SSRG International Journal of Industrial Engineering
ISSN: 2349 – 9362 /doi:10.14445/23499362/IJIE-V8I1P104
Volume 8 Issue 1, 21-27, Jan-Apr 2021
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Fabrication and Performance Evaluation of Farmer Friendly Electric Weeder

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Abstract *- The main intention of this project is to provide and implementing electric & mechanical technology to obtain the maximum yield to farmers, and also to provide a costless operation than conventional type weeding process. It's easy to operate in between the small crop rows . This Effective weeding mechanism has capable of uprooting, bury and cut weeds at different times. The working diameter of the weeding mechanism is suitable to operate within 30cm to 45cm crop rows. By implementing 'C' type rotor blades , It has good weeding efficiency, and less crop damage than comparing to other type blades.*

KEYWORDS: *electric weeder, working diameter, type of blade*

INTRODUCTION

The Agriculture is the backbone of our country, and also we are the second largest country producer of agricultural products. Nowadays, the Automobile sector has moved on to electrical vehicles to reduce emission levels and to attain an eco-friendly environment .

OBJECTIVES

- The main motto of our project is to reduce the Emission, Increase weeding efficiency and Reduce the cost of operation in the weeding process to the farmer by using electrical and mechanical technology to overcome the conventional fuel type weeder.
- In the present situation, the worker cost is high although there is insufficient of workers to work agriculture field .
- Most of the farmers in India are using hand weeders for removing the weed from the field because they cannot be able to buy expensive tools or machines.

For that, we have done an electrically powered motor weeder machine to overcome the above problems . It's a farmer-friendly machine because it required less manpower to operate the machine, it reduces emission and less operating cost.

LITERATURE SURVEY

The following literature is based on the research papers published in various national and international journals, books, and review articles :

A. Z.M.Imara **:** the project on the development of a power weeder for mechanical control of weeds in the rice field .If the help of a two-stroke engine 2hp/6500rpm, the machine performance was 15 hours/ha capacity at a traveling speed 1.8km/hr. The mass of the machine was 24.5kg . It has a two sets of blades; each set has 4 blades on L shape in the vertical axis. (1)

B. Mukesh k singh : The project has done the manual operated weeder need use of muscles power for it push-pull operation; thus an attempt was made to utilize the electrical power Through battery for developing a four-wheel weeder that will share the major workload of operated for providing easy in operation. Rear wheels should be larger than the front wheel for obtaining better traction . The machine is operated by workers in pushing mode of operation walk-behind type . (2)

C. Md.aqib naque et al **:** The soil tiller and weeder is one of the main farms of mechanization in promoting soil tiller and weeder especially considering the fact that the majority of the farmers having small land. It was reducing the human effect . The semi-automatic machine is developed to reduce the time and effect required for production up to a great extent; also, the machine manufacturing cost is less as compared to others. (3)

The main aim of this review paper is to have a proper understanding of different aspects or constraints of weeders.

WEED CONTROL

Weed control is one of the main and most difficult tasks in agriculture that accounts for a considerable share of the cost involved in agriculture production. Farmers

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generally expressed their concern for the effective weed control measure to arrest the growth and propagation of weeds .

In ancient days , weed control in agricultural practices have been carried out by smallholders cultivating between 2 to 3 hectare , by using human-powered tools such as a hoe, wheel hoe, frame weeder, etc.,

In Indian agriculture, it is a very difficult task to weed out unwanted plants manually as well as using bullock-operated equipment, which may be further lead to damage to many crops. More than 33% of the cost incurred in cultivation diverted to weeding operations, thereby reducing the profit share of farmers.

WEEDING METHOD

We have chosen the mechanical method as the best way because the Biological method takes more time duration and it needs huge manpower for the weeding , It's not suitable for all farmers, and the chemical method of weeding is an easy process, but it affects the soil properties, and nowadays peoples are looking for good food without any side effects. Finally, the mechanical weeding has been conducted on economical method s for weed removal without damaging the crops.

Weeding Machines designed and developed with the intent of being operated in specific crops row gap between 30cm to 45cm like Maize, Tomatoes, Groundnut These machines are mostly intra row weeding machines which remove weeds within multiple crop rows at once.

AGRICULTURAL BENEFITS

Motorized agriculture weeding machine not only uproots the weeds between the crops rows but also keeps the soil surface loose, ensuring better soil aeration and water intake capacity. Weeding by motorized Weeder reduces the cost of labor and also saves time.

COMPONENTS

Battery

Fig : 1 Battery (Lead acid)

The lead–acid battery was invented in 1859 by French physicist Gaston Planté and is the earliest type of rechargeable battery. Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio.

These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by starter motors. Lead–acid battery As they are inexpensive compared to newer technologies, lead–acid batteries are widely used even when surge current is not important, and other designs could provide higher energy densities45% of the value from batteries sold worldwide

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MCB Switch

Fig : 2 MCB switch

a switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another. The most common type of switch is an electromechanical device consisting of one or more sets of movable electrical contacts connected to external circuits.

When a pair of contacts are touching, a current can pass between them, while when the contacts are separated, no current can flow.

Dc to Dc Booster

Fig : 3 Dc to Dc Booster

A boost converter (step-up converter) is a DC-to-DC power converter that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element: a capacitor, inductor, or the two in combination.

DC Motor

Fig :4 DC Motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in a part of the motor.

Power Transmitting mechanism

Fig : 5 chain sprocket

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotates once, it causes the gear that drives the wheels to rotate more than one revolution. Duplex chains are another type of chain, which are essentially two chains joined side by side, which allow for more power and torque to be transmitted.

Rotor shaft

Fig : 6 Rotor shaft

A rotor shaft or axletree is a central shaft for a rotating wheel or gear. On wheeled vehicles, the axle may be fixed to the wheels, rotating with them, or fixed to the vehicle, with the wheels rotating around the axle.[1] In the former case, bearings or bushings are provided at the mounting points where the axle is supported.

Blades

Fig : 7 Blades

In this study, three units of rotary cutting blades were used for weeding operations. Each unit consists of four "C" shaped blades connected in the orthogonally opposite direction on a rotary flange which is attached to the rotatory shaft by means of the sleeved hub and nut – bolt system.

Bearings

Fig .8 Bearing

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

FABRICATION PROCESS

- **Arc welding**

Fig :9 Arc welding

Welding is a fabrication process used to join materials, usually metals or thermoplastics, together. During welding, the pieces to be joined (the workpieces) are melted at the joining interface, and usually, a filler material is added to form a pool of molten material (the weld pool) that solidifies to become a strong joint.
A welding power supply is used to create and maintain an electric arc between an electrode and the base material to melt metals at the welding point. In such welding processes, the power supply could be AC or DC, the electrode could be consumable or non-consumable, and a filler material may or may not be added.

- **Grinding**

Fig : 10 Grinding

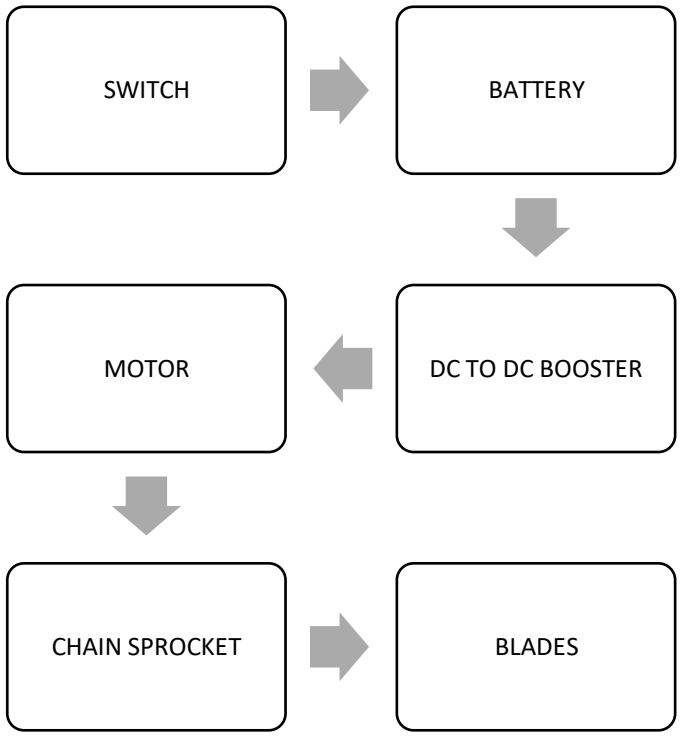
A Grinding wheel essentially consists of a large number of abrasive particles, called grains, held together b a suitable agent called the bond. It may be regarded as a multipoint cutting tool with a cutting action similar to that of a milling cutter, except that the cutting points are irregularly shaped and randomly distributed over the active face of the wheel.

- **Paint Finishing**

Fig:11 Painting

Finishes can improve corrosion resistance. Aluminum has a naturally occurring oxide film that protects it from corrosion. This oxide film is sufficient for many applications. But in extreme environments, extra protection may be needed.

Finishes can enhance the appearance of the aluminum. Depending on the look you are trying to achieve, you will need to select the appropriate finish. Maybe you want something that's brightly colored. Maybe you're trying to achieve a "mirror" finish. You need to choose a finish that will give you a look you want to achieve.



WORKING LAYOUT

Construction :

For the weeder machine, the material should not affect the weight of the weeder, so for we are using a mild steel square tube as a frame. In this frame, the battery is located at the top of the frame. Then the battery positive terminal is connected to the switch, and the negative terminal is grounded. Switch is connected by a copper wire which is directed towards the dc to dc booster. The dc to dc booster which is used to increase the output voltage of the dc motor. A Dc motor which is fixed below the battery and placed at the center of the frame. The chain one end is connected with the dc motor, and the other end is connected to the chain sprocket, which is fixed at the rotator shaft. At the both ends of the shaft, the bearings are provided for smooth rotation of the shaft. The rotor blades are made up of mild steel; it's fixed on the flange with the help bolt and nuts for easy removing and fixing of blades purposes. Finally, the two rubber wheels are fixed on the backside for the weeder movement

Working:

The power is supplied from the 12v Battery; when the switch is ON, the electrical power from the battery is directed to the DC to DC booster. The DC to DC Booster which will increase the voltage with a potentiometer and the increased power transferred to the DC motor. The DC motor which converts electrical energy into mechanical energy. To transfer the rotational power from DC motor to blades by rotating mechanism with the help of chain sprocket. The sprocket which is already fixed at the rotating shaft; by this process, the rotating shaft will start to rotate. The Blades are also fixed in the shaft with flange. From this process, the blades will rotate and cut the crops.

PERFORMANCE EVALUATION

1. Weeding efficiency
2. Plant damage
3. Field capacity
4. Performance index

A. Weeding efficiency

$$\text{weeding efficiency (\%)} = \frac{W1-W2}{W1} \times 100$$

Where,

W_1 = Number of weeds before weeding.

W_2 = Number of weeds after weeding.

Weeding efficiency is the ratio between the numbers of weeds removed by power weeder to the number of weeds present in a unit area and is expressed as a percentage. The samplings were done by quadrant method, by random selection of spots by a square quadrant of 1 square meter . Higher the value of weeding efficiency better is the weeder performance.

B. Plant Damage

$$Plant\ damage(\%) = \{1 - \left(\frac{q}{p}\right)\} \text{x } 100$$

Where,

q = number of plants in a 10m row length after weeding.

P = number of plants in a 10m row length before weeding.

Plant damage is the ratio of the number of plants damaged after operation in a row to the number of plants present in that row before operation. It was calculated by the following formula . It is expressed in percentage.

C. Field Capacity

The effective field capacity of the power weeder was computed by recording the area weeded during each trial run in a given time interval. It is dependent upon the speed of operation. With the help of a stopwatch, time was recorded for the respective trial run along with the area covered. Effective field capacity,

D. Performance Index

$$PI = \frac{\text{FC} \times (100 - \text{PD}) \times \text{WE}}{\text{P}}$$

Where,

FC = Field capacity , ha/hr

PD = Plant damage,%

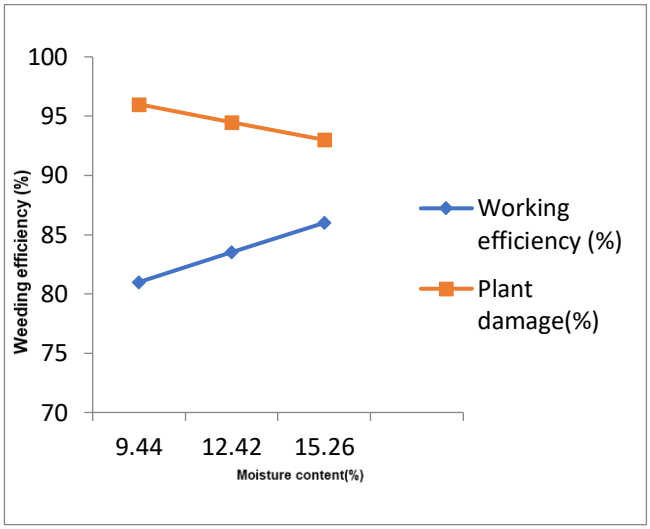
WE= Weeding efficiency,%

P = Power, hp.

Performance of the weeder was assessed through performance index (PI) by using the following relation as suggested by the Performance index.

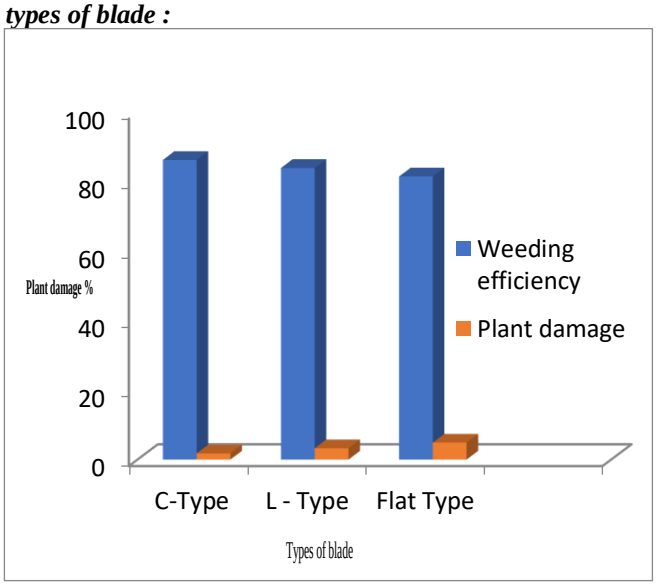
RESULT AND DISCUSSION

A. Performance parameters of weeder as a function of soil moisture content :



The above graph 1 represents the graphical representation of the weeding function in soil moisture content. When the moisture content of the soil increases working efficiency and weeding efficiency also increases, respectively. Plant damage will be slightly decreased when the moisture content of the soil is high.

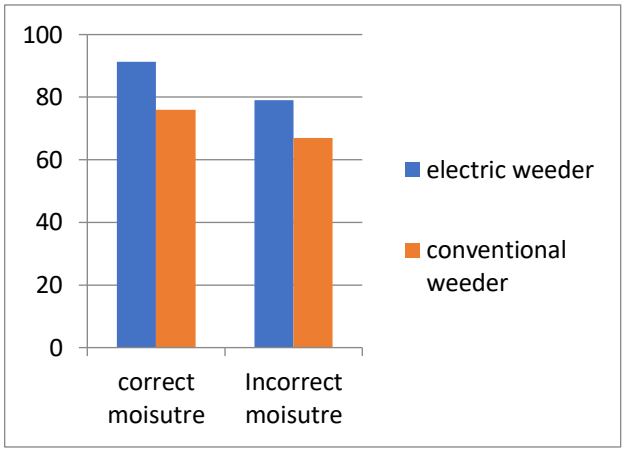
B. Performance parameters of weeder with different types of blade :



Graph 2 Comparison of blades with plant damage

The above graph 2 shows the graphical representation of weeding efficiency and plant damage of comparing with several types of blades. When comparing C- type blade with L-type and flat type, C-type blade has better weeding efficiency with 86.23 %. Also, plant damage is lesser at 1.77%.

C. Weeding efficiency of electric weeder and conventional weeder



Graph 3 Weeding efficiency of electric weeder and conventional weeder

The above graph 3 shows the weeding efficiency of electric and conventional weeders. When the moisture content is correct, the electric weeder has better efficiency of 91.6% than the conventional type weeder has 79%, during the incorrect moisture content, the efficiency has 76 %, for conventional weeder 67 %.

D. Field performances of ridge profile power weeder

S.NO	PERFORMANCE PARAMETER	RESULT
1.	Weeding efficiency	91.6 %
2.	Plant damage	2.66 %
3.	Average forward speed,	1.02 km/h
4.	Field capacity	0.08 ha/h
5.	Performance index	192.34
6.	Average field machine index	66.51 %

CONCLUSION

Hereby the fabrication and performance evaluation has confirmed that it has less operating cost than conventional type weeder. It shows the 'C' type blade gives better weeding efficiency and less plant damages

during the operation on the field than compare to other types of blades. Weeding efficiency is reduced while the moisture is higher than 17% in soil.

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