



Efficiency of weed with weeder machine in paddy field 3 rows

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Abstract

The objective of this research is to develop a machine to eliminate weeds in rice fields. and test the performance of a 3-row, 2-wheel-drive weed-killing machine in rice fields with a HINOTA EA65A engine of 5.6 hp as the engine. Tested at speeds of 1.7 and 2.3 km/h. Use an average working speed of 2.1 km/h. It has a theoretical capacity of 1.31 rai/h. Actual working ability 0.91 rai/h. Work efficiency was 69.85%, efficiency in eliminating weeds the dry weight of weeds before extermination was 0.18 kg, the dry weight of weeds after extermination was 0.05 kg, the efficiency in eliminating weeds was 69%, and the fuel consumption was 3.86 l/rai. A comparative study of prototype weed exterminators in rice fields. With the developed weed-killing machine in black rice fields, it was found that the prototype weed-killing machine in black rice fields has an average weed-killing efficiency of 66%. It can be seen that the developed weed-killing machine for rice fields has a speed of work, theoretical ability, and actual ability to work higher than the prototype black rice weed exterminator, and the efficiency of eliminating weeds is higher as well.

Keywords: Weed, Weeder blades, Weeder machine, Rows weeder

1. Introduction

Rice is an important economic crop for both domestic consumption and export to the world market. It is the most commonly grown plant in Thailand. There is a cultivated area of 62.310 million rai, a yield of 26.308 million tons, a yield per rai of 422 kg, an increase from 2023/24 with a cultivated area of 61.928 million rai, a yield of 25.569 million tons, a yield per rai of 413 kg, or an increase of 0.62, 2.89 and 2.18%, respectively [1]. In Surin province, there is a total rice cultivation area of 3,411,175 rai, yielding 1.4 million tons [2]. Rice farming is the main occupation of Thai people because Thailand has topography and weather conditions suitable for rice farming. more There was a lot of rain and continued for a long time. The area is a lowland area with standing water everywhere. For rice farming, 2 main factors are the basis of rice farming and determine the method of growing rice and the rice varieties that will be used in rice farming: 1. The area is characterized by high or low elevation and climate. 2. Conditions water for farming the normal annual rice farming season runs from May to July every year, depending on the amount of rainfall. After 3 months, the rice that was planted or sown will be fully ripe and ready for harvest. As for off-season rice, it can be done all year long. Because the rice varieties used for cultivation are varieties that are not sensitive to photoperiod. When the rice reaches maturity, it can be harvested. There are two methods of farming for farmers: sown rice farming and black rice cultivation. Sow rice farming involves planting rice by sowing seeds directly into fields that have already been prepared. This saves labor and time. But there are a lot of weed problems in the rice fields. Black rice cultivation involves growing rice by planting seeds to germinate and grow for a certain period of time and then transplanting them into the prepared area. Makes it possible to control weeds the problem of weeds in rice fields causes a lot of damage to farmers. This causes the yield to be less and also increases the production cost of eliminating weeds. Currently, farmers are being encouraged to cultivate black rice. To reduce weed problems in rice fields and machines have been used in rice cultivation for convenience and speed and to reduce labor shortages [3] from the problem of weeds in rice fields. Weeds, especially in black rice fields, are eliminated by uprooting them by manual labor. But there is a problem of labor shortage. and high wages Using chemicals to kill weeds also faces the problem of expensive chemical costs and problems with pollution and toxic residues from chemicals that affect people's health problems. Later, there were attempts to import rice field weed exterminators from abroad to sell and use in Thailand. But there is a problem with the conditions of the fields and rice that are different from the imported countries, making the use not as effective as it should be. And there has been an effort to develop a weed exterminator for use in the country. Both the pecking practice model and the rotary model, which can be used reasonably well but have problems with adjusting the working depth. This is

because each rice plot has different weed root depths, both due to soil conditions and weed varieties. And it can only work on one or two rows at a time.

This has been studied in many studies, such as development of Cost-Effective and Easily Replicable Robust Weeding Machine—Premiering Precision Agriculture in Pakistan [4]. Finite Element Simulation of Power Weeder Machine Frame [5]. Development of a mechanical weeder and experiment on the growth, yield, and quality of rice [6]. Key technologies of machine vision for weeding robots: A review and benchmark [7]. Evaluation of agronomic, technical, economic, and environmental issues by analytic hierarchy process for rice weeding machine [8]. Design of and Experiment on Reciprocating Inter-Row Weeding Machine for Strip-Seeded Rice [9]. Technical Aspects of Multipurpose Weed Cutter or Power Weeder [10]. Design and test of post-seat weeding machine for paddy [11]. Developed a weeding machine for rice fields. Self-propelled type [12]. Developed a 3-row weed exterminator in rice fields [13]. The weed exterminator is a one-wheeled type. Which can be used reasonably well but has problems with adjusting the working depth. This is because each rice plot has different weed root depths, both due to soil conditions and weed varieties. And it can only work on one or two rows at a time.

From such problems, the researcher therefore had an idea to create a 3-row, 2-wheel-drive weed-killing machine for rice fields, which has the following advantages: The depth of weeding can be adjusted evenly. and can work in 3 rows simultaneously, increasing work ability It is also used to eliminate weeds in rice fields instead of removing them and using chemicals. To reduce production costs in weed control not harmful to the environment and gives farmers the option to use weed killers. The objective of this research is to develop a machine to kill weeds in rice fields. and test the performance of a 3-row, 2-wheel drive weed killer in rice fields.

2. Materials and methods

2.1 Study and develop a machine to kill weeds in rice fields.

Study documents and textbooks on principles of mechanical design, design, study, and construction of weed exterminators in rice fields. The transmission system is designed to send power from the engine. The drive system is designed to transmit power from the engine to the propeller shaft. To drive the 3-row rice weed remover, the double-sharp blade transmission system receives power directly from the bevel gear with the shaft. Using a small 5.6 hp HINOTA EA65A engine as the source of power (Figure 1).

The researcher chose to use blades to eliminate weeds. "E Waek Khom Ku" (Figure 2), which received a national research award from the "11th National Crop Protection Exhibition" for its weed-killing blades Can eliminate weeds cleanly, quickly, and can get anywhere, whether it's close to the base or along sugar cane furrows, oily furrows, or garden furrows that have overgrown grass that doesn't look clean. Cutting is not left behind, leaving traces where weeds can easily grow. This is different from basic grass-cutting blades that leave traces of weeds up to 3 - 4 centimeters, allowing the weeds to photosynthesize and continue to grow [14].

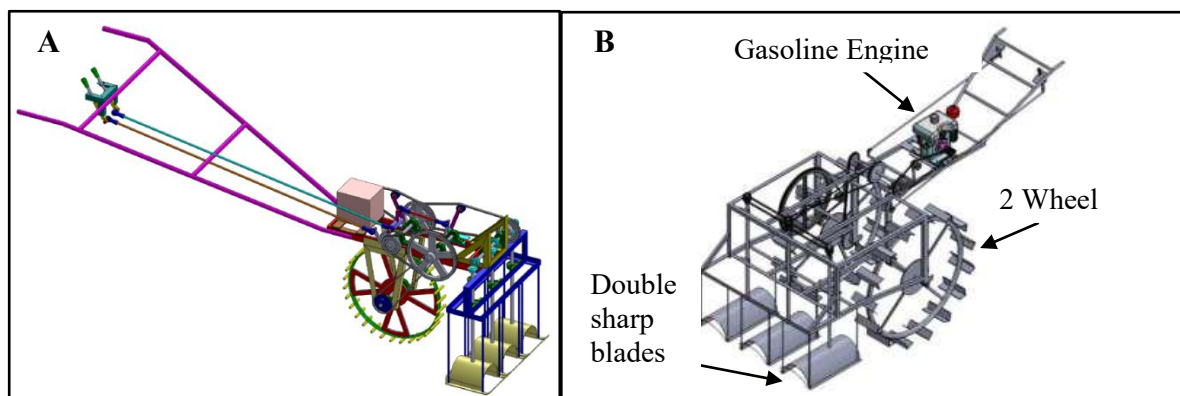


Figure 1 Design of weeder machine A) original, and B) development



Figure 2 weeder blades [14]

2.2 Methods for testing the performance of weed killers in rice fields

2.2.1 Measure the working area (A) and measure the width of the weed killer in the rice field, and test weed-killing machines in rice fields by measuring the total working time (T) in the area being tested and measuring work time and lost time of testing the weed killer in rice fields.

- 2.2.2 Randomly collect weed samples in the planting plots before and after testing. Randomly collected in an area of 1 square meter, 3 samples per weed plot in the black rice field. The weed samples collected were dried in an oven at 110°C for 24 h.
- 2.2.3 Randomly collect 3 soil samples in the plantation plot to find the percentage of soil moisture. Use a steel cylinder to randomly collect soil samples in the test plot. All soil samples were placed in an oven at 110°C for 24 h.
- 2.2.4 Find the amount of fuel consumption. This is due to the condition of soil moisture and the amount of weeds in the test plot. Affects fuel use by filling the engine tank with fuel until the tank is full. Then do the test. After testing in each plot is completed. Put the prepared fuel in a measuring cylinder. Fill the engine's fuel tank to find the amount of fuel used.
- 2.2.5 Analysis of test results.

- 1) Actual ability to work as in Equation (1)

$$C = \frac{A}{T_{th} + T_f} \quad (1)$$

With C is work capability (rai/h), A is work area (m²), T_{th} is theory work time (sec), and T_f is work lost time (sec) [15]

- 2) Efficiency as in Equation (2)

$$FE = \frac{C}{C_{th}} \times 100 = \frac{T_{th}}{T_{th} + T_f} \times 100 \quad (2)$$

With FE is work efficiency (%), C is work capability (rai/h), and C_{th} is theory work capability (rai/h) [15]

- 3) Fuel consumption rate as in equation (3)

$$Fc = \frac{L}{A} \quad (3)$$

With Fc is Consumption rate (L/rai), L is fuel used (liters), and A is work area (m²) [15]

3. Results and discussion

3.1 Results of the study and development of weed exterminators in rice fields

Results of the study and development of weed exterminators in rice fields the engine sends power to a 2-inch pulley, then to an 8-inch, 2-inch, and 12-inch pulley, respectively, and to a 15-tooth and 42-tooth gear to drive the wheels. The blade part uses an engine to transmit power from a 2-inch flywheel to a 7-inch, 5-inch, and 4-inch flywheel to make the blade rotate, thus creating a weed-killing machine in rice fields (Figure 3).



Figure 3 Weeder machine in paddy field 3 rows

3.2 Results of testing the performance of the weed exterminator in rice fields.

The results of the study show the performance of weeder machines that were developed for weed control machines in rice fields. Effective in eliminating weeds. It has an efficiency in eliminating weeds of 69% and when compared with the weed-killing machine in the prototype rice field. Weed-killing machine in the prototype rice field. It has an average weed-killing efficiency of 66%, which can be seen as the developed weed-killing machine for rice fields. There is a speed of work: theoretical ability and actual ability to work Higher than the prototype black rice weed exterminator. And the efficiency of eliminating weeds is higher as well (as shown in Table 1 – 3 and Figure 4). It is more efficient than the 3-row weed killer in black rice fields (gear type) that has an actual working capacity of 1.11 rai/h. Efficiency in eliminating weeds is 42.85% and a 3-row black rice weed killer (belt type) [12]. And the study of similar research on weed control, it was found that an actual working capacity of 0.73 rai/h. Theoretical working capacity is 0.89 rai/h Efficiency in eliminating weeds was 32.02%[13].

However, the weed-killing machine developed for black rice has limitations in that it is suitable for use on flat ground. Because if the area is very rough or the mud is deep It will cause the machine to not work fully. The plant eliminator is suitable for eliminating weeds in black rice fields when the rice plants are 2 months old. If the rice plants are older than that, it will be more difficult to get rid of weeds. and will cause the rice plants to break.

Table 1 Result of performance of weeder machine

Field	Drive speed (km/h)	Theoretical capacity (rai/h)	Effective field capacity (rai/h)	Effective (%)
1	1.7	1.12	0.83	74.10
2	2.3	1.41	0.96	68.08
3	2.3	1.41	0.95	67.37
Average	2.1	1.31	0.91	69.85

Table 2 Effective of weeder machine

Field	Weight of before weeder (kg)	Weight of after weeder (kg)	Effective (%)	Oil consumption rate (L/rai)
1	0.30	0.09	70	4.25
2	0.10	0.03	75	3.67
3	0.15	0.06	63	3.67
Average	0.18	0.05	69	3.86

Table 3 Effective of weeder machine between original and development

Field	Original (%)	Development (%)
1	68	70
2	75	75
3	55	63
Average	66	69

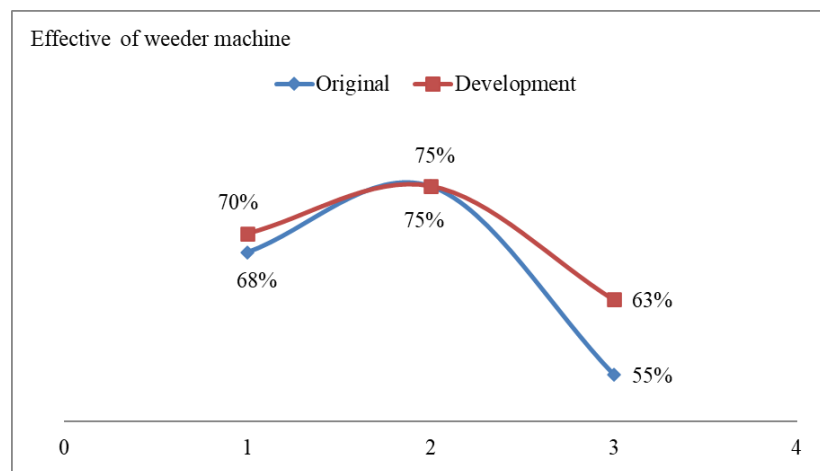


Figure 4 The comparison of the efficiency of the weeder machine between the original and development

4. Conclusions

A machine for eliminating weeds in rice fields that has been developed Use the engine as the source of power. to drive the wheels to turn and use a 3-row blade to remove weeds in the rice fields, with a 2-wheel drive feature, using an average working speed of 2.1 km/h. It has a theoretical capacity of 1.31 rai/h. Actual working ability 0.91 rai/h. Work efficiency was 69.85%, efficiency in eliminating weeds the dry weight of weeds before extermination was 0.18 kg, the dry weight of weeds after extermination was 0.05 kg, the efficiency in eliminating weeds was 69%, and the fuel consumption was 3.86 l/rai. The weed exterminator in rice fields is suitable for flat ground. Because if the area is very rough or the mud is deep It will cause the machine to not work fully. The plant eliminator is suitable for eliminating weeds in black rice fields when the rice plants are 2 months old. If the rice plants are older than that, it will be more difficult to get rid of weeds. and will cause the rice plants to break.

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