

Postharvest Management of Rice for Sustainable Food Security In Malaysia

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Introduction

Postharvest losses (PHL) of paddy can be defined as losses that occur due to spills, human negligence and incompetence during postharvest handling operations. Losses include improper machine settings during combined harvesting, mishandling during transportation inefficient processing systems that results in broken rice and improper storage resulting in unpleasant odors, discoloration and insect attacks. PHL of paddy can be measured quantitatively and qualitatively. Reduction in PHL of paddy is necessary to increase Malaysia's rice self-sufficiency level (SSL) from the current SSL of 71.5% to a targeted value of 90%. The question is, to what extent should the management of postharvest fertilities be able to do to increase the supply of rice and sustain the food security in Malaysia.

Paddy production

Paddy is one of the important crops in Malaysia because rice is the staple food of the people. Malaysia produces around 1.68 million MT of rice every year. However, production of paddy is not sufficient to supply the domestic demand. The consumption of rice in Malaysia is around 2.775 million MT a year. Hence, Malaysia imports around one million MT of rice from Thailand, VietNam, Pakistan and India. The production of rice grew around 1%, less than increase in demand or consumption (Table 1).

Table 1. Rice production and consumption in Malaysia, 1980-2013

Year	Production (Tones)	Average annual growth rate (%)	Consumption	Average annual growth rate (%)
1980	1318332	3	1500000	-1
1985	1257970	-1	1520000	0
1990	1215065	-1	1490000	0
1995	1372584	2	1715000	3
2000	1381662	0	1946000	3
2005	1490015	2	2150000	2
2010	1588456	1	2690000	5
2013	1685236	1	2775000	1

Source: Ministry of Agriculture and Agrobased Industry

There are many factors that contributed to a low yield of paddy production in Malaysia. Postharvest losses is one of the critical elements that need to be managed carefully because it will increase the production yield without increasing the land area. For example, Malaysia produced 1.7 million MT of rice in 2013 and the PHL was estimated at 28.5%, or equaled to

480,000 MT resulting in a revenue loss of RM576 million (US\$130 million) based on the paddy price of RM1200 per MT.

MARDI was mandated to conduct a study to determine the causes of PHL and propose solutions to reduce it. A study was conducted in 2015, and it covered all postharvest handling activities along the production chain, including harvesting, transportation, drying, milling and storage. The study was conducted in the granary areas of Muda Agriculture Development Areas (MADA) in Kedah and the Integrated Agriculture Development Areas in Terengganu (IADA KETARA). For value chain of drying, milling and storage, the study was conducted in BERNAS rice mill in Yan, Kedah, Besut, Terengganu and Pasir Puteh, Kelantan.

Results showed that good postharvest management could reduce the PHL from 28.5% to only 9.97%. The outcomes of this study indicated that the management of post-harvest in the supply chain of paddy could increase the total yield by 311,792 MT valued at about RM374.15 million (US\$84.46 million) based on the current price of paddy at RM1,200 per MT.

The study was repeated again in 2016 which covered both dry and wet seasons at Kemubu Agriculture Development Area (KADA) in Kelantan. The results showed that the PHL was reduced to 7.89% and this is equivalent to about 205,000 MT losses of paddy. In terms of a revenue losses of paddy in 2016 is about RM246 million which is at the same price of paddy as in 2015.

Postharvest Management

Postharvest management is important for the paddy industry because it will affect the total production of rice in the country. The more the losses can be reduced the more rice can be produced without increasing the land area, the frequency of cultivation and the input supply. In general, there are several factors that contribute to higher postharvest losses in the paddy industry. This paper discusses some of them.

Harvesting

Paddy PHL during harvesting are caused by improper settings, high travel speed and poor condition of combined harvesters used during the harvesting process. This contributes to spillage during the process. Existing combined harvesters use the tangential flow threshing mechanism while newly introduced combined harvesters use the axial flow threshing mechanism. Improvement in the technology includes conducting proper maintenance and setting of combined harvesters before operation, upgrading of existing combine harvesters from using single threshing drum to double threshing drum and purchase of axial flow combined harvesters has resulted in the reduction of harvesting losses of existing combined harvesters from 9.0% in 2010 to 4.9% in 2015 and 1.38% in 2016. Newly introduced axial flow combined harvesters has also reduced the harvesting loss to 2.41% in 2015 and 1.39% in 2016.

Transportation

The main causes of PHL during transportation are imperfect and unsuitable conditions of lorries while transporting the paddy. Losses occurred along the transportation chain, i.e., during transferring of paddy from harvesters into lorry, transportation from the paddy field to the central collection areas, management and control of paddy in the central collection areas and transporting of paddy from the central collection areas to the milling plant. The baseline losses during transportation chain from paddy fields up to the milling plant was 6.0%. Losses

during transportation chain in 2015 was 1.10% and 0.63% in 2016. There was a decrease trend in PHL during transportation chain due to the introduction of a good, sealed transportation system. In addition, proper handling practices during transportation of paddy from fields to factories also reduced the rate of losses.

Drying

Paddy losses during drying started from the collection of wet paddy before being dried. The losses can be due to delays in the drying process after harvest, inefficiency of pre-cleaning system and the use of improper parameters such as temperature, bed thickness and air flow during the drying process. Most losses in drying occur because of either improper use of dryers, lack of maintenance and technical knowhow hence resulting in uneven drying condition and fissured grain. The dried paddy quality in terms of percentage of head rice yield, broken rice and milling recovery is also considered in determining paddy losses. Losses in paddy drying were found to be insignificant (0.37% in 2015) in comparison to the basic data of 3.50% in 1985. In 2016, the percentage of paddy losses in drying (KADA area) was about 0.12%. Overall, current data has shown that the quality of rice being produced was a major concern as compared to percentage of quantitative losses.

Milling

The paddy PHL during milling maybe due to various factors such as poor handling and machinery inefficiency. Poor handling during the milling process resulted in a lot of spillage. Inefficient machineries incur losses during dehusking, bran removal, whitening process and grading of rice. Spillage occurs during the transfer activities in each process due to inefficient conveyor belts systems. The baseline losses in milling was 6.0% (1985). The losses for milling of paddy in 2015 was 2.4% and in 2016 is about 3.05%.

Storage

Losses during storage is usually affected by storage technique whereby quality deterioration such as grain discoloration will reduce milled rice quality. There is greater reduction in quality when rice is stored in normal practices in commercial mill in comparison to hermetic bag or airtight storage technique. It is indicated that infestation by insects during storage gives higher losses in terms of both rice quality and quantity. PHL during storage are measured by the physical quality of the paddy and the number of insects present in a unit area and storage are about 10.0% in 1985, 1.20% in 2015 and 2.71% in 2016.

Conclusion

Postharvest losses affected the production of rice and food security in Malaysia. Harvesting is the most critical factor that contributes to higher postharvest losses in paddy industry in Malaysia, followed by losses during transportation, losses at the rice miller and during storage. Proper postharvest management has reduced losses and hence, improve the total yield of rice in the country.

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