therefore, in order to improve the rice farmer's income in Pyar Pon Township, and the whole country in general, government policies should give top priority to the following factors such as provision of accurate and timely price information, provision of basic adult education, improvement in the delivery of extension services, increase access to credit, improvement of transportation, and improving the pre-processing operation.

Exchange Rate (1 US$= 815Kyats)

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