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ANALYSIS OF WORKING CAPACITY AND FUEL CONSUMPTION OF HAND TRACTOR ON DRY LAND IN NAGARI TANJUNG BONAI LINTAU BUO UTARA TANAH DATAR

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ABSTRACT

Hand tractors are very useful in the territory of Indonesia which was famous as an agrarian country. Its location on the equator lane brings its own advantages for soil conditions in Indonesia. Land in Indonesia can be processed into agricultural land so that agriculture can become the main livelihood of Indonesian people in general, especially in Nagari Tanjung Bonai Kabupaten Tanah Datar . Nagari Tanjung Bonai was one of the areas of horticultural crop development, where people really need a tool to cultivate the land. However, cultivating the soil in farming manually will be more difficult for farmers. For that, farmers need a tool or machine to facilitate their work in cultivating their plantation land. One of them was by using hand tractors. The results of soil treatment using hand tractors are influenced by the depth of tillage and the speed of the tractor works, while the depth of tillage and the speed of work will affect the working capacity and fuel requirements. The purpose of thwas research was to calculate the amount of fuel requirement and the working capacity of hand tractor with the ground tool of steel claw plow with variation of soil preparation, depth of tillage and speed of work. The soil cultivation pattern was carried out by varying the back and forth pattern and the pattern of traveling. Research method used was Randomized Complete Block Design (RCB) with factorial arrangement. The first factor was the depth of the plow conswasting of 2 levels of treatment that were: 20cm and 30 cm plow depths. The second factor was the speed of the tractor conswasting of the gear speeds of 0,25 m/sec and 0,5 m/sec. The parameters measured were the fuel consumption and hand tractor working capacity for each pattern of soil treatment. The results showed that the average fuel requirement at 20-30 cm depth of tillage and the working speed of V1 on the alternating pattern was 1,35 L/hour, in the circular pattern 0,99 L/hour and at velocity V2 on the alternating pattern was 1,48 L/hour and the circular pattern was 1,35 L/hour. The average working capacity at 20-30 depth with velocity V1 in the alternating pattern was 10,65 hour/ha and the circular pattern was about 7,65 hour/ha, and at velocity V2 the alternating pattern was 9,85 hour/ha and the circular pattern was 5,5 hours/ha

Keywords : Working Capacity, Fuel Consumption, Pattern of Soil Preparation.

I. INTRODUCTION

In Indonesia, horticulture cultivation was still done conventionally using human (manual). Therefore, the use of soil-preparation machines was very important to increase production. Thwas was caused by the lack of knowledge of the farmers on technological developments that make more prioritize the preparation of land manually (Haerani, 2001).

Hand tractor was the equipment used by human, working system that was needed by hand tractor impulse, and of course using human. Handtractor serves to cultivate the soil, has a high efficiency because the reversal and cutting the soil can be done at the same time. Thwas two-wheeled tractor was a versatile tractor because it can serve as a driving force for other tools such as water pumps, processors, trailers and others (Sutrwaso, 1999).

Agricultural tractors are now an integral component of agricultural and rural development. Residents have benefited from the use of tractors to do land-grinding work quickly and many have switched to picking tractors rather than using animals or muscle power for the same job. Thwas was because they can compare that it turns out to be treating the soil with a tractor more profitable than any other way. The same thing was done by the farmer community of Tanjung Modang Nagari Tanjung Bonai Kecamatan Lintau Buo Utara Kabupaten Tanah Datar. Farming communities have very large antuasias with the use of hand tractors, especially for dry land. When

viewed in terms of economic use of hand tractors compared with human labor was very more efficient, can produce greater capacity and fewer working hours.

The pattern of tillage using a hand tractor was closely related to the time lost due to bends during tillage. Based on thwas the pattern of preparation should be determined to minimize turning time because at the time the tool was not working. In order to see the efficiency of hand tractor usage, it was necessary to test the hand tractor of steel claw hand tract with some soil preparation pattern so it was expected to produce the best alternative soil farming pattern to help farmers to increase production, farmer income and reduce production cost and improve farmer's welfare.

The principle of construction of thwas small tractor conswasts of: drivingforce motor drive, landing chaswas and body, power successor components, tires wheels, implements soil preparation equipment. As for the preparation in the use of hand tractors before operation so that thwas tractor can work smoothly and economically, that was to prepare the clothes of the operator, conduct inspection, check the clutch, the tractor must walk straight, check the tire pressure, check the parts that need to be lubricated (Hardjosentono, 2002).

Soil preparation was the hardest part of the entire cultivation process, where it consumes about one-third of all the energy required in agricultural cultivation. How to cultivate the land will affect the results of preparation and energy consumption (Mundjono, 1989).

Mardinata and Zulkifli (2014), Patterns of soil preparation are closely related to time lost due to bends during tillage. The pattern of treatment should be chosen in order to minimize as much as possible the removal of the apparatus to reduce as much of the time as possible because at the time of removal the device does not work. Therefore it should be cultivated plow or rake keep working during the operating time in the field. The more app removal at turns, the lower the efficiency of the work.

The speed of vehicles and fuel consumption has a strong relationship. The faster the tractor goes, the more fuel consumption will increase. High speed tractor because pwaston burn more fuel. The more fuel that was burned the more banyk power generated so that the faster the vehicle moves.

II. MATERIALS AND METHODS

The experiment was conducted by using factorial randomized block design (RAK) on the land with the pattern of back and forth back and forth. The research was conducted in the farmer's group Sago Lestari Jorong Tanjung Modang Nagari Tanjung Bonai Kecamatan Lintau Buo Utara Tanah Kabuapten Tanah Datar June 2017. Research using a Quick hand tractor with a steel claw tillage tool. The size of the land plot used was 20 x 20 m. The first factor was into the plow (D) conswasting of two (2) levels of treatment that was within 20 cm and a depth of 30 cm. The second factor was the speed of the tractor (V) conswasting of velocity 1 ie gear 1 (0,25 m/sec) and velocity 2 using 2 gear (0,5 m/sec).

Research procedure: before the tractor engine was turned on it was ensured that all supporting equipment or tractor components are fitted perfectly. The fuel tank was fully charged before the tractor was run. The cultivation of the land begins with a velocity of V1 and a velocity of V2 at a depth of 20 cm, 30 cm for a pattern of back and forth arranging the field. After completing the preparation of one tractor machine the hand was turned off then the fuel tank was fully charged and record how much fuel was added to the tank. The land treatment was done 3 replications for each treatment and land treatment pattern.

Calculation of fuel consumption and working capacity can be used the following formula:

$$\text{Fuel Consumption (l / hour)} = \frac{\text{Added Volume}}{\text{Working time}} \quad (1)$$

$$\text{Working Capacity (hour / ha)} = \frac{\text{Working time}}{\text{Land area}} \quad (2)$$

III. RESULTS AND DISCUSSION

Observation of the results of research with the pattern of land preparation back and forth tightly and around as shown in Table 1.

Table 1. Result of Observation of Fuel Consumption and Working Capacity

Treatment	Depth	Speed	Parameter			
			Pattern Back and Forth		Pattern Around	
			KBBM (l/hour)	KK (hour /Ha)	KBBM (l/ hour)	KK (hour /Ha)
20 cm	V1 (0,25m/sec)		1,27	9,4	0,94	7,2
	V2 (0,5 m/sec)		1,43	9,2	1,30	4,9
30 cm	V1 (0,25 m/sec)		1,43	11,9	1,05	8,1
	V2 (0,5 m/sec)		1,53	10,5	1,40	6,1

Seen in Table 1, the highest fuel consumption was at a velocity of V2 at a depth of 30 that was 1,53 l / h on a pattern of back and forth groundwater treatment. The lowest consumption was seen at a depth of 20 cm, velocity V1 in the pattern around 0,94 l / h. The highest work capacity was seen at 4,9 hours/ha on the inside of 20 cm in the circular pattern.

Mardinata and Zufkifli (2014), in the use of hand tractors fuel consumption factors and work capacity are the main factors seen in tractor selection. Tractors that consume small fuel for the same mileage are the options to be achieved. Meanwhile, for the work capacity of tractor with the largest working capacity becomes the choice.

The results show that the fuel consumption in the surrounding pattern was smaller than the fuel consumption of the back and forth pattern. The depth of tillage also gives more influence in tillage also requires greater fuel. For work capacity using velocity V2 indicates higher capacity than velocity V1 and depth factor also affect work capacity, the deeper the tillage the smaller work capacity.

A. Fuel Consumption (L/Hour)

The results show the fuel consumption on soil tillage and different depth as shown in Table 2.

Table 2. Result of Fuel Consumption Analysis

Soil Preparation Pattern	Depth	Speed		Average
		V1 (0,25m/sec)	V2 (0,5 m/sec)	
Pattern Back and Forth	20 cm	1,27	1,43	1,34
	30 cm	1,43	1,53	1,48
	Average	1,35	1,48	1,41
Pattern Around	20	0,94	1,3	1,12
	30	1,05	1,4	1,23
	Average	0,99	1,35	1,18

The average fuel consumption based on the speed of the tractor was found that the highest fuel consumption was at the speed of tractor 2 and the alternating treatment pattern was 1,48 l/hour. While the average consumption of the lowest fuel was at the speed to 1 that was 0,99 l/hour in the preparation of land pattern. The average consumption of fuel based on the depth of soil preparation found the highest fuel consumption was at a depth of 30 cm that was 1,48 l/hour on the preparation of land back and forth meetings. While the average consumption of the lowest fuel was obtained on soil preparation around 20 cm depth of 1,12 l/hour.

Djoyowasito (2002), the deeper the depth of the soil the speed of work was lower. Thwas phenomenon occurs because the wheel slip was very high at the time the tool works and also the number of weeds that are cut off and chunks of large-scale soil, so that the time to travel the dwastance determined to be long.

Tractor fuel consumption will be greater if the penetration of the soil was greater. Penetration of land will be greater if the depth of the soil deepens. The deeper the tillage the slower the tractor will run because the required tractor power will be greater. As a result the greater the power required to move the tractor. Tractor power was generated from rotation of pwaston in cylinder. The more cylinder pwaston rotation, the more fuel will be spent. The results also show the longer the length of tractor dwastance.

Yuswar (2004), speed was one method to increase the work capacity of agricultural equipment that was by increasing the speed of the tractor means to increase the working capacity of the soil preparation equipment without having to increase the weight and the number of propulsion units that burden the soil.

The results of thwas study showed the higher the speed of the tractor the more fuel needed and the more deeply preparation the soil also the fuel needs. According to Pramuhadi (2004), the addition of tractor power requires greater combustion so that the tractor fuel consumption was also greater than that the penetration of soil penetration also affect the fuel consumption.

B. Working Capacity (Hour/Ha)

The results show the working capacity of the soil preparation for alternating velocities and the circular pattern as shown in Table 3.

Table 3. Results of Work Capacity Analysis (Hour/Ha)

Soil Preparation Pattern	Depth	Speed		Average
		V1 (0,25m/sec)	V2 (0,5 m/sec)	
Pattern Back and Forth	20 cm	9,4	9,2	9,3
	30 cm	11,9	10,5	11,2
	Average	10,65	9,85	10,25
Pattern Around	20	7,2	4,9	6,05
	30	8,1	6,1	7,1
	Average	7,65	5,5	6,58

The capacity of the average hand tractor work based on the speed of the tractor was found that the highest working capacity was at the speed of the tractor 2 and the circular of 5,5 hours/ha. Meanwhile, the lowest average hand tractor work capacity was at the 1st speed of 10,65 hours / ha on the backyard pattern preparation. The average hand tractor work capacity based on the depth of soil preparation found the highest working capacity was at a depth of 30 cm ie 6,58 hours / ha on the preparation of ground around. Meanwhile, the lowest average hand tractor work capacity of the fuel was found on alternating soil treatment at 30 cm depth at 11,2 hours / ha.

The average work capacity of tillage speed treatment has an effect on the work capacity. The faster the tractor works the greater the work capacity of the tractor. Rizaldi menurut (2006) work capacity of a preparation equipment was influenced by several factors, namely: 1) size and shape map; 2) topographic area; 3) the state of the tractor; 4) the state of vegetation at the soil surface; 5) soil condition; 6) operator skill level; And 7) land treatment pattern.

The soil treatment pattern will affect the working capacity of the tractor used. The soil tilling pattern gives the best capacity because at the time of operation with the alternating pattern it will take time to turn so that the work capacity will be smaller. Thwas was in accordance with the statement (Suastawa et al, 2000) the pattern of soil preparation was closely related to the time lost due to curves during the preparation of the soil. The pattern of treatment should be chosen in order to minimize as much as possible the removal of the apparatus, since at the time of removal the device does not work, the more the apparatus was removed at turn time, the lower the working efficiency. The results showed that the difference in speed and depth of soil preparation gave effect to the fuel consumption and the working capacity of the tractor during the preparation of the soil.

IV. CONCLUSION

A. Conclusion

1. The average fuel requirement at a tillage depth of 20-30 cm and at the working velocity of V1, for the alternating pattern was 1,35 L/hour, and for the circular pattern was 0,99 L/hour. At the working velocity of V2, for the alternating pattern fuel requirement was 1.48 L/hour and for the circular pattern fuel requirement was 1,35 L/ hour.
2. The average working capacity at a tillage depth of 20-30cm, at the working velocity of V1, for alternating pattern was 10,65 hours /ha and for the circular pattern was 7,65 hours /ha. At the working velocity of V2, for the alternating pattern working capacity was 9,85 hours /ha and for circular pattern working capacity was 5,5 hour/ha.
3. Based on the efficiency of fuel consumption and working capacity, the circular pattern was the best soil tilling method.

B. Suggestion

In the preparation of land by hand tractor using a circular pattern of traveling around with a speed tractor V2 with a depth of 20 cm.

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