ASSESSMENT OF GINGER YIELD DISPARITY BETWEEN MANUAL AND MECHANIZED PLANTING TECHNIQUES

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ABSTRACT

This study delves into a comprehensive comparison between two primary approaches to ginger planting: manual and mechanized methods. It unveils notable differences in both the rate of planting and subsequent yield outcomes. Mechanized planting emerges as a standout performer, exhibiting a staggering seven-fold increase in planting speed when contrasted with the manual counterpart. This highlights the superior efficiency of mechanized techniques, particularly in covering expansive agricultural areas within shorter timeframes. The disparities in rhizome weight between the two methods are particularly intriguing. It is discerned that the variance is predominantly attributed to the distinct levels of soil disruption associated with each approach. Mechanized planting, by virtue of its machinery, introduces a controlled disruption of the soil structure. This manipulation potentially impacts the accessibility of nutrients and the retention of moisture in the soil, consequently influencing the developmental trajectory of ginger plants. Noteworthy findings also emerge regarding the consistency of yield. While there appears to be no significant variation in rhizome width between the two methods, mechanized planting demonstrates a reduced standard deviation in both weight and width. This suggests a higher degree of uniformity and predictability in yield outcomes with mechanized planting, as opposed to the manual method. These findings underscore the practical advantages of mechanized

planting beyond just speed. By ensuring a more consistent and standardized crop output, mechanized techniques hold significant promise for enhancing efficiency and productivity in ginger cultivation. Moreover, they offer potential solutions to the challenges posed by labor shortages and the need for increased agricultural output to meet growing demands.

Keywords: mechanized ginger planting, mineral soil, comparative yield outcome

INTRODUCTION

Ginger, a widely cultivated crop, has traditionally been planted and harvested manually. However, there is a growing interest in mechanized methods due to their potential for increased efficiency and reduced labor requirements. Numerous studies have underscored the substantial time and labor savings achievable through mechanical planting and harvesting of ginger. For example, research indicates that mechanical planting can save up to 90% of productive time and 85% of the total labor involved compared to conventional manual methods (Pandey et al., 2023).

The mechanization of ginger planting holds promises for reducing drudgery and enhancing both production quantity and quality. Studies have emphasized that mechanized processes can significantly lower labor requirements and boost efficiency, thereby leading to higher profits and greater economic viability (Igbo et al., 2013). Furthermore, the adoption of mechanized techniques has been linked to reduced greenhouse gas emissions, improved soil health, and enhanced social inclusion by improving working conditions and reducing reliance on labor (Mmasa and Mhagama, 2017).

Numerous research endeavors have focused on designing and developing mechanized equipment for ginger planting and harvesting. For instance, efforts have been made to devise seed metering mechanisms for ginger planters to ensure accurate seed spacing, depth, and high planting speeds, all of which contribute to reduced labor requirements and increased efficiency (Pandey et al., 2023). Similarly, the design and fabrication of ginger harvesting machines have been explored to streamline the harvesting process, save time, cut labor costs, and maintain ginger quality (Sanjay et al., 2015).

In essence, mechanized ginger planting highlights the potential advantages of mechanization in terms of reducing labor requirements, increasing efficiency, and enhancing overall productivity and economic viability. Various studies have underscored the significant time and labor savings associated with mechanical planting and harvesting of ginger, as well as the potential for mitigating greenhouse gas emissions and improving soil health. Additionally, research efforts have been directed toward designing and developing mechanized equipment to address the labor-intensive and time-consuming nature of manual ginger planting. However, there remains a need for a comprehensive comparative analysis of ginger yield between manual and mechanized planting methods to assess their impact on productivity, labor requirements, and overall economic viability. While manual planting has long been the dominant method for ginger cultivation, the potential benefits of mechanized planting and harvesting, such as increased efficiency and reduced labor dependency, have drawn attention. This underscores the necessity for a thorough comparative analysis of ginger yield between manual and mechanized planting methods to evaluate their potential impact on productivity, labor requirements, and overall economic viability. This study seeks to contribute to existing knowledge by offering a comparison of the yield, labor input, and cost-effectiveness of manual and mechanized ginger planting and harvesting methods.

MATERIALS AND METHODS

The study was carried out during a single growing season to maintain consistency in the mineral soil type at the MARDI Research Plot in Serdang, Selangor. Thailand Ginger seeds were utilized in the experiment, as depicted in Figure 1. Manual planting involved two rows, while mechanization involved five rows. Throughout the ginger cultivation cycle, data on growth parameters such as plant height and canopy development were gathered at regular intervals. Statistical methods were employed for a comparative analysis to determine the significance of yield differences between manual and mechanized planting techniques.

Figure 1: Thailand ginger seeds

Ginger Planting

As shown in the Figure 2, two labours were required to plant ginger manually. One operator dug holes while another operator put the seeds into the holes and covered up with soil. Figure 2 showed the manual planting technique. Planting time was recorded for each planted row.

Figure 2: Manual planting technique

Figure 3 showed the mechanized planting technique by using Yanmar Pedestrian-Typed Root Ball Transplanter. Two operators were required to operate the machine. Planting time was recorded for each planted row.

Figure 3: Mechanized planting technique

Ginger harvesting

Gingers were harvested manually just to compare the difference between manual planting and mechanized planting. Weight of rhizome and width of rhizome per plant were recorded and statistical analysis has been done.

RESULTS AND DISCUSSION

Ginger Planting

Table 1 represented the planting difference between mechanized and manual. It showed the planting rate of mechanized planting was 0.14 ha/hr while manual planting only 0.02 ha/hr. It showed that mechanized planting seven times faster than manual planting.

Table 1. Planting rate difference result between mechanized and manual

Treatment	Planting rate (ha/hr)	No. of operators
Mechanize	0.14	2
Manual	0.02	2

Ginger Harvesting

Figure 4 showed the 17 weeks old ginger plant which was considered as young ginger to be harvested.

Figure 4. 17 weeks old ginger

Figure 5 represented gingers that have been harvested manually. The harvested weight and width of gingers were presented in Table 2 below.

Figure 5. Harvesting gingers manually

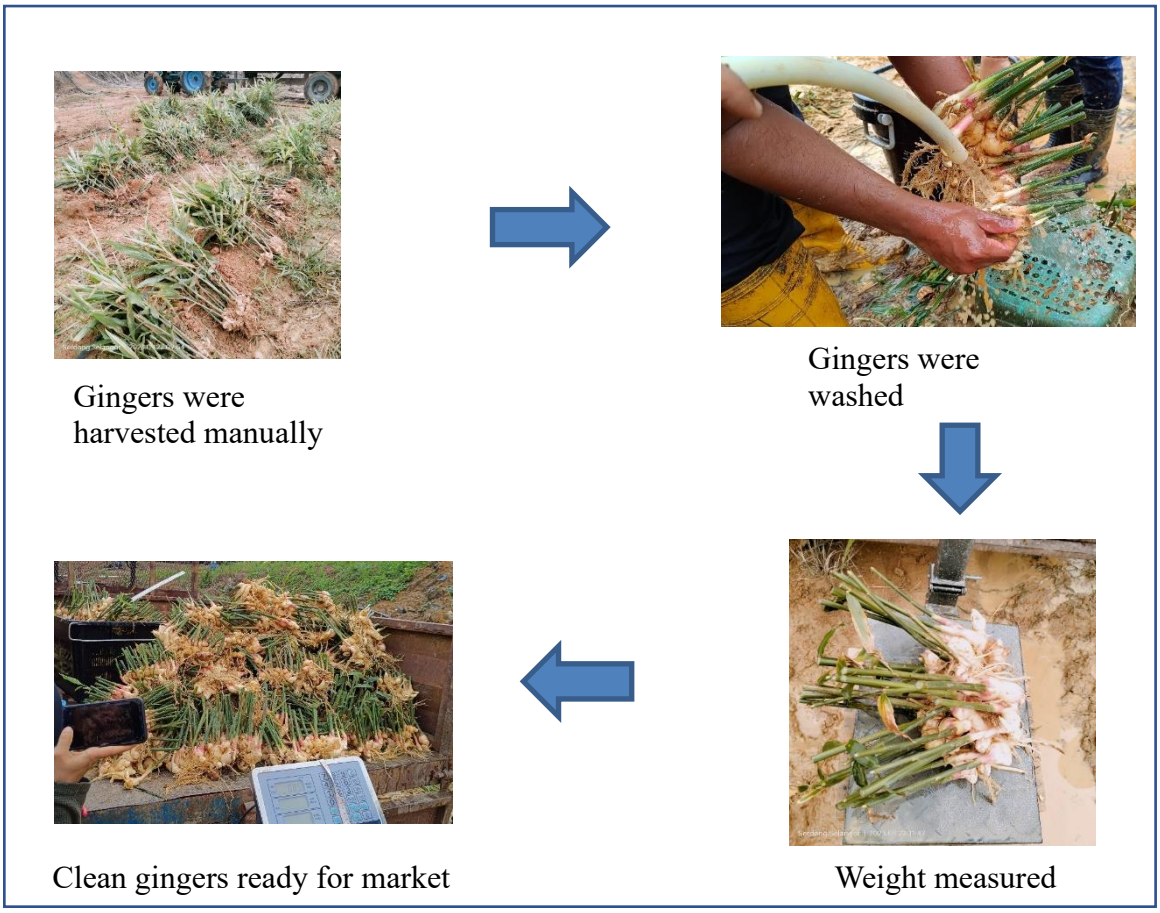

Table 2. Harvested weight and width of ginger rhizome

Treatment	Rhizome weight (g)	Weight SD	Rhizome width (cm)	Rhizome width SD
Mechanized	629 [b]	263.65	33.2 [a]	4.87
Manual	750 [a]	441.26	31.6 [a]	7.11

Based on the table 2, there was a significance different of weight between mechanized and manual planting because of the level of soil disturbance that can be caused by mechanized method can vary from that which is caused by manual method. The movement of mechanization on the soil can have an effect on the availability of nutrients, the retention of water, and ultimately, the growth of plants. Meanwhile for the rhizome width, it showed no significant difference between mechanize and manual planting. However, the standard deviation of weight and width for mechanized planting showed lower value compare to manual planting. It means that the yield from mechanized planting was more uniform than the yield from manual planting.

CONCLUSIONS

The study summarized the contrast between mechanize and manual planting techniques unveiled significant disparities in planting rates and yield attributes. The mechanize planting exhibited a planting speed that was seven times greater than manual planting, highlighting its efficacy in covering expansive areas. The notable disparity in rhizome weight between the two approaches can be due to the differing degrees of soil disruption, where automation has the capacity to affect nutrient accessibility and water retention, thereby affecting plant development. It is worth mentioning that although there is no noticeable variation in the width of the rhizome, the reduced standard deviation in both weight and width for mechanize planting suggests a greater level of consistency in yield compared to manual planting. This implies that the mechanize planting provides not only faster planting but also helps to a more standardized and even produce, emphasizing its potential practical benefits for agriculture.

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