

## Preliminary Study of existing Pineapple Transplanter

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### Abstract

*Problems getting labor and increasing in labor wage with the large farm size will be directing the pineapple farmers towards to the use of farm mechanization. Manual pineapple planting required 15 workers to plant one hectare of pineapple, which involve planting of 43500 suckers. A Manual/semi-automatic mechanical pineapple transplanting machine, might helpful to be used for facilitating pineapple planting activity but a lot of issues regarding safety and standardization of works are need to be an-counterred. This machine is able to plant pineapple in 13 hours/ha. Therefore a gripper type mechanical transplanter was proposed and developed to be used as a reference to improve the design of the pineapple transplanter. It is more smaller compared to the existing pineapple transplanter. The objective of the study was to evaluate and compare the performance of the machine in terms of ease of handling, reliability, stability, safety and maintainability. Preliminary tests showed that the changes done have improved the workability of the machine for mechanical transplanting of pineapple suckers.*

Keywords: Manual/gripper transplanter, Gripper type, Pineapple, Transplanter,

### Introduction

Pineapple is one of the tropical fruits that has a bright future in supporting the Malaysian economy. Currently, 95% of the domestic canned pineapple production is used for the export market while the rest is for domestic market. Fresh pineapple contributes only 30% of the export market and 70% for domestic market. (MPIB, 2012) It is listed under NKEA for agriculture to increase production targeting the export market especially in the Middle East and Europe. It is forecasted that farmers would be enable to earn a monthly income of RM4500 per hectare and at the same time contributing RM1.6 billion to Gross National Income (GNI). (PEMANDU, 2011). To support the increase in production rate would mean that the planting density should be increased. A hectare of pineapple would require 43,500 plants. A standard worker is only able to plant 3000 suckers/day. This means that 15 workers are required to plant one hectare of pineapple in one day. In addition, domestic labor is difficult to obtain. As a result, domestic agriculture is highly dependent on foreign labor.

It is expected that mechanization would be the main enabling factor to support the increase in pineapple cultivation. MARDI has taken measures to handle this issue by developing a complete mechanized pineapple production package, which includes a mechanical transplanter. This machine is able to plant pineapple in 13 hours/ha. However it would still require two operators at the rear to release the suckers from the transplanter bin and place them in the soil. (Rahim et al., 2007)

The existing transplanter know as manual/semi-auto pineapple transplanter raised issues such as planting

losses in the field and safety concerns. Therefore a gripper type mechanical transplanter was proposed and develop to be used as a reference to improve the design of the pineapple transplanter. It is more smaller compared to the existing pineapple transplanter. This machine requires one operator to transfer the seedlings or cuttings from the loading tray to the grippers. The objective of this study was to study and improved mechanical transplanter for pineapple suckers transplanting on operation work. A preliminary experiment based on the design study and operation process for current transplanter and the gripper type mechanical transplanter was done. There are major need to be Improve were suggested based on these two activities.

### Materials and methods

#### *Pineapple Transplanter*

The manual/semi-auto pineapple transplanter (Figure 1) were been develop in 2007 by Mr. Rahim Abdul Rahman The machine is a tractor-mounted transplanter and requires 3 operators, where one of them works as a tractor driver and the remaining 2 operators seat at the rear of the machine and place the sucker manually into the holes that made by the machine. Manual pineapple planting required 15 workers to plant one hectare of pineapple, which required 43500 suckers. Previous tests showed that

using a minimum forward travel speed of 0.8 km/h, the operator had difficulty in loading the suckers onto the clippers.



Figure 1. Previous Existing manual/semi-auto operation transplanter

Therefore, Gripper type mechanical transplanter was developed (Figure 2).



Figure 2 gripper type mechanical transplanter

Design concept that been taken is from previous vegetable planting machine that where been custom to able to plant pineapple suckers (Figure 3).

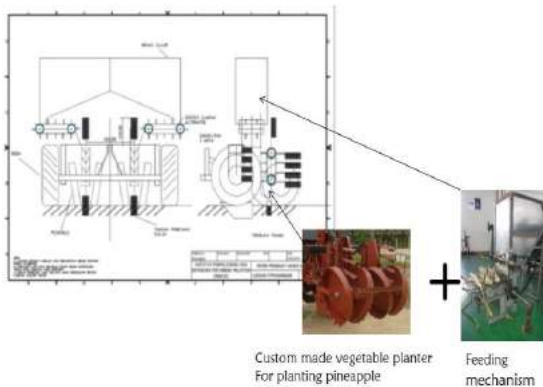


Figure 3. Design Concept for gripper type pineapple transplanter

This machine was ground wheel driven, which meant that the mechanisms of the machine were generated by the rotation of the ground press wheel. This ground wheel would move the three roller chain systems that would move the grippers. These grippers

4 hold the seeds, or in this case, the pineapple suckers, before transferring them to the soil. A furrow opener is located at the front of the machine to open up the soil to ease transplanting. An operator seat and a seed tray are available for the operator to sit on and to load seeds to transfer to the grippers. The planting distance can be pre-determined by changing the sprocket near the loading tray.

#### Field test

A preliminary study for the The manual/semi-auto pineapple transplanter was done at Tampin. Negeri Sembilan, this machine or implement was attached to a 90 hp New Holland tractor (model 7740) and Josapine varieties were been tested during this test and for the the gripper type transplanter field test was done at Engineering Research Center (ER) research plot, using but with modification done on the furrow opener depth. This machine or implement was attached to a 90 hp New Holland tractor (model 7740). MD2 varieties were tested during this test to observe suitability of this transplanter to transplant pineapple suckers. The quality of the transplanting was observed in terms of actual planting distance and the condition of the pineapple suckers after transplanting.

#### Result and Discussion

##### Pineapple Transplanter

The manual/semi-auto pineapple transplanter The transplanter were mounted at the rear of a New Holland tractor (model 7740) using a minimum forward travel speed of 0.8 km/h, the operator had difficulty in loading the suckers onto the clippers. Different chain pitches were used for the three roller chain system used for the planting mechanism. The clippers also needed improvement to properly hold pineapple suckers. The furrow opener was too small, thus required widening. The ground press wheel, which also drives the planting mechanism, is considered too big. Design improvements done were changing the roller chain system configuration to reduce the sucker loading while maintaining planting distance. The existing mechanical transplanted raised issues such as planting losses in the field and safety concerns (Figure 4). The current transplanter has a huge loading bin, and two operators would sit at a low position near to the ground to grab pineapple suckers from the loading bin and positioned it in front of a mechanical soil puncher. This low position has created some safety concerns because the tractor driver cannot see the two planting operators (Figure 5). This puncher would create a soil opening and a set of soil compacter wheels will compact the soil after transplanting. During the transplanting process, unsuccessful planting occurred due to mis-planting or suckers not planted in a vertical position (Figure 3). The tractor drive had difficulties in seeing the transplanting operators from the tractor cabin because they were sitting at a very low position.



Figure 4: The manual/semi-auto pineapple transplanter (1) operator seat at the lower back of the machine- safety Issue (2) Speed of the feeding mechanism missing point



Figure 5: Low position of planting



Figure 6: Show (1) the gripper mechanism was too fast because it depended on the wheels from the tractor's travel speed. (2) show that the pineapple sucker is a bit bigger than the gripper

### Gripper type Transplanter

Gripper type transplanter was mounted at the rear of a New Holland tractor (model 7740). The forward travel speed was initially set at 0.8 km/h, which was the slowest travel speed that can be adjusted for the tractor. It was observed that at this speed, the operator had difficulty in placing the pineapple suckers from the loading tray to the grippers, because the gripper mechanism was too fast (Figure 6). The transplanter could easily transplant all grades of the MD2 variety without any complications. However, the diameter of the suckers was too big for the machine. Improved design needed for the gripper by increasing the length of diameter of the gripper (Figure 6). The modified furrow opener succeeded in creating a furrow about 5 to 8 cm deep, to allow the pineapple suckers positioned vertically. However the design of furrow need to be study to improved the effiesiecy of the opener because some of the suckers fall down during the planting (Figure 7). The furrow depth could be adjusted by controlling the three-point hitch of the tractor.



*Figure 7: Show the pineapple suckers fall down during the planting*

### Conclusions

By comparing 2 type of conceptual design as a resultant, this gripper type transplanter can improve the work efficiency of pineapple transplanting to about 70-80% compared with manual/semi-auto operation and more friendly use and safety compare to previous machine. The machine is very effective in reducing labour workload especially during transplanting operation for making holes and carrying suckers.

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