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Mini Hand Tractor Model Design Petrol Motor Drive

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Abstract:
A hand tractor is a machine-powered agricultural implement that may be used for land/land processing. Tillage operations may be sped up and made easier with tractors. The hand tractors that are now on the market are usually too big to operate on terraced or narrow terrain, where there isn't enough flat land for rice fields. To combat this, farmers must be provided with instruments that are straightforward, inexpensive, and effective methods of working in accordance with their demands and the state of the rice fields, where there are still several processes. The axle will be directly coupled to the model of the teeth to shred the soil to be plowed instead of using wheels in this revolutionary hand tractor's design idea. The 2 HP gasoline engine that will power this hand tractor is envisioned. The gasoline engine will switch on and create power when the ignition lever is pushed tightly. This power will then be directed to the gearbox, which transforms into the wheel axle or plow blade that will move the tractor. To use the tool, start the tractor's engine when it is already positioned above the soil to be plowed. Next, run the tractor slowly while turning it to equally plow the soil. Finally, carefully stop the tractor and switch off the tractor engine. The calculation showed that the productivity of manual plowing (PI) was 54.213.09 and that the productivity of manual plowing with a small tractor machine (PII) was 133.691.49 and increased by 146.61%.

Key Word*: mini hand tractor, ergonomic, work productivity*

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I. Introduction

Using hand tractors makes the process of plowing rice fields faster and uses less energy, but they are still rather expensive, costing anywhere from 5 to 15 million. Using agricultural equipment and tools, such as tractors for tillage, is necessary to boost farming productivity[1], [2].One example of how technology is being used in agriculture to solve issues, particularly those that are labor and time-related, is the hand tractor. A technology appropriateness foundation or a selective agricultural mechanization system can be used to maximize the utilization of hand tractors.

Farmers must be provided with tools that are easy to use, inexpensive, and effective ways to operate in accordance with their demands and the state of the rice fields, where there are still several stages, in order to solve these issues. Hand tractors with iron wheels and power ranging from 6 to 10 HP are excellent for cultivating dry rice fields or plantations, as illustrated in Figure 1.1. Because it can simultaneously spin and cut the dirt, this equipment has a high efficiency[3], [4]. This tractor is used for a variety of tasks, but land cultivation is the most frequent one since it is an agricultural task that demands more power than other tasks do. Accordingly, a hand tractor model with a straightforward design, an affordable price, and minimal maintenance expenses was created. The axle will be directly coupled to the model of the teeth to shred the soil to be plowed instead of using wheels in this revolutionary hand tractor's design idea. It is intended to utilize a gasoline engine with a 2 HP capacity for this hand tractor.

The gasoline engine will switch on and create power when the ignition lever is pushed tightly. This power will then be directed to the gearbox, which transforms into the wheel axle or plow blade that will move the tractor. To use the tool, switch on the driving device when the tractor is already positioned above the ground to be plowed. Next, run the tractor slowly while turning it to uniformly plow the field. Finally, gently come to a halt and turn off the tractor's engine.

II. Material And Methods

2.1 Research Design

This research is a one-short case study with a pre and post-test design group which was conducted observationally on the working process [5]. Chart can be described as follows:

Figure1. Research Design

Information:
R = Random sample.
P0= the result of the pretest experimental unit.
PI = the result of the posttest experimental unit.

2.2 Research Variable

The variables to be measured in this study include: (1). workload as measured by pulse of rice before and after work; (2) complaints of fatigue and skeletal muscles before and after work; (3) work productivity after work by comparing work pulse (beats per minute) with the number of products produced (kg) during working time (minutes). The measurement of variables number (1) to number (3) is the information data of the initial condition and the final condition which is then compared to determine the comparison before using mini hand tractor model design petrol motor drive.

2.3 Data Analysis

The data from the test results using Hand Tractor was calculated based on the volume of cutting results, length of work, fatigue complaints and work productivity analyzed by the t-paired test which will then be analyzed descriptively to obtain conclusions.

III. Results And Dicussion

3.1Product

The gear box is rotated with the aid of bearings found on the left and right sides of the tractor wheel, and the wheel is replaced with moving blades to dredge the soil. The operation of a mini hand tractor powered by a 2 Horsepower gasoline motor begins with the gasoline motor lever being pulled as quickly as possible until it comes to life.

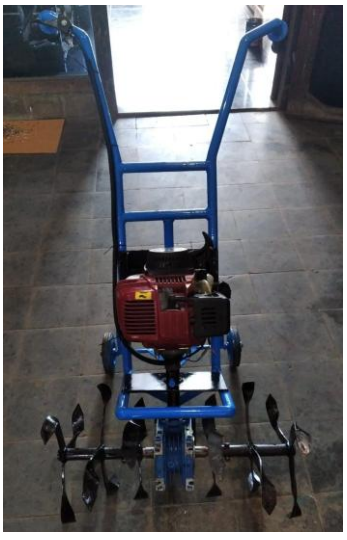

Figure 1. Hand Tractor Design

3.2 The Result of Ergonomics Test Using Hand Tractor

3.3.2 Subjective Complaint

A Nordic Body Map (NBM) questionnaire was used to assess the subject's musculoskeletal problems both before and after job activities. The questionnaire's reliability received a Cronbach's Alpha score of = 0.755, while the validity of the questionnaire yielded data demonstrating that all items are valid (r count > r table),

where the table r at = 5% is 0.458 or significance 0.05. (above 0.6). As a result, the questionnaire is trustworthy and valid.

The average score for the measuring of musculoskeletal problems in the manual plowing work process (PI) was 28.16 0.69 before work and grew to 41.34 3.98 after work or saw an increase of 13.18 3.42. According to measurements made during the plowing process using a micro tractor machine (PII), the average score of musculoskeletal complaints was 30.62 (0.90) before work and climbed to 37.31 (3.08), or by 6.54 (1.72), after work.

3.3.2Work Load

Based on a comparison of the result (output) and the input (input) at a certain time unit, the work productivity of the subjects in the hand tractor process was recorded. The entire area plowed by farmers while they were working was the output, and the farmers' working hours were the input. The calculation showed that the productivity of manual plowing (PI) was 54.213.09 and that the productivity of manual plowing with a small tractor machine (PII) was 133.691.49 and increased by 146.61%. A decrease in workload, lessened weariness and musculoskeletal problems, as well as an increase in the area of plow yields, were all contributing factors to this rise in output. Kimberly [6] asserts that altering the work system is required to boost output since it will shorten working hours and enhance output by reducing worker tiredness. According to Torik, et al.[7]the design of an ergonomic work system can lessen worker weariness. This boost in productivity is the result of a lighter workload and an ergonomic work position that lessens tiredness and musculoskeletal problems while increasing output. Altering the work system is required to boost output since it will shorten working hours and enhance output by reducing worker tiredness. The design of an ergonomic work system can lessen worker weariness[8], [9].

Ergonomics researchers frequently advocate ergonomic interventions to boost production, as seen in Priambadi's[10] and Bawa Susana's [11] studies. For example, changing working conditions for gamelan artisans who scald instruments can boost output by 26.67% and 54.88%, respectively. According to Setiawan's [12] research, work station design can boost productivity by 20.29%. According to Tarwaka[13] fatigue is a body's protective mechanism so that the body avoids further damage so that recovery occurs after rest.

Adiputra, N. [14] said that through ergonomic intervention in small-scale industries using ergonomic work equipment will reduce workload and subjective complaints significantly thereby increasing productivity. Pascale C, and Shawna [15] stated that the discipline of human factors and ergonomics (HFE) can provide approaches and methods to research and overcome these challenges during systematic manners. Ergonomics systems approach to explain some work system barriers and facilitators experienced by healthcare workers [16]

By designing the assembly process can save the necessity for raw materials and processes, in order that overall costs are often saved within the manufacturing industry [17]. Increased pulse at work and complaints after work cause work productivity to be low[18]. Work posture that's not physiological are often caused by the characteristics of task demands, work tools, work stations, and work Posture that are incompatible with the skills and limitations of workers [8], [18]. Non-physiological work posture that's administered for years can cause bone deformities in workers [8]and couse subjective disorder of workers [19], [20].

IV. Conclusions

Based on the discussion that has been carried out, the following conclusions can be:

1. The workload of workers is reduced by 48% when the Mini Hand Tractor Model for Petrol Motor Drive is used in the plowing operation. In the P0 study (manual plowing), the average working pulse of the workers was 93.13 bpm, which included the light workload category (pulse 75-100), whereas in the P1 study (plowing with a mini tractor machine), the average working pulse of the workers obtained the average pulse rate work of 73.95 bpm, which included the very light workload category.
2. The findings of the manual plowing process's measurement of musculoskeletal complaints (PI) showed that the average score was 28.16 0.69 before work and grew to 41.34 3.98 (or saw an increase of 13.18 3.42 points) after labor. According to measurements made during the plowing process using a micro tractor machine (PII), the average score of musculoskeletal complaints was 30.62 (0.90) before work and climbed to 37.31 (3.08), or by 6.54 (1.72), after work.
3. Before manual plowing, the average score of fatigue complaints (PI) was 30.80 (1.40), and it climbed to 39.10 (3.06) after labor, or a score rise of 8.29 (3.19). Prior to working on the small tractor machine's plowing operation, the average score of tiredness complaints was 30.95 (1.08) and increased to 36.10 (2.06) after work, representing an increase in score of 5.7 (0.99).
4. The calculations show an increase of 146.61% between the manual plowing work productivity (PI) of 54.213.09 and the plowing work productivity (PII) of 133.691.49 when utilizing a small tractor machine.

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