Experimental Test of Rice Planting Equipment with A Circular Model

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Abstract. Especially on the island of Bali, agriculture as a culture still plays a vital role in supporting the development of tourism, both in terms of values, religiosity, and the environment, as well as farmers as producers, both in rice fields and non-rice fields (moors), because of the Tri Hita Karana philosophy (the balance of the relationship between God, humans, and the physical environment). Ironically, as a popular tourist destination, Bali's agricultural land is vulnerable to pressure due to tourism. It is not uncommon for them to leave the agricultural sector due to significant differences in income. Because of this, a design for rice planting equipment was created to make it easier for farmers during the planting process, thereby reducing costs and time during the rice planting process. In this test, data was collected on rice planting tools using a circular model, traditional tool design, and planting. This test was carried out by comparing rice planting using tools and without using tools (manually) with an area of 100 square meters planted with a test length distance of 10 meters and measurements using a stopwatch. From the calculation results, it can be concluded that during the planting process, the time required is faster and saves energy, because the planting process using a circular rice planting tool can save more efficient planting time, up to half the time of manual planting.

Keywords: Agriculture, Circular Model, Technology

1 Introduction

Agricultural human resources have an important role in building sustainable agriculture. The Strategic Plan of the Ministry of Agriculture (Ministry of Agriculture 2015a) focuses on agricultural development through the concept of sustainable agricultural development (Susilowati, 2016). The sustainable agricultural development paradigm is essentially a system of agricultural development through optimal management of all potential resources, both natural resources, human resources, institutions, and technology, to ensure that an effort continues and does not experience decline in the context of improving the welfare of society as a whole. Therefore, quality human resources who are committed to developing the agricultural sector are one of the factors for the success of sustainable agricultural development (Widayat & Purba, 2015).

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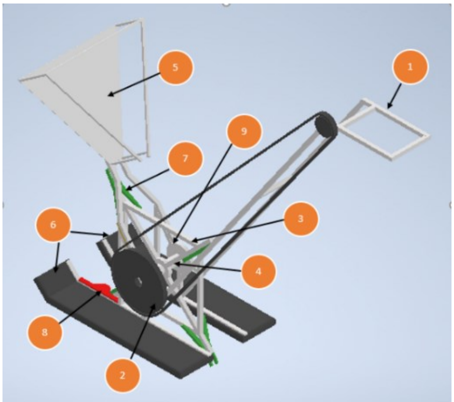
Especially on the island of Bali, agriculture as a culture still plays a vital role in supporting the development of tourism, both in terms of values, religiosity, and the environment, as well as farmers as producers, both in rice fields and non-rice fields (moors), because of the Tri Hita Karana philosophy (the balance of the relationship between God, humans, and the physical environment) (Wirata, 2013). Ironically, as a popular tourist destination, Bali's agricultural land is vulnerable to pressure due to tourism itself. In reality, there is a conversion of agricultural land into non-agricultural land which is facilitated by local government policies. Apart from that, human resources are increasing, the need for infrastructure as a result of city development and the development of industries related to tourism, is increasingly encouraging the conversion of agricultural land, especially rice fields, into non-agricultural land in the form of housing, offices, universities, centers. spending and especially for tourism supporting infrastructure such as hotels, restaurants, nightclubs, and so on (Supatminingsih, 2022).

It is not uncommon for them to leave the agricultural sector due to significant differences in income. Tourism provides opportunities to increase people's income and welfare, but the challenges it presents cannot be underestimated (Husein et al., 2009) . These challenges include, firstly, the decline in the area of productive agricultural land in Bali due to land conversion, secondly, the decreasing interest of the younger generation in entering the agricultural sector (Saferi et al., 2022). Currently, there are several types of rice planting equipment available on the market, but the rice planting equipment available in terms of price is still less affordable (expensive) and also uses rice seeds planted in special fields/media (Ahmad, 2019). Rice planting equipment has previously existed and how to use it is still complicated because, in the process of using it, there are two systems, namely the manual system and using a combustion motor as a driver connected to an eccentric shaft (Sulistiyan, 2016), in the sense that the rice planting equipment has not reduced the farmer's workload. especially farmers in Bali. Rice planting tools will help to reduce processing time so that farmers can do the next job, apart from that, rice planting tools also reduce the costs that farmers have to incur because using planting tools means farmers no longer have to pay for planting wages, so farmers will get a profit the bigger one (Nabawi et al., 2019; Prasetyo & Ariyanto, 2021).

2 Methodology

2.1 Design

In this research, the experimental test method for designing/designing rice planting tools with a circular model was chosen, where planning, design, and technical calculations of materials and components will be carried out as well as simulation tests and making models of the tools that have been determined. This building design was chosen because many farmers still plant rice manually (traditionally). Based on the problems above, it is necessary to design a rice planting tool with a circular model to make it easier for farmers when plant rice so that it will be more effective and efficient and not take up a lot of time. The basic concept is to utilize spindle rotation which is transmitted by a chain so that it moves the shaft and rotary clamp. rice with a circular movement direction that is directly connected to the planting mechanism, so that farmers simply push and rotate the spindle on the rice planting tool.



Caption :
1. Frame
2. Chain and Sprockets
3. Rotary
4. Shaft
5. Container/place for rice
6. Floating pad
7. Rice clamp
8. Clip opening and closing flow
9. Bearings

Figure 1. Design of rice planting tools with a circular model

2.2 Data Analysis

This research is divided into several stages, the stages are as follows:

Tool Need Analysis. The initial stage of this research determines the design with a circular model connected to the planting mechanism, analyzes the circular motion of the effectiveness of rice planting, and a comparison of the tools designed with the manual (traditional) planting method. For rice that will be planted, it still uses rice that is sown traditionally without having to use new planting media technology. Starting with observing the problems and needs desired when planting rice, then continuing with observations to obtain information about the advantages, disadvantages, and obstacles experienced during the traditional (manual) rice planting process.

Working Principle. The working principle is first by rotating the spindle transmitted by the chain so that it rotates the sprocket below it which is directly connected to the shaft and rotary. When the shaft rotates, the rotary also rotates so that it produces a circular rotation, the clamp installed in the rotary will alternately contact the opening and closing groove of the upper clamp and clamp the rice in the container. After that, the clamp that has clamped the rice will immediately contact the open-close groove at the bottom so that it releases the rice (plants rice) and so on, the mechanism system will continue to repeat itself until the rice planting process is complete.

Test Results. This rice planting tool still has shortcomings, namely the capacity of the rice seedling capacity which is still very minimal, this is because this tool is still a prototype. With a minimal capacity, this tool can only plant rice approximately 20-25 meters long, so when the rice seeds run out, they must be refilled. Another disadvantage is that the agricultural land must be clean from post-harvest cuttings that after being plowed will still be left as an obstacle when planting using a rice planting tool with this circular model, this will cause the remaining stalks and roots of the rice to get stuck in the tool clamp.

Accredited Journal. The study aims to assess the effectiveness of a circular model rice planting tool by comparing its planting speed with traditional methods. The trial phase evaluates the tool's performance and functionality. If the tool can work well, it is continued with a comparative trial of rice planting with and without tools (manual), while if the tool does not work well, the tool will be redesigned. All results of this study will be presented in a paper published in an accredited national journal. Testing in this study will be tested directly on rice fields that are ready to be planted. This study uses descriptive analysis. Descriptive analysis is a depiction or graphic description that describes the phenomena that occur in an experiment. The fixed variables in this study are the planting distance used is 10 meters with a planting distance of 30 centimeters which is repeated 10 times. The independent variables are land conditions and the number of seeds planted.

3 Result and Discussion

3.1 Result

This test was carried out on rice fields ready for planting by comparing rice planting using tools and without using tools (manually) with an area of 100 square meters planted with a test length distance of 10 meters with a rice planting distance of 30 centimeters and measurements using a stopwatch. The test was carried out 10 times so that the comparative results of planting time using tools and without tools (manual) were known.

Table 1. Comparison of planting rice without tools and with tools

No	No tools (Minute)	With tools (Minute)
1	23.73	13.47
2	24.66	13.41
3	23.23	13.56
4	24.02	14.16
5	24.09	13.34
6	24.54	13.57
7	23.77	13.88

8	24.06	14.43
9	23.65	13.47
10	24.01	12.99

3.2 Discussion

From the results of data collection, it was found that the planting process with tools and without tools (manual) had a time difference that was almost two times greater when compared to using tools. This result was due to the manual planting system which was carried out using a smelter (backward planting) and also Planting by bending over means that farmers occasionally have to stretch their muscles to start the planting process again.

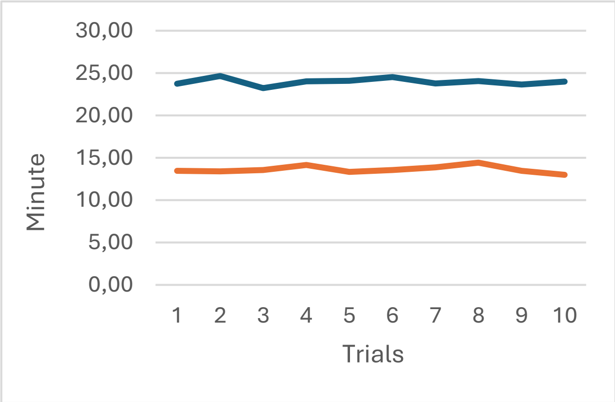


Figure 2. Comparison curve of rice planting without tools and with tools

The following is the analysis obtained from the comparison curve for planting rice without tools and with tools. In testing a planting tool with a circular model with a land area of 100 square meters planted with a spacing of 30 cm, it can be concluded that the planting process takes approximately half the time of manual planting and saves energy. However, the results of planting on land with this tool, the number of seeds planted cannot be adjusted and some failed to be planted because this planting tool is still in the testing phase. In testing planting rice seeds with a rice planting tool, when compared with the rice planting process and to speed up the traditional planting process, it requires 2-4 people to speed up the planting of rice seeds. Like everyone planting rice seeds simultaneously at the same distance. The advantage of planting rice manually is that when planting we can control how many rice seeds will be planted without fear of a failed planting process.

4 Conclusion

The planting process using a rice planting tool with a circular model has a time difference of almost two times greater than using a tool, meaning this tool can increase efficiency and productivity in the rice planting process by up to 2 times. Even though this tool has advantages in terms of time and energy, there are obstacles in controlling the number of rice seeds that are successfully planted. There are variations in the number of rice seeds that were successfully planted and those that failed to be planted. This shows that this tool is still not consistent in providing uniform planting, or other factors influence the suitability of the tool for certain environmental conditions and soil types.

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