Study of suitability postharvest handling level of potatoes in Kerinci District

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Abstract. Almost 60% of Jambi Province's potato production comes from Kerinci District. As well as other food crop products, productivity must be balanced with the quality of the produced. Postharvest handling based of Good Handling Practices concept is the key to producing high quality and competitive potatoes and optimizing the results obtained. The data obtained showed that there was a decrease in potato seed yield around 16% during the storage. The loss was contributed by rotten and moisture migration tubers. Very few studies have been conducted to evaluate the appropriateness of postharvest handling of potatoes according to GHP concept in Kerinci District. Therefore, purpose of the study was to determine the level of suitability of postharvest handling of potatoes in Kerinci District. The research method is descriptive exploratory by making hostages systematically, factually and accurately. The data were obtained through observation, interviews and calculating the percentage of postharvest handling suitability based of the GHP concept. The results showed that the level of suitability for postharvest handling of potatoes in Kerinci District was around 69% with the average improvement that had to be done at the cleaning, storehouse handling, sanitation and packing type stages around 31% and digging tube loss reaching 100%. In principle, carrying out potato postharvest activities based of the GHP recommendations is an effort to minimize yield losses. The results of this study are expected to be a solution for improving the quality and competitiveness of potato commodities in Kerinci District, Jambi Province.

1. Introduction

Potato (Solanum tuberosum L.) is one of the most important horticultural commodities in Indonesia. This commodity has been cultivated and developed in almost all parts of Indonesia such as Central Java, West Java, East Java, North Sulawesi, North Sumatra, and Jambi. The cultivation of potato in Jambi Province is spread over three regencies, namely Merangin, Kerinci and Sungai Penuh. The area of potato cultivation in Jambi Province in 2020 is 3,785 hectares with a distribution, Merangin District is 282 hectares, Sungai Penuh is 20 hectares and the widest is in Kerinci District, which is 3,483 hectares [1]. The total potato production of Jambi Province's in 2020 is 692,596 tons. The main production center is in Kerinci District with a total production in 2020 of 638,621 tons or equivalent to 92% of the province's total production [1].
Productivity must be supported by the quality of the products produced so that maintaining the quality of postharvest products is very necessary. Although an increase in production is expected, neglecting postharvest handling will have an impact on product availability and loss of income [2]. Postharvest losses are a measure of the availability of food ingredients and at the same time have an impact on the quantity and quality of the product [3]. Potatoes in fresh form are susceptible to damage due to mechanical, physiological, and biological factors that can affect the chemical content of potatoes [4]. Agricultural commodities have a short shelf life, and to reduce losses, postharvest handling must be considered [5]. The Potato is a commodity that is easily damaged and undergoes active metabolism [6]. The quality of potato tubers can be stored for a longer period and can minimize yield losses during the storage. Each of the postharvest step can contribute to yield losses as a result of various damages that occur during harvesting, sorting, grading and during storage. Even an increase in yield loss can occur if many tubers are scattered or left in the soil after harvesting.

Generally, handling fresh potatoes in Indonesia has not yet applied adequate technology in its trade system, so the damage rate is still more than 20% [7]. Based on potato seeding activities in Kerinci District, it was found that during the storage period there was a yield loss around 16%. This yield loss was contributed by tubers that were identified as rotten and moisture migration during storage [8]. This indicates that damage during storage can occur due to accumulation of damage in the previous step. Poor storage sanitation can exacerbate potato tuber damage during storage. Moisture migration and rotting tubers are the dominant contributors of damage that occurs during storage as a result of poor storehouse conditions [2].

The Accuracy and obedience of producers in implementing the concept of GAP (Good Agriculture Practice) during the production process must be carried out. GHP (Good Handling Practices) during harvest and postharvest handling and GMP during processing are mandatory and highly recommended as an effort to minimize product damage, especially by microorganism contamination [9]. Postharvest losses can occur from all postharvest stages such as harvest time, initial handling, postharvest handling, transportation, distribution and storage and packaging [10]. Reducing postharvest yield losses is crucial to ensure global food availability in the future [11].

Proper postharvest handling is expected to reduce yield loss, extend the shelf life and improve product quality. The application of the concepts of Good Handling Practices (GHP) and Good Manufacturing Practices (GMP) in postharvest handling is a reference that must be applied to improve product quality [12]. However, very few studies have been conducted to evaluate the appropriateness of postharvest handling of potatoes according to GHP recommendations in Kerinci District. This research needs to be done in order to objectively identify some of the underlying causes of losses entire of the postharvest steps. Thus, this paper was written with the aim of knowing the level of suitability of potato postharvest handling practices in Kerinci District, Jambi Province.

2. Materials and methods

The research was conducted in the potato production center of Jambi Province, namely in Kerinci District. Sampling was taken in 3 subdistricts, namely Kayu Aro, Kayu Aro Barat and Gunung Tujuh Subdistricts. The research took place from April to December 2019.

The materials used in the implementation of this activity are potato planting, questionnaires, clear plastic and net sacks, wooden boxes, plastic baskets, hoes, small rakes and storehouse. This research is an exploratory descriptive research. Descriptive research intends to make a systematic, factual and accurate description of the facts and characteristics of a particular population [13]. Primary data was collected using a structured questionnaire through direct observation in the field and interviews with respondents. Respondents were selected purposively as many as 6 respondents, consisting of three data collection
locations and each location represented by 2 respondents who had been determined based on information from key informants at the district level, then subdistrict, then village and finally farmers.

Checking the suitability of postharvest handling of potatoes using the Good Handling Practices (GHPs) checklist starting from the stages of harvesting, cleaning, sorting, grading, storing and packaging. Table 1 below is the GHP checklist used.

| No | Description |
|----|-------------|
| 1  | Harvest; harvest index, demolition without physically damaging the tubers |
| 2  | Curing; Tubers above ground 1-2 hours |
| 3  | Cleaning the tubers from the remaining soil or attached roots |
| 4  | Initial sorting; separating good, damaged, market-worthy tubers |
| 5  | Clean tubers after sorting are put in a net sack or basket |
| 6  | Digging tubers loss |
| 7  | Sorting II and grading |
| 8  | Tubers separation: good/defective, normal/no, yes/no pest |
| 9  | Grading tubers: AL/XL, A, B, C and baby |
| 10 | Storehouse |
| 11 | Storage available |
| 12 | Packaging |
| 13 | The capacity of each pack ranges from 40-50 Kg |
| 14 | Request packing based on the destination market |

The assessment of the level of conformity (%) is calculated using the following formula:

\[
\text{Level of suitability with Good Practices} = \frac{\text{Number of correct answers}}{\text{Total questions in the checklist}} \times 100\%
\]

### 3. Result and discussion

The results showed that the sampling farmers were not fully able to carry out postharvest handling according to GHP recommendations. Based on Figure 1, the ability of farmers in the three locations to carry out postharvest handling of potatoes well is 46-69%. Postharvest steps that can be carried out according to the recommendations are the implementation of the harvest steps related to determining the harvest index, sorting and grading. Meanwhile, around 30-50% of sampling have to make improvements in postharvest handling of potatoes. Harvesting methods, especially in the technique of dismantling tubers, have not been fully implemented properly. The use of harvesting tools, namely hoes and harrows, has the potential to injure the tubers if not done carefully and can increase shedding losses. Shrinkage caused by the presence of potato tubers left in the soil during the process of dismantling the tubers. Bulbs that are injured during the harvesting process will be susceptible to physical damage and microbiological damage at the next stage. In the end, the damage that occurs during harvest will shorten the shelf life and increase yield losses. Figure 1 below shows the suitability of GHP at the farmer level.
The sorting stage is carried out simultaneously with grading, in this case the grading is applied based on the average tuber weight. Table 2 is a reference for the grading stages carried out by farmers. The average level of suitability for handling potatoes according to GHP in Kerinci District can be seen in Figure 2 below. Based on figure 2, the level of suitability of postharvest handling of potatoes for each step is different. This shows that farmers give good enough attention at some steps but not optimal at the other steps. In fact, farmers tend not to carry out handling according to GHP recommendations. The level of suitability for postharvest handling at the steps of determining the harvest index, sorting, grading, packaging and selecting packaging according to capacity can reach 100%. While at the cleaning step, handling storehouse, type of packaging according to market objectives then sanitation, the level of conformity with GHP is lower, which is around 21.7-75%. This shows that in general, farmers carry out postharvest handling but are not detailed yet in accordance with the recommendations of the GHP concept. Moisture migration and rotten were dominantly found during storage. This may occur as a result of poor handling at the harvest step, tuber cleaning and as a result of inadequate storehouse availability. Bulbs with residual soil and root debris were still found during storage. Therefore, each steps has the potential to contribute to yield loss and of course it will be detrimental to the farmers themselves.

![Figure 1. GHP suitability level per sampling](image1.png)

Figure 1. GHP suitability level per sampling

![Figure 2. GHP suitability level for handling potatoes according to GHP in Kerinci District](image2.png)

Figure 2. GHP suitability level for handling potatoes according to GHP in Kerinci District
Table 2. Tubers weight (gram) [14].

| Size  | Weight (gram) |
|-------|---------------|
| AL/XL | > 200         |
| A (large) | 120-200     |
| B (standard) | 80-120    |
| C (mini) | 50-80        |
| Baby  | 20-40         |

The Farmers can perform grading step according to the GHP concept because they have a great motivation to group tubers according to their class. The grading of tubers will provide opportunities for farmers to get a better selling price. However, the step for digging lost tubers requires improvement of up to 100%, meaning that the potato farmers in all research locations do not dig up the scattered tubers after harvest. Meanwhile, the digging lost tuber that occurs has an impact on reducing farmers' income. The majority of the sampling farmers did not comb the tubers that were left in the soil. Based on observations during the study, the potential for shrinkage of potato tubers in Kerinci District ranges from 8.8-13.2% or if converted to rupiah, farmers lose income about IDR 3,080,000-4,620,000 per hectare.

The farmers comprehension for good postharvest handling of potatoes is influenced by habitual factors that have been carried out for generations and otherwise. In general, the factors that affect the poor improvement of postharvest handling of potatoes in Kerinci District are similar to the constraint factors that occur in other agricultural commodities. Poor of knowledge, assistance from stakeholders and support for adequate harvesting equipment are obstacles for farmers to be able to optimally apply postharvest handling according to the Good Handling Practice (GHP) concept. The losses during the harvest and postharvest processes in many developing countries are caused by poor of technology and infrastructure, storage and transportation [15]. Yield losses in agricultural products occur almost along the postharvest handling chain and even occur in handling using agricultural tools or machines [16]. Assistance to farmers through technical guidance needs to be done to ensure the strengthening of understanding of GHP in a sustainable manner. Fresh handling technology at the farm level that is easy and inexpensive still relies on traditional methods [7]. Intensive knowledge transfer is expected to be able to change the mindset of farmers towards more responsible farming management. So that farmers have full ability and authority as problem solving related to the problems they face [17].

4. Conclusions
Based on the use of the GHP checklist, it shows that the level of suitability for postharvest handling of potatoes in Kerinci District is around 69% with an average improvement that must be carried out at the steps of cleaning, handling storehouse, type of packaging according to market goals and sanitation about 31%. The Farmers really need to carry out the step for digging lost tuber to minimize yield losses. The abandonment on the postharvest step means contributing to the reduced availability of potatoes as one of the food ingredients needed by the community. The assistance for the farmers through technical guidance should always be provided as an effort to narrow the gap of ignorance in postharvest handling of potatoes, according to the recommendations of the GHP concept. Information and data on the level of suitability postharvest handling practices for potatoes are expected to be an evaluation material and reference for those who need it. Then, it can be a solution for improving the quality and competitiveness of potato commodities in Kerinci District, Jambi Province.

Acknowledgement
It is necessary to design the right harvesting tool, which is safe for the product and effectively minimizes scattered losses. It is hoped that there will be collaboration between all elements, both researchers,
universities, provincial and district governments and other stakeholders to increase farmers' understanding and knowledge regarding postharvest handling of potatoes according to the GHP concept.

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