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PADI POST HARVEST LOSSES IN TANJONG KARANG, SELANGOR

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RINGKASAN

Tujuan utama kajian ini dijalankan adalah untuk mengetahui jumlah kehilangan yang berlaku dalam sistem lepas tuai padi di Tanjong Karang. Kajian tersebut telah dijalankan mulai dari bulan Mac hingga Jun 1981.

Menuai di kawasan ini masih lagi memerlukan tenaga manusia yang banyak. Memandangkan keadaan ini, faktor-faktor seperti kekurangan tenaga buruh, kelewatan menuai dan membanting, cara membanting dan pengendalian padi dan juga jenis padi yang ditanam memainkan peranan yang penting dalam kehilangan padi. Sebanyak 3.48% – 7.42% padi telah hilang semasa membanting. Kehilangan semasa membanting adalah lebih tinggi disebabkan oleh padi yang tertinggal di jerami. Sebanyak 2.46% – 6.02% telah hilang dengan cara ini. Padi terpelanting adalah kehilangan yang lebih rendah iaitu di antara 1.02% – 1.65% sahaja.

Kebanyakan kehilangan di peringkat kilang adalah berkaitan dengan penurunan mutu yang disebabkan oleh beras patah dan hancur. Jumlah beras hancur yang dikeluarkan oleh kilang-kilang kecil adalah jauh lebih tinggi jika dibandingkan dengan kilang-kilang yang besar. Sebanyak 39.5% beras penuh telah didapati berkurangan di kilang-kilang kecil; sementara 8.8% sahaja yang dialami oleh kilang-kilang besar. Faktor utama yang menyebabkan beras hancur ialah sistem kisaran yang terdapat di kilang-kilang kecil di mana proses tersebut dijalankan dengan sekali gus. Sebanyak 0.7% padi telah hilang semasa proses pembuangan sekam.

Kehilangan semasa penyimpanan sebanyak 22.8% dialami oleh kilang-kilang besar sementara cuma 2% – 5% sahaja yang berlaku di kilang-kilang kecil. Kehilangan ini bergantung kepada jumlah padi yang disimpan, masa penyimpanan dan juga sistem penyimpanan yang digunakan oleh pengilang-pengilang.

INTRODUCTION

The total padi production in the state of Selangor is about 104 752 tonnes per annum, of which 53% is produced from the irrigated areas (MINISTRY OF AGRICULTURE, 1979). This amount contributes to about 6% of the total padi production of the whole country.

The main irrigation scheme, the Tanjong Karang Irrigation scheme which is situated along the North West coasts of Selangor has an area of about 20 000 ha of padi land (TUNKU MAHMUD, 1978). The whole area is further sub-divided into eight sub-areas which comprises Sawah Sempadan, Sg. Burung, Sekincan, Sg. Leman, Pasir Panjang, Sg. Nipah, Pancang Bedina and Bagan Terap.

As padi is one of the important crops grown in this area, great efforts have been taken to boost up its production through the use of high yielding varieties, double cropping, better irrigation facilities and cultivation techniques. Presently, this area is able to yield about 3.9 tons/ha of padi (MINISTRY OF AGRICULTURE, 1979) and the yield is expected to rise even higher by the end of the Fourth Malaysia Plan (1981–1985) when improvement on the irrigation facilities is completed.

The amount of grain losses within the Tanjong Karang area is unknown. However, it has been estimated that about 13.39% of the total harvested crop is lost (PROJEK BARAT LAUT SELANGOR, 1981). This amounts to about 14 026 tonnes per annum or M$6.7 million per year. A higher percentage of loss occurs at farm level, which is estimated to range from 3.5% – 13% while losses at mill level range from 0.01% – 0.39% (PROJEK BARAT LAUT SELANGOR, 1981).

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Most of these losses are mainly quantitative and they occur during the post production operation which includes harvesting, threshing, milling, storage and transportation.

This study was carried out due to lack of reliable data on post harvest losses in the area. The main objectives of the study were to determine the seriousness of the problem and to pin-point the critical stage of the post harvest losses. With these objectives in view, effective control measures will be recommended to reduce the losses.

MATERIAL AND METHODS

The methodology used to evaluate post harvest losses in this study was by HARRIS and LINDBLAD (1978). Losses at farm level were measured manually in accordance to the method of harvesting and threshing carried out by the farmers.

a) Sampling Area

Stratified random sampling was carried out in Tanjong Karang during the main harvesting season beginning from March until June 1981. The area was divided into eight sub-areas which include Sawah Sempadan, Sg. Burung, Sekincan, Sg. Leman, Pasir Panjang, Sg. Nipah, Pancang Bedina and Bagan Terap. However, only five sub-areas were selected for sampling, namely Bagan Terap, Sg. Nipah, Sg. Leman, Sg. Burung and Sawah Sempadan.

Fifty three farmers were selected at random based on their availability at the farm site during the sampling period.

To determine the losses during each operation the farmers were allowed to carry on their work as usual.

b) Potential Yield

The potential yield at field level was determined by taking replicated crop-cut samples using a one-meter square sampling frame. The samples were carefully harvested by hand and wrapped in plastic bags to prevent any losses due to shattering. It was assumed that the potential yield had 100% of the grains harvested.

c) Losses at Farm Level

1) Harvesting loss

Harvesting loss was measured using the same sampling frame mentioned above. The frame was thrown at random into the field and all fallen grains that remained on the ground within the sampling frame were collected and weighed. This process was replicated several times. The harvesting loss was calculated as follows:–

$$\% \text{ Harvesting Loss} = \frac{\text{Weight of fallen grains}}{\text{Weight of potential yield}} \times 100$$

The calculation was made after all weight measurements were corrected to 14% moisture content.

2) Threshing loss

Losses incurred during threshing were determined by weighing the padi recovered around the threshing tub due to spillage and by stripping all grains that were left on the straws after the threshing operations. The spilled grains were collected by placing a large plastic sheet about five feet in radius from the threshing tub. All grains found on the plastic sheet including those that were thrown backwards by the threshing operation were considered as spilled grains. Bundles of padi were taken at random and threshed manually. The percentage of threshing loss was determined based on the amount of matured grains recovered from both the straws and spillage.

All samples obtained were weighed and cleaned in the laboratory and the percentage of moisture content and impurities measured.

In addition to the field sampling, interviews were also conducted with the farmers

to obtain background information regarding their post production practices.

d) Losses at Mill Level

Losses at mill level include both losses due to milling operation and storage.

Twenty-two mills were selected at random for sampling which included only 10% of the small mills (< 2 tonnes capacity) and all of the large mills (2–5 tonnes capacity).

To determine the milling loss, samples were taken before and after milling and analysed for milling recovery. Samples of husk discarded by the huller were also taken and any rice and padi recovered were weighed.

Storage losses were based on millers' observations and data were gathered through interviews.

RESULTS AND DISCUSSIONS

Post Production Practices at Farm Level

The post production activities were defined as those activities that the grains had to undergo beginning from the process of harvesting until they were ready to be consumed (BOURNE, 1977).

From interviews that were conducted with the farmers, it was observed that the main post production operations carried out at farm level were harvesting, threshing and bagging of the grains. Only a small portion of the grains (10.1%) were dried and stored at farm level, mainly for home consumption *(Table 1)*. The rest of the grains were sold immediately after harvest.

The storage period was short ranging from three to six months and a majority of the farmers stored about 3–10 bags of padi *(Table 2)*. However, most of the padi was not available by the end of the third month; they had either been consumed by the family or sold for cash. This was observed when visits were made at the end of the third month period for sampling purposes. As a result no data was available for assessing storage losses at farm level.

Losses at Farm Level

From the samples collected, losses due to harvesting and threshing were determined. Grain losses incurred from the time the padi was cut until it was bundled were called harvesting loss. Threshing losses included both spillage and unthreshed padi left on the straws. All losses were calculated based on 14% moisture content.

Table 3 shows the average percentages of losses that occurred in each sampling area. Generally, it was observed that losses due to threshing was significantly higher than harvesting losses.

Losses during harvesting ranged from 0.13% to 1.54 percent. Most of it occurred due to shattering which resulted from delayed harvesting and threshing operations. These delays usually happened when there was not enough labour to carry out the job. The system of using two groups of people to do the harvesting and threshing also played an important role in incurring grain losses. Usually the first group will do only the cutting operation, leaving the threshing to be done later, which could last more than 24 hours before the grains were finally threshed. Shattering of the grains occurred when they were tied into bundles for threshing.

Threshing losses vary greatly from 3.42% in Bagan Terap to 7.42% in Sg. Nipah. These losses were due to both spillage and unthreshed padi being thrown away together with the straws. A substantial amount of padi ranging from 2.46% to 6.02% was left unthreshed. There were several factors which accounted for these losses. Firstly, the threshing process was usually done by contract labour. They usually threshed the padi in a hurried manner

Table 1. Percentage of padi dried and stored at farm level in Tanjong Karang area

No. of farmers	Total padi harvested (bags)	Total amount dried and stored (bags)	% dried and stored
53	2 367	238	10.1

Table 2. Number of farmers who stored padi at farm level in Tanjong Karang area

	Number of farmers	Percent
Storage capacity (bags)		
No storage	27	50.9
< 3	2	3.8
3 – 6	7	13.2
7 – 10	10	18.9
> 10	7	13.2
Total	53	100.0
Storage time (months)		
No storage	27	50.9
1	5	9.4
3	8	15.1
6	13	24.6
Total	53	100.0

Table 3. Percentage of losses incurred during harvesting and threshing in Tanjong Karang area

Location	Harvesting loss (%)	Threshing loss (%)	Spillage (%)	Left on straw (%)
Bagan Terap	0.0 a*	3.48	1.02	2.46
Sg. Nipah	0.48 a	7.42	1.39	6.02
Sg. Leman	0.59 a	6.84	1.35	5.49
Sg. Burung	1.54 b	6.36	1.65	4.71
Sawah Sempadan	0.13 a	6.26	1.38	4.88
		NS**	NS	NS

*Means having any letter in common are not significantly different at 5% level.
**NS – Not significant.

so as to finish their work as soon as possible so that they could move on to other areas.

The variety of padi planted also influenced the threshing losses. Inadequate threshing of padi with low or moderate shattering ability resulted in higher percentages of losses due to unthreshed padi. This was observed in Sg. Nipah and Sg. Leman areas where 50% of the farmers planted padi variety Setanjung (MR 1) which has a moderate shattering ability. The amount of unthreshed padi left on the straw was 6.02% and 5.49% in Sg. Nipah and Sg. Leman areas respectively.

Improper handling of the grains during threshing also resulted in losses due to spillage. But the amount of loss was significantly lower when compared with the grains that was thrown away with the straws. This was because most of the farmers used threshing tubs which were provided with cloth or gunny sacks to prevent the grains from spilling and scattering. The average percentage of losses due to spillage ranged from 1.02% to 1.65 per cent.

Losses at Mill Level

It was not possible to get accurate figures on losses during milling especially those incurred by the small mills. This was because a large number of the mills were not in operation during the sampling period. These mills were usually under-utilised and they were operated for about two to three hours per day mainly for domestic consumption. It was reported that these mills used less than 20% of their total milling potential (SAMSUDDIN, IBNI HAJAR and HASHIFAH, 1982).

Two types of losses were incurred during the milling process; the overall breakage occurring during milling, and the total amount of rice thrown away after the milling process.

It was observed that reduction in the percentage of head rice occurred in all samples taken from the mills *(Table 4)*. The reduction in head rice yield was significantly higher in samples obtained from the small mills. An average reduction of 39.5% and 8.8% were observed in small and large mills respectively *(Table 4)*.

One of the main factors which is responsible for higher amount of breakage was the compact, single pass milling system, found in most small mills. In the single pass milling system the hulling and whitening process was carried out simultaneously thus creating a high frictional force on the grains resulting in breakage (SAMSUDIN *et al.*, 1982).

In the conventional mills, the frictional force was reduced through a multipass milling system whereby the whitening process was carried out through a series of whitening cones. This system of milling was found in most of the large and medium mills resulting in higher amount of head rice in the final product.

The reduction in head rice yield reflected a reduction in grade and loss in revenue to the mill operators. This loss was much higher in the small mills. With an average of 42.4% head rice yield the quality of the rice is graded as sample grade which could be sold at only half of the original price of the grains. For example, if the mill could produce milled rice with minimum quality of grade B_2, the price per 100 kg of rice is M$77.10 but with sample grade the price is only M$49.40 (WARTA KERAJAAN, 1974). This results in a loss in revenue of M$27.70. Based on the total production of rice in this area the lost in revenue could amount to M$20.9 million per year.

Losses due to the hulling process was comparatively small. It was observed that only 0.7% of rice was lost together with the husk *(Table 4)*. These losses were mainly attributed to improper setting of the hullers. With proper adjustment the loss could be reduced to zero. However, this figure only represented losses at the big mills. Data on the small mills were not available since the mills were not in operation during the

Table 4. Losses during milling and storage in Tanjung Karang

Type of mills	Milling system	Head rice (%) At mill	Head rice (%) At lab.	Reduction in head rice (%)	Loss with husk (%)	Storage loss (%)
A. Small mills (<2 tonnes capacity)						
1. Syarikat Kerjasama Pt. 4	Single pass	49.8	82.2	39.4	NA*	2 – 5
2. Syarikat Bekerjasama Pt. 13	Japanese	55.7	87.6	31.9	NA	0
3. Kilang Beras Hj. Mokhtar Sastaja	Single pass	54.1	84.6	30.5	NA	0
4. Syarikat Kerjasama Serba-guna Kunci Air Berang Bhd.	Single pass	25.7	81.2	55.5	NA	5
5. Syarikat Kerjasama Serba-guna Jayadiri Bhd.	Single pass	40.6	67.8	27.2	NA	2 – 5
6. Kilang Beras Thong Shok Fok	Single pass	28.2	81.2	53.0	NA	0
Average		42.4	81.9	39.5	–	2 – 5
B. Large mills						
1. Kilang Padi Sg. Besar Bhd.	Multipass	73.1	87.9	14.8	0	38.0
2. LPN Perkongsian	Multipass	79.6	84.9	5.3	3.2	1.0
3. LPN Sekincan	Multipass	66.9	79.7	12.8	0	20.0
4. LPN Ulu Tiram Buruk	Multipass	64.6	72.0	7.4	0	30.0
5. LPN Sg. Besar	Multipass	47.9	57.7	9.8	1.2	34.0
6. Paramount	Multipass	72.0	74.7	2.7	0.1	14.0
Average		67.4	76.2	8.8	0.7	22.8

*NA = Not available.

sampling period. SAMSUDIN *et al.*, (1982) reported that about 0.96% of padi and rice were being lost together with the husk in the commercial small mills.

Table 4 also indicates losses during storage. There was a vast difference in storage losses incurred by both the small and large mills. In the small mills storage losses ranged from 2% – 5% while in the large mills an average of 22.8% was observed. The differences in the storage losses found in both mills depend on the amount and length of time the grains were stored. A majority of the small mills did not store any grains at all. However, SAMSUDIN *et al.*, (1982) reported that about 25% of the small mills in the country were involved in storage practices in one way or the other. The storage capacity was usually small (about 500 bags) and the duration of storage was very short usually less than three months.

Higher percentage of losses occurred in the large mills due to large quantities of padi ranging from 2 142 tonnes to 10 000 tonnes being stored and the inefficiency of the storage facilities. Each of the LPN complex has an average storage capacity of about 6 000 metric tonnes of padi (SHAMSUDDIN,

MOHD. ARABEE and LIM, 1979). The grains were mainly stored in bulk either in rectangular flat bottom storage godowns or in concrete tower silos. Losses were mainly due to the occurrence of hot spots in the grain resulting in quality deterioration. Yellowing of the grain was a common phenomena especially in grains stored in concrete tower silos. Other factors such as mouldiness, insect and rodent infestation also prevailed but the amount of loss was relatively low since control measures were adequately available. The use of insecticides and fumigants to control insects was a common practice together with other control measures such as cleanliness of warehouses and other possible means of physical and mechanical measures (SHAMSUDDIN *et al.*, 1979).

The storage time was also relatively longer than that of small mills. Most of the grain were stored between three and six months period but some were stored for as long as nine months.

CONCLUSION

The results of this study indicate that about 0.13%–1.54% and 3.48%–7.42% of the padi grown in the Tanjong Karang area was lost during harvesting and threshing respectively. Further losses were incurred during handling, milling and storage. Although losses during handling were not determined during this investigation, losses due to milling and storage were relatively high. An average of 8.8% and 39.5% reduction in head rice yield was observed in the large and small mills respectively; while the storage losses ranged from 1%–38 percent.

Substantial losses occurred during threshing when the grains were discarded together with the straws. As much as 6.02% of grains was lost in this manner. Several factors such as attitude of operators, inadequate threshing and improper handling played important roles in affecting these losses. The variety planted may also contribute towards the losses.

Since losses due to unthreshed padi was greater, it is recommended that the number of times the bundle is beaten should be increased especially for grains that have low or moderate shattering ability. The lack of labour in certain areas could also be compensated with the use of mechanical harvesters.

Losses during milling could be minimised by proper adjustment of the mills to achieve maximum efficiency. Mills with out-dated and inefficient equipments should be replaced with a more modern and efficient milling components so that breakages could be reduced. In addition, a training programme for millers should be initiated to make them understand the importance of grain quality and maintaining the efficiency of their milling equipments.

Storage losses were relatively high at large mills especially in the LPN complexes. Depending on the amount, storage time and methods of storage an average of 22.8% storage loss was observed. At the large mills, the storage capacity could amount to as much as 10 000 tonnes of grains stored for a period ranging from three to nine months. Most of the grains were stored in bulk in concrete tower silos where aeration facilities were not available resulting in quality deterioration of the grains. However, the introduction of aeration facilities into the silos, was able to prevent further deterioration. DHIAUDDIN (pers. comm., 1982) reported that yellowing of the grains was greatly reduced to about 1.5% by aerating the grains using an airflow rate of $0.3 m^3/t/min$ enabling the grains to be sold as A_2 grade. Thus, it is encouraging to note that aeration plays an important role in maintaining grain quality. Therefore, it is recommended that aeration should be made available, especially in bulk storage systems.

SUMMARY

This study was conducted to determine the magnitude of losses in the padi post-harvest system in Tanjong Karang. A survey was carried out in the area during the main harvesting season beginning from March until June, 1981.

Since harvesting operation was manually done, several factors such as lack of labour, delay in harvesting and threshing, improper threshing and handling, and the variety of padi planted, played important roles in contributing to both harvesting and threshing losses. The amount of padi loss was about 3.48% – 7.42% and 0.12% – 1.54% for threshing and harvesting respectively. Higher amount of padi was lost due to improper threshing as substantial amount was thrown away with the straws. The percentage of unthreshed padi lost ranged between 2.46% – 6.02 percent. Losses due to spillage were much lower ranging from 1.02% – 1.65 percent.

Losses during milling was mainly related to grain breakage. The total amount of breakage observed was significantly higher in small mills. A total of 39.5% and 8.8% reduction of head rice yield was observed in the small and large mills respectively. The main factor responsible for the higher amount of breakage was the compact single pass milling system found in most small mills. During the hulling process only 0.7% of the grains were lost.

Storage losses were significantly higher in the large mills where an average of 22.8% of the grains were lost. Only 2% – 5% losses during storage were found in the small mills. The differences were due to the amount, storage time and storage methods used by the millers.

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