Kepes
http://scholopress.com/kepes-journal
2023 Volume 21 Issue 3 pp. 291-296

Modification of a Motorcycle Become a Simple Rice Thresher Machine

*Harman [1], Israkwaty [1]

[1]Mechanical Engineering, Akademi Teknik Soroako, Indonesia

Abstract

Rice has been the main commodity for Indonesia because it is the staple food for most of its population. Therefore, the government must guarantee its availability throughout the year. However, the rice supply still mostly relies on local farmer's production with planting frequency only 2 to 3 times per year. Separating grains from rice stems generally still uses the traditional methods, which include from pounding rice in a particular container that resembles a raft, to finally trampling to release the seeds. Generally, rice threshing machine has been widely adopted as substitution for traditional methods to minimize the post-harvest losses. However, the local farmers find new challenge when transferring the rice thresher to the harvest location. The four-wheeled vehicles are unable to access the small rice-fields path. Thus, it must be lifted by 4 to 6 man using wood or bamboo. This study aims to design and to manufacture simple rice thresher that will easily access the rice-fields path, using 100cc used motorcycle with a maximum power of 7.3 PS (5.5 kilowatt) as the main driver, which can be produced by local craftsmen and accessed by all small farmers. This study uses an experimental method, from designing the threshing components to making the prototypes. The result is the rice threshing with threshing drums in diameter of 220mm and 800mm in length. The overall size of the machine is 200 cm in length, 100 cm in width, and 130 cm in height.

Keywords: Thresher, Rice, Machine, Farmer

1. Introduction

South Sulawesi is among the province with largest percentage of rice production beside Java Island in Indonesia with an average of 6 million tons per year. It is even the largest so far where the total land availability is about 8% (Agricultural Statistics, 2018). However, the ratio between the population growth and rice production per year is unbalance. When the rice production decreases, and the need for the rice increases, eventually may cause the rice deficit. In addition, the other problem is the post-harvest rice processing method. In many developing countries, the rice farmers are still using the old method to separate the rice grain from the stalks and the husks, by pounding the grain against a particular tool that resembles to a raft (Resky, 2013), in such a way to push the separation (Fig. 1). This old and traditional method leads to low quality of the paddy rice and the grain loss. The manual threshing might also be tiring for the farmers.

The traditional way of separating the grain from the stalk is also creating another issue. The loss of the rice grain which is 5 % (Rohkani, 2009), and time to separate the grain from the stalks and the husks takes 12 days per hectare with 10 people to do the process (Rupajati, 2016). As a matter of fact, threshing machine has been widely adopted for many years to minimize the loss after the harvest. However, the farmers found problem while transferring the machine into the rice field. The small path along the rice field

*Corresponding author
DOI https://doi.org/10.5281/zenodo.7936583#91

makes the farmers needs 4 to 6 people to transfer the four-wheeled vehicle by using wood or bamboo.

Fig. 1 Separating grain from rice stalk (Rupajati, 2016)

Some rice thresher machines for small-scale farmers have been developed in some areas (Rupajati et al., 2016), of which includes a simple rice thresher purely made from steel with a thick of 3 mm. The prime mover used a 5.5 HP combustion engine with a rotation of 600-630 rpm. Within this specification, this simple thresher is able to produce 100 kilograms of grain per hour. For its simple material, the machine is light and movable but unfortunately it is difficult to transfer it to the rice field (Fig. 2).

Fig. 2 Closed drum rice thresher (Rupajati, 2016)

Another type of the rice thresher which is made from simple material is one which is made from steel and wood (Kristanto. A. et al, 2015). The prime mover used a 5.5 HP combustion motor and the output is about 260 kilograms of grain per hour. Thresher is also easily moved, but it needs at least 2 people to transfer it to the rice field. However, the machine creates minor problem for it was made from wood. Wood does not resistant to weather changes. It is easily to wreck when exposed to sunlight or continues rainfall (Fig. 3).

Fig. 3 Steel and wood rice thresher (Kristanto. A. et al, 2015)

Anton Kuswoyo (2017) made a different type of rice thresher by using mechanical energy from a motorcycle rotation that is used as the main driver. The thresher box was put on the back of a motorcycle and a chain is installed to connect the cylinder shaft and the motor engine. During the process, the motorcycle is held in a straight position, the engine is turned off, and the wheels are spinning. The rice thresher is ready for use when the chain successfully turned the wheels and eventually turned the cylinder. The output capacity is about 300 to 400 kilograms per hour. However, to keep the machine steady during the process is something which is requires solution. For it unstable position, the machine might just overturn anytime, so it will wreck and might also be unsafe to the operator. The machine also requires two people to operate (Fig. 4).

Fig. 4 Mechanical rice thresher (Kuswoyo. A, 2017)

As it shown on the previous presentation, therefore there is a huge need of a particular design in which will maximize the post-harvest production. The machine must be transferred easily to reach the sites. Therefore, the farmers will no longer have problem carrying the thresher through the rice field, and the production will increase. In order to mechanize the process, another simple rice thresher with trailer coupling system is designed and tested.

2. Methodology

This research applied an experimental method during designing and manufacturing. The design makes a rice thresher machine used by a motorcycle as its main power source. The modification of the motorcycle is made in some parts of which include change in the chassis system. The rear wheel is made into two parts, left and right, the driving mechanism, and also the electrical system, while the rice thresher will be connected to the motorcycle. The design is using Autodesk Inventor Professional software version 2016. Some images of the design can be seen down below (Fig. 5).

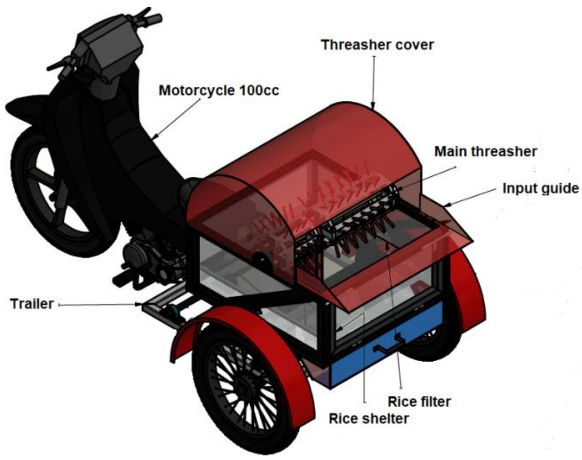

Fig. 5 3-D Thresher machine design

3. Results and Discussion

The thresher which has been designed is comprised of two main units, the power and the thresher. The engine used as the main driver is Honda Supra X 100 Model, which produced in 1998-2005. The engine specifications are as follows:

Table 1 Main Power Engine Specifications

No.	Description	Specification
1	Type	4 –*Stroke*, SOHC, 1 cylinder
2	Displacement (cc)	97,1
3	Max. Power	7,3 ps @ 8000 rpm
4	Min. Torque	0,74 kgf.m @ 6000 rpm
5	Transmission	4-*speed* (N-1-2-3-4-N), *constant mesh*
6	Firing system	AC-CDI, Magneto

As it can be seen in Fig. 6, the rear of the motorcycle was modified by extending the chassis to a width of 95.5 centimeters. Two shafts were added to hold the sprocket, the pulley, and left and right rear. The distance between those two rears was 116 centimeters. A differential system is added to keep the rear wheels steady when the motor make a turn. The distance between front and rear wheel changes from 125 to 160 centimeters in length.

Fig. 6 Power Unit Transmission System

In Fig. 7, the picture shown some lights were added to the back of the thresher box; the light for the brake, tail, and turn. This will allow the motor to operate on the road during the day and night.

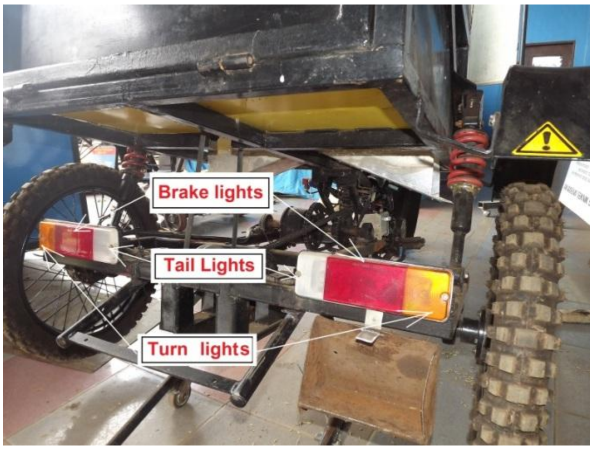

Fig. 7 Rear Lights

The thresher components were designed in such a way to ensure the unit will run smoothly. The unit were consists of some important parts; rice shelter, threshing cylinder, feeder chute, and grain outlet collection (Fig. 8). The thresher unit is assembled at the rear of the motor by the chassis modification which then is supported by a sock breaker. The main compartment of the thresher is added with a measurement of 90 centimeters long, 85 centimeters wide and 38 centimeters high, with 80 centimeters in diameter of threshing cylinder. This compartment will be used as the temporary container to hold the rice after the grains get combed off and fall on the sloppy tray and slide downwards. Round bar with 8 millimeters in diameter and 7.5 millimeters in length is plugged into the threshing cylinder with diameter of 22 centimeters to form combs with distance between bars is 6 centimeters long. Both end of the threshing cylinder is supported by pillow block SKF number P204 and bearing number 6204. The overall size of this thresher unit is 200 centimeters long, 100 centimeters wide and 130 centimeters high.

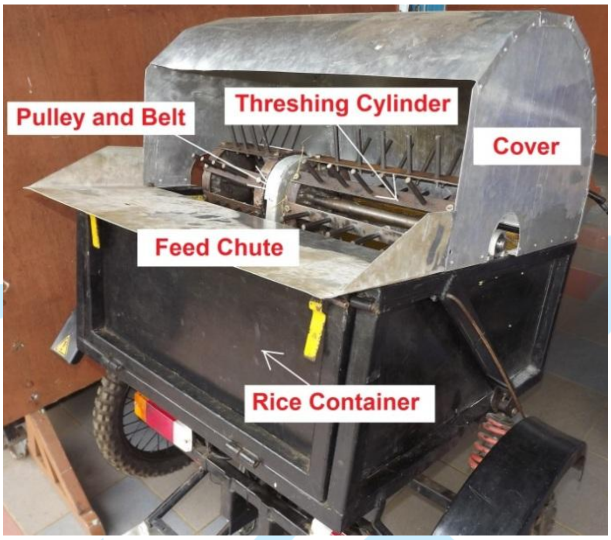

Fig. 8 Threshing Unit

3.1 *Working Principle*

This thresher is quite simple to operate as it does not require any specific skill for the operation. The mechanism that is used is quite simple as well. The first thing to make sure is to find the exact threshing site. The thresher needs to be set before used. The thresher is ready for use when the rear wheels are released against the floor by stepping onto the brace that has been properly prepared and set. The wheel on the right side of the thresher must be locked to prevent them from rotating by the time the other wheel on the left side is released. The motor is turned on by simply turning the ignition key or done by kicking the manual starter. In order to rotate the cylinder, the transmission motor then is inserted. The motor power is transmitted through a chain and sprocket system to the axle, where the pulley and belt is attached for power and eventually ignited rotation to the cylinder. After all the above steps are done, the thresher is ready for used. The transmission ratio between thresher and axle is 1:2.

3.2 Performance

The performance tests were done several times to give different conditions to the thresher (Fig. 9). During each of test, duration and capacity were recorded. The rotational speed of the drum was on 510 rpm. The total time or duration is 62 seconds, while the capacity of separating the grain is 1.741 grams. It can be summarizing from the result that within an hour (60 minutes), the thresher is able to separate the grain as much as 101.09 kilograms. The details are shown in Table 2.

Fig. 9 Performance Test

Table 2 Paddy Removal Rate

Trial Number	Time (s)	Paddy Removal (grams)
1	13	355
2	12	342
3	14	362
4	11	337
5	12	345
	$\Sigma = 62$	$\Sigma = 1741$

4. Conclusion

The output of the thresher during the performance test has shown good result. The thresher is proven effective to reduce the time spent for separating the grain from the stalks and the husks. The capacity of the grain is up to 101.09 kilograms per hour. The thresher can be moved from one place to another easily. The operational and output efficiency has proven multiply to a greater level.

Funding Information

The authors did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Conflict

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Agricultural Statistics (2018). Ministry of Agricultural Republic of Indonesia.
2. Dhananchezhiyan, P., Parveen, S., & Rangasamy, K. (2013). Development and Performance Evaluation of Low Cost Portable Paddy Thresher for Small Farmers. *International Journal of Engineering Research and Technology*, *2*(7), 571-585.
3. Hasbullah, R., & Riska, I. (2009). The Use of Threshing Technology to Reduce Grain Losses and Maintain Grain Quality of Paddy. *Jurnal Keteknikan Pertanian IPB*, *23*(2), 111-118.
4. Kristanto, A., & Widodo (2015). Perancangan ulang Alat Perontok Padi yang Ergonomis untuk Meningkatkan Produktivitas dan Kualitas Kebersihan Padi. *Jurnal Ilmiah Teknik Industri Universitas Ahmad Dahlan, 14*(1), 78-85.
5. Kuswoyo, A. (2017). Rancang Bangun Mesin Perontok Padi Portable dengan Penggerak Mesin Sepeda Motor. *Jurnal Elemen*, *4*(1), 35-38.
6. Novianto, R. (2013). Perancangan Mesin Perontok Padi yang Portable dengan Biaya Terjangkau. *Jurnal Riset Daerah Edisi Khusus*, pp. 105-116.
7. Olugboji, O.A. (2004). Development of a Rice Threshing Machine. *AU J.T*, *8*(2), 75-80.
8. Paman, U., Bahri, S., & Asrol (2014). Custom Hiring Services of Power Thresher for Small-Farm Rice Threshing in Kampar Regency, Indonesia. *International Journal of Advanced Science Engineering Information Technology*, *4*(4), 70-73.
9. Rupajati, P., Saharudin, S.A., & Dwita, D. (2016). Rancang Bangun Mesin Perontok Padi (Paddy Thresher) dalam Upaya Peningkatan Kualitas dan Efisiensi Produksi Beras Pasca Panen, pp. 7-12.
10. Zain, M.M., Haslindah, A., & Fatmawati (2016). Threshing machine working plan design using break down model for rural in production improvement. *ARPN Journal of Agricultural and Biological Science* Vol, *11*(8), 317-321.