Introduction of Multifunction Weeding Tools to Increase the Efficiency of Rice Weeding Activity on Sloping Land to Farmer Group Tani Sejahtera, Rojomo Village, Wonosobo District, Central Java

Makbul Hajad*, Eko Yulfiarno, Muhammad Haykal Fikri, Nur Raudhatil Jannah

Department of Agricultural and Biosystems Engineering, Faculty of Agricultural Technology, Universitas Gadjah Mada, Indonesia.

*Corresponding author's email: makbul.hajad@ugm.ac.id
doi: https://doi.org/10.21467/proceedings.151.29

ABSTRACT

Wonosobo Regency is dominated by slopes where 80% of the land is careened for more than 20 degrees. In this condition, it is challenging to find a workforce for farming activity, resulting in a high cost for any agricultural activities—one of the activities that need much labor is the weeding activity. The introduction of appropriate technology is required to support agriculture's sustainability which will efficiently reduce the production cost. This paper proposed an empowerment activity model for farmers in the slope area, which targeted two main goals: introducing the multifunction weeding tools to increase the rice weeding activity's efficiency and increasing the farmer group competency in the operational management of the agricultural machinery. The empowerment activity was incorporated with a farmer group called Tani Sejahtera in Rojoimo village, Wonosobo. This group has become a model for other farmer groups owning several agricultural machineries and a workshop to develop appropriate technology in their farming. The empowerment was done through (1) the accompaniment in the appropriate weeding tool's development from design to evaluation and (2) training for the farming group on the agricultural machinery's operational management. These empowerment activities affected the farmer group's independency accretion towards the appropriate technology development that is needed for the farming activities where the cost can be reduced, along with the farmer group's comprehension of agricultural machinery operational management is increased. This empowerment activity can be a model to escalate farmers' independence in sloping land regarding the development and operational management of the appropriate agricultural tools and machinery.

Keywords: Agricultural Practice, Appropriate Technology, Empowerment Model, Machinery Management, Sloping Land.

1 Introduction

Rojoimo village is one of the villages in Wonosobo Regency, Central Java. This region is known for its sloping land, which dominates the land up to 80% with an incline up to more than 20 degrees [1]. The farmers cultivating in this area use conventional methods with traditional tools. As standard agricultural machines' designs and characteristics are primarily suitable for agricultural activities in flat lands, commercial agricultural machinery introduction tends to take much work. This type of machine's usage will be inefficient in sloping land which the land area is typically non-flat and narrow [2]. The appropriate agricultural technology is then required to increase the cultivating activity's efficiency in the sloping land.

As the land has a significant sloping contour and small-sized, it is required to use machines that are lightweight, easy to handle, and are possibly turned over as minimum as possible [3]. Farmers need to move the machine from one location to another in the sloping contour land to the upper or lower position. Meanwhile, the heavy weighted machines will be difficult to use, contrasted with lightweight machines, as it will make the operation much easier and more efficient. In addition, farmers are required to make more turnover during operation in narrowed land, making it more non-productive—thus, inefficient and performing poorly.

Proceedings DOI: 10.21467/proceedings.151; Series: AIJR Proceedings; ISSN: 2582-3922; ISBN: 978-81-961472-6-6

Weeding, as one of the farming activities, requires a high number of laborers, especially in -sloping areas. Currently, the weeding activity in Rojoimo village is conducted in the traditional method—the farmer needs 30 people per 1 Ha land size for 8 working hours a day, which will be paid Rp50.000 each person [4]. That cost is considered a burden for farmers, especially on terraced land with sloping topography, as of most of Wonosobo Regency's agricultural lands. This is also the underlying reason why weeding activity becomes the dominant cost in the rice cultivation process, which then requires the development of appropriate rice weeding tools, especially for the sloping land, to reduce the cost and improve the rice production activity's efficiency.

This program proposed the empowerment model for the farmer group in Rojoimo village, Wonosobo Regency. This program was also incorporated with one of the farmer groups in Rojoimo village called Tani Sejahtera, which has become a home of around 102 mainly cultivating rice. Tani Sejahtera was chosen as the role model in Wonosobo since it has some superiority in agricultural application mechanization in farming activities. This farmer group even has its workshop regarding appropriate technology tools' production process for farming activity.

Another approach that can be used to enhance agricultural machinery operation's efficiency is through implementing the proper agricultural machinery management, selecting appropriate machinery capacity, designing machines properly, excellently using and maintaining machinery, and also determining machine operation's cost properly; that will lead to a better economic state of the agricultural machinery operation [5]. Proper operational management of the agricultural machinery is highly required, especially for its practice in sloping and narrowed land areas, resulting in agricultural machinery introduction will be succeeded.

This program proposes the empowerment model activity for the farmer group in the sloping area in terms of (a) developing the appropriate agricultural machinery for rice weeding activity and (b) enhancing the farmer group's capability through training related to agricultural machinery operational management. This program aims for the farmer group to develop their agricultural machinery needs for each farming activity and better comprehend the operational management concept for agricultural machinery, especially in the sloping area. Hence, this program may accelerate the agricultural machinery's introduction in sloping areas and simultaneously increase farming activities to improve farmers' welfare in sloping areas and/or regions.

2 Research Methodology

This program was conducted in Rojoimo village, Wonosobo Regency, Central Java Province (Figure 1), located nearly 88.1 km from Yogyakarta. The program was conducted jointly with the farmer group Tani Sejahtera which has 102 farmer members. The program's main goal was to introduce the multifunction rice weeding tool and to train the farmer group regarding agricultural machinery's operational management in the sloping area. This program was executed in June-October 2022.

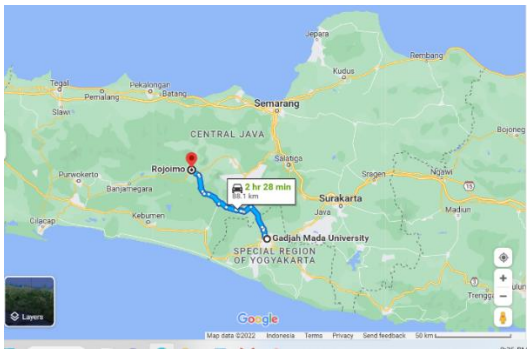
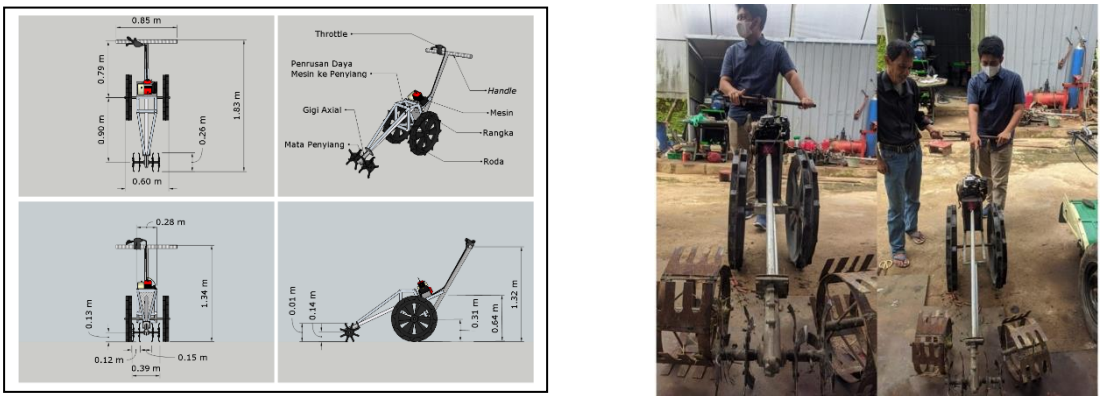


Figure 1: *Rojoimo Village, Wonosobo Regency, Central Java Province, Indonesia – depicted as the distance between the village and Yogyakarta*.

2.1 Development of Multifunction Rice Weeding Tools

Several activities were performed as introducing the multifunction rice weeding tool to the farmer group. These can be explained as follows. Firstly, the project team discussed with the farmer group Tani Sejahtera regarding agricultural activities done in the Rojoimo village (Figure 2). This discussion discussed the data regarding commodities, agricultural machinery and tools' usage, land size, expenditure on each farming activity, and understanding the agricultural machinery's operational management. Secondly, the project team introduced the rice weeding tools' design to the farmer group aiming to get responses from the farmers regarding potential developments of adding tools' function (Figure 3). Thirdly, the project team constructed the multifunction rice weeding tool at Tani Sejahtera's workshop. In this stage, as the group members, farmers were involved in designing, selecting the materials, and contributing to the construction itself. This gave farmers experience in developing the appropriate agricultural machinery. Fourthly, a machinery performance test was conducted on the farmer's land to see the machine's field capacity, estimate the machine's operational cost, functionally test different machine functions and turning angles, and test the machine's weight. Lastly, the project team and the farmers evaluated the design to obtain the machine's performance enhancement opportunity and estimate the machine's future challenges.

Figure 2. *Discussion with farmer group Tani Sejahtera members to identify the need for appropriate agricultural machinery specification*



(a) (b)

Figure 3. *Display of the rice weeding tools' original design to the farmers*

2.2 Training of the Agricultural Machinery Operational Management

Several activities were also conducted to enhance the Tani Sejahtera group members' comprehension of agricultural machinery operational management. Firstly, a discussion was conducted between the project team and the farmer group Tani Sejahtera members regarding the agricultural machinery operational

Proceedings DOI: 10.21467/proceedings.151
ISBN: 978-81-961472-6-6

Series: AIJR Proceedings
ISSN: 2582-3922

management's understanding (Figure 4). In this stage, numerous information was collected. Secondly, the training was held as conceptualized following the information collected. The training was then arranged in the Agricultural Extension Service, Department of Agriculture, and the Government of Wonosobo Regency meeting hall. This training involved the project team, Tani Sejahtera members, and the agriculture department staff.

Figure 4. *Discussion with Tani Sejahtera members to identify basic knowledge about the operational management of agricultural machinery.*

2.3 Empowerment Steps

In order to achieve the activity's empowerment goals, the program was performed as explained in Figure 5 below.

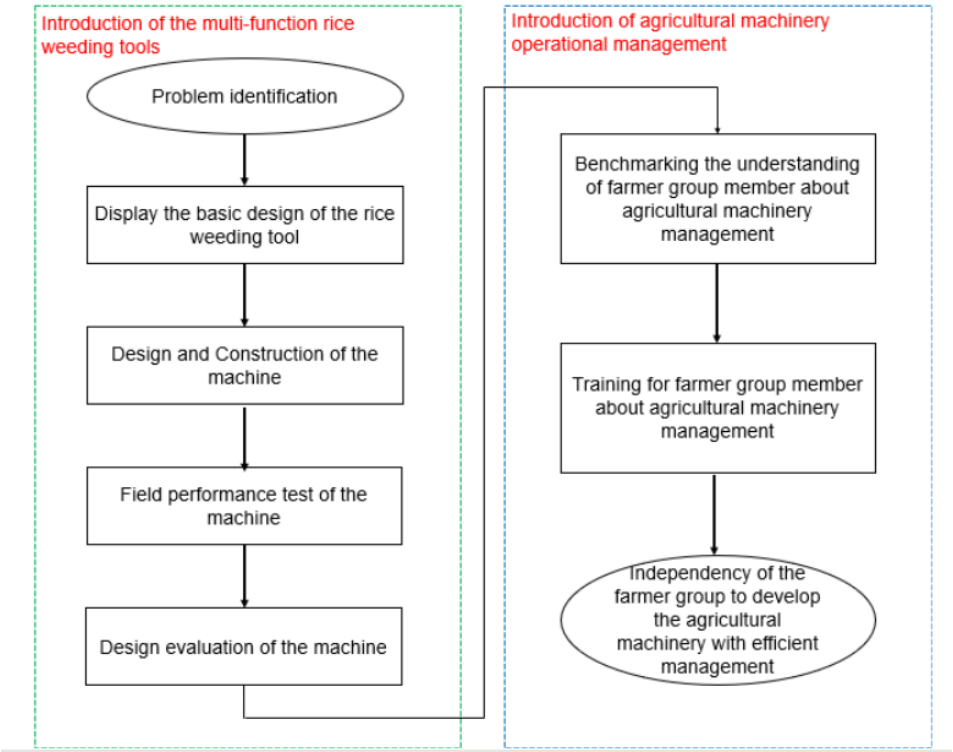


Figure 5. *Empowerment program's flowchart in Rojoimo Village, Wonosobo Regency, Central Java.*

2.4 Empowerment Goal Parameters

The program's purpose was for farmers in sloping areas to fully acknowledge the concept of developing the appropriate agricultural technology and implement the basic concept of agricultural machinery management. A qualitative questionnaire was used to measure the farmer group members' comprehension of the objectives.

3 Results and Discussion

3.1 Introduction of Multifunction Weeding Tools

The introduction of multifunction rice weeding tool aims to increase the weeding activity's efficiency and reduce the cost. Several activities have been done for farmers in sloping areas to fully acknowledge the concept of developing the appropriate rice-weeding tools as designed in sloping areas.

3.1.1 Problem Identification

Firstly, according to the identification process, most Tani Sejahtera members cultivate rice commodities. The farmers plant paddies in small-sized land of less than 1000 m2 for each land plot. Farming activities were conducted through conventional methods using a labor force. The weeding activity is the dominant cost of all farming activities. Farmers need a rice weeding tool that is easy to handle, lightweight, and has a slight turning angle as it is used in a sloping area and is small-sized. The tools should also be used multi-functionally, such as for rice weeding activity, homogenizing soil block materials, as they are also producing soil blocks for seeding media, and other activities on the farm or land. Farmers also confirmed that the current agricultural machinery management's implementation resulted in inefficient field machinery performance. The discussion also concluded that the rice weeding tool should be developed multi-functionally and is suitable for sloping areas (Figure 6).

Figure 6. *Discussion with Tani Sejahtera members about the farming activity*

3.1.2 Rice Weeding Tools Display

Following the previous step, the current rice weeding tool's design that has been developed is then displayed and discussed with Tani Sejahtera members (Figure 7). This activity aims to obtain farmers' impressions regarding the rice weeding tool's design and the demanded features to be added so that the tool can be used maximally. The functional test of the tool's weight and turning angles confirmed that the tool might be suitable for sloping and small-sized areas. The project team and Tani Sejahtera members also coincide with adding other features for the tool, especially for homogenizing soil block component materials.

Figure 7. *Displaying the current rice weeding tool design to the farmer group member*

Proceedings DOI: 10.21467/proceedings.151
ISBN: 978-81-961472-6-6

Series: AIJR Proceedings
ISSN: 2582-3922

3.1.3 Design and Construction of the Multifunction Rice Weeding Tool

The next step is to design and construct the new features for the rice weeding tool. The construction process has been done jointly with the project team in Tani Sejahtera's workshop. It is finished within two weeks and ready for the field performance test (Figure 8).

Figure 8. *Multifunction rice weeding tool with different features: (a) soil block material mix and (b) weeding activity*

3.1.4 Field Performance Test and Evaluation

According to the field performance test (Figure 9), it is revealed that the multifunction rice weeding tool is capable of being used in sloping and small-sized lands. The field performance test also confirmed that the tool could be used for rice weeding activity and material mixing processes. It is estimated that the proposed development may reduce the weeding cost by up to 40% as the tool has a capacity of up to 16 hours per hectare and can be operated by two operators per day with eight working hours each.

After the field performance test, the project team and Tani Sejahtera members concluded that the tools could be developed furthermore, such as adding other features to plant seeds and other purposes. This means that one tool can possibly be used for various activities simultaneously to maximize the tool's functionality and efficiency.

Figure 9. *The multifunction rice weeding tool's field performance test*

3.2 Training on the Operational Management of Agricultural Machinery

The discussion showed that the Tani Sejahtera members are acquired to attend the training session regarding agricultural machinery operational management with the topic related to (a) factors and strategies to improve agricultural activities; (b) methods to determine the economic machinery capacity and

operational cost; and (c) maintenance methods to improve the machinery's expiration date. The training was then arranged in the meeting hall of the Agricultural Extension Service, Department of Agriculture, the Government of Wonosobo Regency (Figure 10).

Figure 10. *Training on the operational management of agricultural machinery for the farmer group*

The discussion showed a significant increment in the group's comprehension regarding agricultural machinery management to manage the machinery more efficiently.

3.3 Empowerment Model of Farmer Group in Sloping Region

This program proposed the empowerment model for the farmer group in Wonosobo. The focus was to enhance the community's capacity to independently develop their agriculture machinery's needs based on their lands' characteristics. This program was also done to obtain the community's sustainable empowerment to enable them to solve their future problems. The training provided in this program aims to enhance the community's ability to manage its machinery and facilities to achieve more efficient results. Overall, this program has introduced the appropriate agricultural machinery for the sloping areas to increase agricultural efficiency to achieve sustainable agriculture in the region.

4 Conclusion

The empowerment model for Tani Sejahtera on the sloping areas has been executed. The accompaniment for this group on their development upon agriculture machinery needs and following the land's characteristics has been described. The results showed an increment in the farmers' comprehension of agriculture machinery management, improving the farmers' capacity for their agriculture machinery and facility management.

5 Declarations

5.1 Acknowledgments

This project was funded by the Directorate of Community Service Universitas Gadjah Mada through the Community Service Program based on the Utilization of Research Results and Appropriate Technology Application with contract No. 466/UN1/DPM/YANMAS/PM/2022.

5.2 Publisher's Note

AIJR remains neutral with regard to jurisdictional claims in published map and institutional affiliations.

How to Cite

Hajad *et al.* (2023). Introduction of Multifunction Weeding Tools to Increase the Efficiency of Rice Weeding Activity on Sloping Land to Farmer Group Tani Sejahtera, Rojomo Village, Wonosobo District, Central Java. *AIJR Proceedings*,206-213. https://doi.org/10.21467/proceedings.151.29

References

[1] BBP Mektan, Power Weeder Penyiang Padi Sawah Secara Mekanis. 2015. Accessed on March 2022, https://bbpadi.litbang.pertanian.go.id/index.php/info-berita/info-teknologi/powerweeder-penyiangan-padi-sawah-secara-mekanis.

[2] Badan Pusat Statistik, Hasil Survei Pertanian Antar Sensus (SUTAS) 2018 SERI A-2. 2019. Accessed on March 2022, https://www.bps.go.id/publication/2019/10/31/9567dfb39bd984aa45124b40/hasilsurvei-pertanian-antar-sensus--sutas--2018-seri-a2.html.

[3] R. A. Hegazy, I. A. Abdelmotaleb, Z. M. Imara, M. H. Okasha, "Development and Evaluation of Small-Scale Power Weeder," MISR Journal of Agricultural Engineering, vol. 31, no. 3, pp. 703-728. 2016. https://doi.org/10.21608/mjae.2014.98430.

[4] Y. B. Padole, "Performance Evaluation of Rotary Power Weeder," Agricultural Engineering Today, vol. 31, no. 3, pp. 21-33. 2007. https://www.indianjournals.com/ijor.aspx?target=ijor:aet&volume=31&issue=3and4&article=006.

[5] J. Pitoyo, "Mesin Penyiang Gulma Padi Sawah Bermotor: Balai Besar Pengembangan Mekanisasi Pertanian Situgadung Pagedangan Tangerang Banten," Tabloid Sinar Tani, pp. 25-27. 2006.