Preliminary Assessment of Grain Losses for Paddy Combine Harvester in Koperasi Felcra Seberang Perak, Malaysia

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Abstract. Paddy is an essential plant in Malaysia that is at risk of being lost during harvesting. This study was investigated the grain loss of the paddy during harvesting process by using combine harvester. The research was conducted at Felcra Seberang Perak, Malaysia. The data collection attempted to investigate the percentage of grain losses during harvesting season. The collected data contain of area (acre/hectare) for three blocks of paddy for three lines. It was done with two blocks, which involve a three line and a require five PVC measuring pipe for each panel. The New Holland with the same brand was determining the speed which affects the losses grain with two blocks. According to the results, the average percentage of grain losses in the Block 1 was 1.08% and Block 2 was 1.21%. The percentage of the grain losses in the Block 1 was higher than Block 2 which contribute to the loss of USD29.26 per hectare. These results show that the farmers loss a lot during harvesting operation which leads to lower the profit.

Keywords: combine harvester; grain loss; rice grain; harvesting

1. Introduction

Rice is one of the staple food that estimated to feed about one-fifth of calorie intake in the world [1]. However, it is a plant that has the risk of being left in the field during harvesting compared to other food crops such as vegetables and fruits. This is because harvester machine can cause the crop to be lost in the fields. Rice cultivation is too vulnerable to harvesting because of the high percentage of grain losses impacting the total yield when using combine harvester.

Nowadays, most of paddy was harvested using combine harvester throughout the country. Even though the machine is used to shorten the harvesting time, many operational issues have been identified with the use of these machines. The performance of the harvester is based on the grain loss during the process [2]. It is estimated that the rice losses about 1% to 5% of its total weight from the harvesting using combine harvester [3]. The loss caused by the combine harvester is categorized into pre-harvest loss, platform cutting loss, threshing loss, and cleaning loss [4]. Mostly, farmers are unaware of the grain losses incurred during the harvesting process which leads to the profit loss [5].

Another factor that contributes to rice grain loss is the travel speed of the combine harvester during the harvesting procedure [6]. The American Society of Agricultural and Biological Engineers (ASABE) suggests the speed should be within the ranges of 3.0 km/hr to 6.5 km/hr [7]. [8] have done a preliminary study on the effect of combine harvester speed on the paddy grain losses in Malaysia paddy field which showed higher speed leads to higher grain losses. Therefore, this paper is a preliminary attempt to evaluate the paddy losses when conducting the combine harvester at one speed. This study would hopefully lead to the findings of the other factors contribute to the paddy loss in the field.
2. Materials and Methods

2.1. Study site

The study was conducted in Koperasi Peserta Felcra Seberang Perak, Malaysia where it consists of 225.94 ha planting area. The fields were planted with variety MR 220. The study was conducted two days in a row in morning.

2.2. Data collection

The data collection attempted to investigate the percentage of grain losses during harvesting season. The collected data contains the area for two block of paddy for three lines each. In this study, the combine harvester operation considerably as contributors to grain losses. The speed of the combine was set to 4.65 km/hr across the procedure. To determine the grain losses, the grain left was collected in a 1m x 1m box. It was done with two blocks, which involved three lines and required five PVC measuring pipe for each panel. The minimum sample is 30 samples for two blocks to be delivered to the laboratory to determine the percentage of grain losses at the paddy field. It measured the amount of grain losses and bean recorded. Formula used for calculating grain losses is as below:

\[
\text{Grain losses} = \frac{\text{grain loses}}{\text{total grain}} \times 100\%
\]

2.3. Machinery

The combine used for the study is New Holland Clayson 8060. Some of the specification of the combine harvester is shown in Table 1.

| Table 1. Technical specification of combine harvester |
|-----------------------------------|
| Model | New Holland Clayson 8060 |
| Years | 1979-82 |
| Engine manufacturer | Ford |
| Engine type | 2715E |
| Displacement | 6220 |
| Power, hp | 116 |
| Fuel tank | 300 |
| Header width, cm | 457 |
| Speed, min-max, km/hr | 1.5 – 22.8 |

3. Results and Discussion

The average speed of combine harvester was set to 4.65 km/hr. Table 2 shows the grain loss that occurred in the two blocks. Generally, the gross weight of paddy loss in the study area ranged from minimum of 0.14 Mt/ha to maximum 0.23 Mt/ha. These amount of grain losses contribute to average of 1.08% grain loss on Block 1 and 1.21% on Block 2 as shown in Table 3. Based on average paddy price of year 2019, these losses contribute to profit losses up to USD29.26 per hectare.

Percentages of the grain losses on the field depend on the performance of the operator control the combine harvester machine. The situation of the field also impacts the percentage of the losses grain. The highest percentage of grain loss happened in Block 2 of sampling site 2 and 3 with 1.39% while the lowest percentage was at Block 2 of sampling site 1.

| Table 2. Report of rice yield losses by combine harvester machine |
|-------------------------------------------------------------|
| No | Block | Number of Seeds | Weight (g) | Number of Seeds | Weight (g) | Gross Weight (Mt/ha) | Net Weight (Mt/ha) |
|----|-------|-----------------|------------|-----------------|------------|---------------------|-------------------|
| 1  | Block 1 (1) | 72.00 | 2.22 | 720.00 | 22.20 | 0.22 | 0.07 |
| 2  | Block 1 (2) | 69.00 | 2.29 | 690.00 | 22.90 | 0.23 | 0.07 |
| 3  | Block 1 (3) | 62.00 | 2.07 | 620.00 | 20.70 | 0.21 | 0.06 |
Table 3. Percentage of yield losses for two blocks

| No | Block (sampling site) | Grain loss (%) | Average grain loss (%) |
|----|------------------------|----------------|------------------------|
| 1  | Block 1 (1)            | 1.15           | Block 1 = (1.15 + 1.1 + 0.99) / 3 |
| 2  | Block 1 (2)            | 1.10           | Block 1 = 1.08          |
| 3  | Block 1 (3)            | 0.99           |                        |
| 4  | Block 2 (1)            | 0.87           | Block 2 = (0.87 + 1.39 + 1.39) / 3 |
| 5  | Block 2 (2)            | 1.39           | Block 2 = 1.21          |
| 6  | Block 2 (3)            | 1.39           |                        |

Since the speed of the machine was set at 4.65 km/hr, the driver of the combine harvester must be a skilled person to control the speed of the machine efficiently forward while operating the machine. Therefore, the skilled driver can efficiently manage the machine while reducing grain losses, particularly when soil condition is not good.

From the on-field observation, it also identified that the driver used the low height cutter to harvest. Hence, it contributes to more loss of paddy during harvesting. The operator needs to know the best way to cut a paddy to a specific height. As found by [9], too low and too high of cutting heights resulted in greater losses in paddy grain. They were suggested that the height of 15 cm above ground is the ideal level for cutting bar.

4. Conclusion
This study was successfully checking the grain losses in the field which was carried out in the early morning after two days of harvesting using combine harvester. As the result showed, the highest percentage of grain loss was 1.39% at two sampling sites while the lowest was 0.89%. The main contribution to the losses was found due to the low cutting height during the harvesting process. This can lead to the income losses up to USD29.26 per hectare. Therefore, it is important to make sure that the operator has enough skills to operate the combine harvester in order to minimize the grain loss. It also important to educate the farmers that the losses during harvesting can be reduced and at the same time will help to reduce farmers’ profit losses.

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