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Development of Metering Device For Precise Hybrid Rice Seeder

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Abstract: Hybrid rice has proven capable to deliver higher yield than ordinary variety. It has yield potential of more than 10t/ha. In direct seeding, hybrid rice requires about 25kg/ha of seed compared to 120kg/ha of ordinary variety. A precise metering mechanism is required to meet the optimum use of hybrid rice. A seeder is developed by MARDI to cater the usage for this variety. It consists of mainframe, seeder unit and wheel drive. It is to be mounted on prime mover and applying mechanical drive to function. The metering device regulates the amount of seed production precisely for 2-3 seed per drop. An experiment has been conducted to determine the most suitable metering setting that could optimize the use of seed per area. From the result, it shown that several metering setting of the device will affect the amount of seed directly. The developed seeder is made specifically for hybrid rice and from the experiment result, the device manage to fulfill the requirement needed in term of lowering the cost of seed and device maintenance as well as user friendly.

Keywords: Rice, hybrid rice and rice seeder

1. Introduction

Rice is the most consumed staple food for a large part of the world's human population, especially in Asia. It is the grain with the second-highest worldwide production, after maize [1]. Now there are many rice varieties in the world and the most effective to get high yield potential is by using hybrid rice [2]. Hybrid rice had a yield advantage of about 15% over the best-inbred cultivars in farmers' fields [3]. Recently, hybrid rice varieties have been commercialized in India, Vietnam, the Philippines, and Bangladesh [4].

The rice fields area in Malaysia is estimated around 673 745 hectares which 510 474 hectares located in Peninsular Malaysia [5] and the demand of increased yield rate is yet to be fulfilled. As a result, the Government is targeting to produce 10 tonne per hectare of rice in order to fulfil the needs of Malaysian rice storage. One of the methods to make this plan succeeded is by producing a high yield of rice through using hybrid rice verity.

Therefore, a complete mechanization package for this rice variety is required. One of the mechanization components in the packages is the planting system. There are various methods of rice planting has been practiced like dry direct seeding, wet direct seeding, manual transplanting and machine transplanting [6]. In addition, there is no machine currently available that capable to comply with the use of low rate of seeding. Manual transplanting can be used for similar purpose, but the method requires high labor force and time [8]. This will pose a problem, particularly for large-scale production.

The objectives of this study is to obtain an appropriate machine for use with the method of low rate of seeding as well as to determine the most appropriate settings used to obtain a suitable seed rate. In addition, the developed machine can save time and labor.

2. Material and Method

This machine is fabricated using a basic seeding machine design. In addition, it uses cheap material to ease modification and maintenance, but capable to perform at a high level. The machine is mounted on a prime mover for planting seeds (Fig. 1). It consists of three main components, namely seeder unit, mainframe and the drive wheels.

Fig. 1: Seeder machine attach with prime mover

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2.1 Seeder unit

Seeder unit (Fig. 2) is the most important component. It consists of two metering devices for each unit to place the seeds on both sides, with the open and close control. It also comprises hopper for storing the seeds, and the flow divider to divide the seed for both the metering device. The seeder unit's body is developed by using PVC material while the seed flow divider is using aluminum sheets formed into 'V' shape. Tilt angle of the seed flow divider must exceed the static coefficient of friction between the surface of aluminum and seeds, of more than 34 degree slope [9]. The distance between the holes is 30 cm. This is consistent with the spacing practiced in normal rice production.

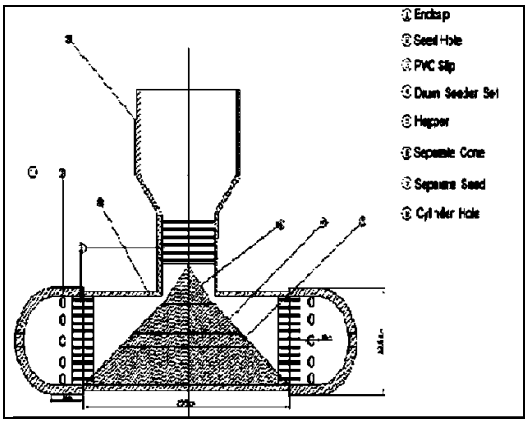

Fig. 2: Seeder unit

2.2 Main frame and drive wheel

The mainframe functions to accommodate 4 seeder units with overall width of 2.2 meters. It is developed using a light rectangular hollow steel section. It will be mounted to the prime mover for operation. The drive wheel functions to rotate the metering device on seeder unit. It moved when towed by prime movers in the field. Rotating metering device will drop seeds into the soil through the holes on both sides via gravity.

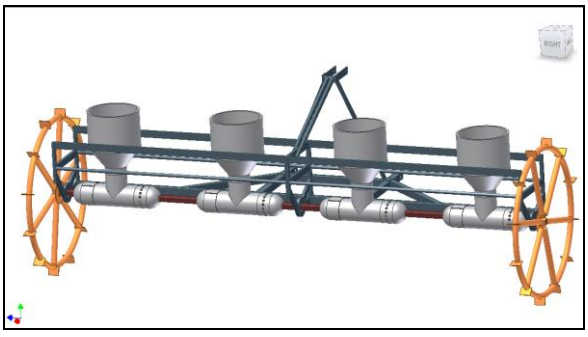

Fig. 3: 3-D drawing of seeder machine

2.3 Method

This research work was conducted in MARDI Seberang Perai Station during the year 2012. The hybrid rice used was Siraj variety who had been introduced commercially in Malaysia since 2011 by MARDI. The experiment was conducted to determine a suitable setting for the metering device to obtain the targeted seeding rate of 25kg/ha. Before the seed is used, it must first be germinated by soaking in water treated with the pre-emergent for 24 hours day and night and evaporated again for 24 hours. Then the seed is tested using the grain flow tester to ensure that the seed can slide on the seed flow divider in the seeder units.

Fig. 4: Grain flow tester

During the experiment, a total of 6 plots with an area of 1 ha each is used for each different openings of the metering device. The openings selected for the experiment is 3, 4, 5, 6, and all the holes. Each seeder units will be filled with germinated seeds. Each unit could accommodate up to 10 kg of seeds at one time. Thus, the machine is capable to carry 40 kg of seeds in a single trip. After that, the remaining seed in the seeder units will be weighed again to determine the rate of seed used.

3. Result and Discussion

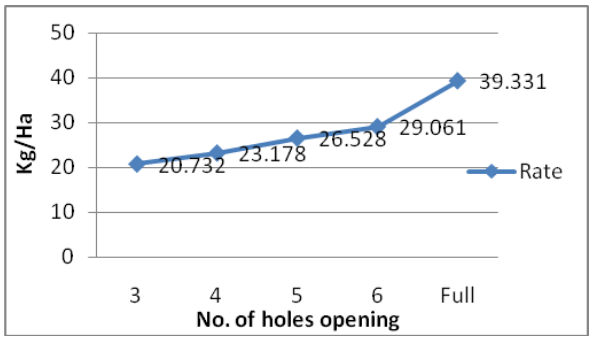

Fig. 5: Seed usage for different holes opening

The result shows that the amount of seed drop is proportional to the holes opening of metering devices. The metering setting of opening 5 holes will result a usage of seed closest to 25 kg/ha. A full hole opening in metering device is not recommended due to its high usage of seed, which is 39.331 kg/ha. A precise

seeding will optimize the cost required for seed thus reducing the overall production cost.

From observation during experiment, the seeds fall to the ground with great success with each setting sets. Seed distribution lines can be clearly seen after the machine moved past the planting area (Fig. 6).

Fig. 6: Seed drop during testing

4. Conclusion

From the experiment, it can be concluded that the difference in the size of holes opening output affecting the drop of seed rate. Further study can be done to monitor the seed growth after planting. In addition, the machine can also be tested for use with other seeds variety sold in the market to expand its use. Generally the experiment shows that the developed machine is capable to be used to sow seeds of hybrid rice with desired rate, even though it is made from local and cheap materials.

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