Design and Fabrication of Cono-Weeder

Dr.R. Manivannan[1], SenthilKumar K[2], Vijay K[3], Vimalbhushan G[4], Yogesh G[5]
[1]*Professor, Department of Mechanical Engineering, Muthayammal Engineering College Rasipuram, Tamil Nadu,637408*
[2,3,4,5]*UG Students, Department of Mechanical Engineering, Muthayammal Engineering College, Rasipuram, Tamil Nadu,637408*

***Abstract*—The Indian economy is heavily dependent on agriculture. In agriculture, controlling weeds is one of the most difficult tasks, and it contributes significantly to production costs. Farmers have raised worry about weed management techniques that are successful in stopping weed growth and propagation. Similarly, weeding in wetland paddy is largely done by hand weeder in all regions. Some of the farmers utilize mechanical operated Cono-weeder machine for weeding process. Nowadays, everything is becoming more contemporary. So, this project work describes about the modified Cono-weeder machine which used for wetland. The battery-operated motor power has integrated with existing weeder machine into modern one. This equipment's design minimizes human labour, lowers costs, and produces work more efficiently. The needs of the marginal farmers will be met by this weeder.**

***Keywords*— Weeding, Mechanical Operated, paddy, Cono-weeder machine. Battery operated**

I. INTRODUCTION

Weed management is a critical aspect of crop production, especially in Indian agriculture, where manual weeding remains the most common yet labour-intensive method. Traditional tools like khurpi and wheel hoe, though widely used, are time-consuming, physically demanding, and inefficient for large-scale operations. To address these challenges, research and development have focused on designing more efficient, user-friendly, and cost-effective weeders. Among these innovations, the Cono-weeder has emerged as a promising tool, particularly suited for row crops like soybean. This literature review explores existing studies and developments related to Cono-weeders, analysing their design, performance, efficiency, and advantages over conventional methods to provide a strong foundation for the current projectMane Deshmukh Vijay et al., (Mar 2016), The alleviation of rural poverty is significantly influenced by agricultural growth. Farmers will be satisfied with the work needed to create a weeder. The weeder is straightforward to use and should have an acceptable level of efficiency. It was quicker than the conventional weed-removal procedure. This method is more cost-effective than manual weeding and requires less work. Maintenance costs are relatively low here because no fuel or electricity is used. The expense of using this equipment to weed is only one-third of what using manual labor would cost. Locally sourced materials are used to fabricate Low-cost Weeder. Overall, the weeder performed satisfactorily.

Rajat Bhosale et al., (Mar 2017), Weed growth can be controlled, the time and money wasted in conventional process is saved. The crops damage and wastage are zero. The operating cost of machine is less. It is affordable to all types of farmers. The inter row weed control is possible. Easy to change direction of machine while working. Machine is environment friendly.

Albert Francis A et al., (May 2017), This equipment is made to remove weeds from cultivated areas with ease. The production of the food sources is also increased by the removal of weeds. Farmers save time when they use our design. Numerous machineries may be used for the cultivation, preparation, spraying, and gathering of food supplies. In a similar vein, the machine design may be used to remove undesirable intermediary plants between plant development.

P.Konda Babu et al., (Jul 2017), In conclusion, observations made after the design, production, and testing of this specific manually driven weeder revealed that the equipment's overall benefits. Compared to the conventional approach of weed management, it was quicker. high effectiveness, Sand soil has the best effectiveness among all soil types; it cannot function in areas with stones or other obstructions.

M. Govardhini, Prof. K. Hemachandra Reddy et al., (Oct 2017), An attempt is made to A solar-powered multicrop weeder has been designed and built. The plans to use solar energy were successfully finished.

This effort is carried out with the goal of producing an efficient weed management solution. The equipment is environmentally friendly and safe to use. This equipment may be used by a single person to remove unwanted plants. This weeder significantly lowers the amount of labor and fuel needed.

Prof. Wakchaure Prakash.N et al., (2017), In order to save farmers' time, money, labor, and physical effort, this study attempts to comprehend the limitations of weeders and weeding procedures. In terms of economic concerns, it highlights the necessity of having the right weeding equipment in order to increase profit and stability. However, there are drawbacks to engine-powered equipment that cannot be totally overcome, such vibration. The performance of weeders can be affected by rotating and adjustable blades, and design factors are also very important. Therefore, in order to increase stability and profit, it is essential to build appropriate weeding equipment.

Guduri Tirupati Reddy et al., (Sep 2018) Since small-scale farmers cannot afford to buy expensive agricultural equipment, we can state with certainty that the project will meet their needs based on the machine's overall performance. Compared to old ways, the machine required less time and manpower; thus, if it is manufactured on a big scale, its cost will be greatly reduced, which we think would partially fulfill the push of Indian agriculture. Thus, the labor issue that is necessary for Indian farming today may be resolved in this way. Sixty-two percent of Indians own property less than one hectare, which accounts for 18% of the country's total cultivated land. One to four hectares make about 44% of the total land area.

Er. Mathan. M et al., (Mar 2019), After five field testing, the electrical power weeder outperforms a standard weeding machine by 80%. This equipment is more effective in controlling weeds and is capable of being controlled by a single person. It is more efficient due to its slower travel speed and deeper operating depth. Farmers may now be self-sufficient and no longer need workers to pull weeds thanks to agricultural technology. The electric power weeder has been tested with various weeds and soil types, and it is easier to operate and more efficient for everyday usage. The fact that zero emissions are guaranteed emphasizes its main objective.

Sarang A. Bhongade et al., (Mar 2019), Rural poverty reduction is significantly influenced by agricultural development. The work needed to create a weeder will satisfy farmers' needs. The weeder should be easy to use and have a reasonable level of efficiency. It was quicker than pulling weeds the old-fashioned way. It requires less work and is more cost-effective than hand weeding. Because there is no fuel or electricity used here, maintenance costs are extremely low. This machine's weeding costs only one-third of what manual labourers would charge. Low-cost Weeder is fabricated using locally accessible materials. The weeder's overall performance was good. Akash Singh et al., (Dec 2019), On the whole project we focused to in increase the weeding process. For the farmer, this is a less expensive and time-consuming tool.

A. Problem Statement

Usually, 15 to 20 days after seeding, weeding and hoeing are carried out. Early on, the weeds should be managed and eradicated. It is normal to lose 20 to 30 percent of grain output, depending on the density of weeds. If proper crop management practices are not followed, this loss might rise to 80 percent. Groundnuts and rice are susceptible to weeds. The yield is reduced by 50% as a result of early growth competition and weed management failure during the first three weeks following sowing. A significant amount of labor is needed for manual weeding, which makes up around 25% of the overall labor demand, which is typically 900–1200-man hours per hectare. The weeder has an 87% functional efficiency, a theoretical field capacity of 0.0375 hectares per hour, an effective field capacity of 0.03 hectares per hour, and a field efficiency of 81%. 87% soil inversion in forty-two days, one guy can weed one acre of land.

B. Objective

The project's goal is to develop, build, and test a battery-operated weeder that will provide farmers the best chance to manage and eradicate weeds from their fields. The main focus of this project work is to develop the motorized weeding machine by Cono weeding technology.

II. COMPONENTS DESCRIPTION

- Weeding Tool
- Motor
- Battery
- Frame Structure
- Toggle Switch
- Voltage Regulator

A. Weeding Tool

The implementation of effective weeding tools and equipment for weed control appears to be critical in order to reduce time consumption, labor requirements, and costs. As a result, a prototype power-operated rotary weeder for weeding in wetland rice farming was manually planned, developed, and manufactured. The conical roller is designed, and a saw-type plate has been affixed around its circle. It includes two spinning cone-shaped drums with adjustable widths. It offers higher soil working efficiency and operating simplicity. It is unsuitable for dark or loamy soils. The axle hole widens with extended usage.

Fig. 2.1 Weeding Tool

S.no	Material	Specification
1	Cone	Dia 2.5” Front end Dia 5.5” Back end HDPE

B. Motor

An electrical device that transforms electrical energy into mechanical energy is called an electric motor. In order to produce force in the form of rotation, the majority of electric motors work by interacting their magnetic field with winding currents. Electric motors can be powered by alternating current (AC) sources like a power grid, inverters, or electrical generators, or by direct current (DC) sources like batteries, cars, or rectifiers.

Fig. 2.2 DC Motor

Any rotational electrical equipment that transforms electrical energy from direct current into mechanical energy is called a DC motor. The most prevalent kinds are dependent on the forces generated by magnetic fields. Almost every kind of DC motor has an internal mechanism, either electronic or electromechanical, that allows it to periodically reverse the direction of current flow in a specific area.

S.no	Material	Specification
1	DC Motor	12 V

Since DC motors could be driven by the direct-current lighting power distribution networks already in place, they were the first to be employed extensively. The speed of a DC motor may be adjusted across a large range by varying the field windings' current strength or the supply voltage. Appliances, toys, and gadgets all employ tiny DC motors.

C. Battery

A device that powers electrical gadgets like flashlights, smartphones, and electric automobiles is called an electric battery. It is made up of one or more electrochemical cells and has external connections. The cathode and anode are the positive and negative terminals of a battery, respectively, when it is producing electricity. The electrons that flow and provide energy to an external device when linked to an external circuit originate from the terminal that is designated negative.

Fig. 2.3. Battery

Electrolytes can flow as ions inside a battery when it is linked to an external circuit, completing chemical processes at the various terminals and supplying energy to the external circuit. The flow of current out of the battery to do work is made possible by the mobility of those ions within the battery. In the past, the word "battery" was used exclusively to describe a device with several cells, but it has now expanded to encompass devices with a single cell.

S.no	Material	Specification
1	Battery	12 V Lithium ion

D. Voltage Regulator

A DC power output is controlled by this circuit. Its range of applications is quite broad. It may be used to regulate the brightness of an LED or light, the speed of a motor, a pump, a toy train, etc. In practice, it may be used to any application that makes use of pulse width modulation (PWM) and regulated DC power. Initially, it served as a large LED dimmer.

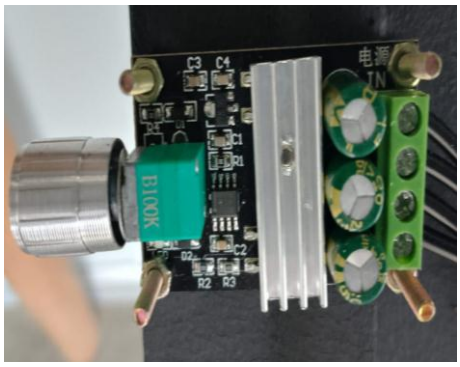

Fig. 2.4 Voltage Regulator

The A1 op amp operates as a square wave generator in this circuit. It has a byproduct triangle wave signal at its non-inverting input. The IC A2 that comes after it serves as a basic comparator. Through the potentiometer P1, a reference voltage is applied to the A2 IC's inverting input. A square wave signal with a steady frequency of about 200 Hertz is the output of A2. The pulse width of this signal varies from 0% to 100%. The pulse's trigger point is set by the P1. The transistor T1 switches a reasonably high current up to 5 amperes, acting as the real regulator. There is a minimum need of 5 volts and a maximum requirement of 30 volts for the power supply voltage.

E.Frame Structure

In order to withstand lateral and gravitational stresses, frame constructions combine beams, columns, and slabs. Large moments resulting from applied loading are often overcome by these structures. In building, framing is the process of fitting components together to provide support and shape to a structure. Typically, structural steel, engineered wood, or wood are used for framing. This frame construction gives our desired machines form and serves as the foundation for our prototype model. Because mild steel's material qualities are appropriate for our building, we used it for this frame structure. The manufacturing procedure used to fabricate the frame structure was covered in the next chapter.

III.CONSTRUCTION AND WORKING PRINCIPLE

The motorized weeder is constructed using a 67" L-angle mild steel frame as the main structure. A float assembly made from MS sheet (37) is mounted at the front for stability. A cone made of HDPE, with a 2.5" front and 5.5" back diameter, is fixed using a 19" L-angle cone holder to guide weeds into the weeding area. The weeding drum is equipped with six serrated and six plain MS blades to uproot weeds efficiently.

A DC motor powered by a rechargeable battery drives the drum via direct coupling or belt/chain. The motor is connected to a speed controller placed near the handle, which is made from a 64" pipe for comfortable operation. A 7" MS sheet Y-clamp supports the assembly. Wiring is neatly routed along the frame for safety. Once assembled, the machine is manually pushed, and the rotating blades remove weeds from the soil, making it ideal for inter-row crop weeding in small farms.

A. Working Principle

In a commercial agricultural system, weeding with instruments like a cutlass and hoe involves a lot of labor; hence, a machine weeder is required to cut down on labor. The machine assembly consists of installing the motor on the frame on a conical drum. After that, the motor is put together on the chassis using nuts, bolts, and welding. The 12V lead acid battery is used to supply electric power to motor. A voltage regulator has utilized to control speed of motor for respective farm weeds. The handle is connected with frame of weeding drum that helps to control direction of machine. Although the machine would be tested in garden area to check its performance.

A. Power Calculation

For reference,

Output mechanical power of the motor could be calculated by using the following formula:

$$P_{out} = T \times \omega$$

where

P_{out} – output power, measured in watts (W);

T – torque, measured in Newton meters (Nm);

ω – angular speed, measured in radians per second (rad/s).

$$\omega = rpm \times 2\pi / 60$$

where

ω – angular speed, measured in radians per second (rad/s);

rpm – rotational speed in revolutions per minute;

π – mathematical constant pi (3.14).

60 – number of seconds in a minute.

For 12V DC Motor,

Speed – 55 rpm

Power – 120W

$$Angular\ Velocity\ (\omega) = \frac{2\pi N}{60}$$

$$= \frac{55 \times 2\pi}{60}$$

$$= 5.76\ rad/s$$

$$Torque\ (T) = \frac{Power}{Angular\ velocity}$$

$$= \frac{120}{5.76}$$

$$= 20.833\ Nm$$

Tangential Force at Roller Edge

$$Force\ (F) = T/r$$

= 20.83/0.063

= 330.63 N

Work Done (per second, minute, or per area)

$$W = P \times t$$

= 120 × 60

= 7200 J

= 7.2 kJ

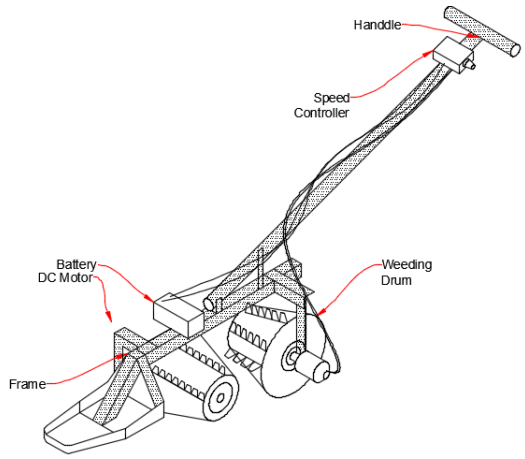

Fig. 3.1 Schematic Representation of Cono Weeder

Fig. 3.2 Fabricated Cono Weeder

IV. RESULT AND DISCUSSION

The motorized weeder was successfully designed and fabricated using a 67-inch L-angle mild steel frame with a front float assembly for stability. An HDPE cone (2.5" front, 5.5" back diameter) guides weeds into a weeding drum fitted with six serrated and six plain MS blades. The drum is powered by a DC motor connected to a rechargeable battery and controlled via a speed regulator mounted near the 64-inch handle. Field tests showed that the weeder efficiently uproots weeds, especially in inter-row spaces on small farms.

Comparison Test	Electrical Weeder (Proposed)	Fuel Weeder (Existing)
Speed of Operation	4.6–10 km/hr	3.5 km/hr
Runtime	6.5 hrs	0.45 hrs per litre
Digging Depth	75–150 mm	170 mm
Loading Capacity	490 kg	250 kg
Soil Type	Both dry and wet soil	Both dry and wet soil
Cost of Operation	2.5 rupees per hour	123 rupees per hour

In comparison with manual or traditional Cono weeders, the motorized weeder demonstrated:

- A reduction in operator fatigue by over 50%
- An increase in field capacity to approximately 0.08–0.10 ha/hr
- Improved weed removal efficiency, ranging from 80% to 90%

Overall, the motorized weeder is a cost-effective and labour-saving alternative for small-scale farmers.

V. CONCLUSION

Agricultural development plays important role as a driver of rural poverty reduction. The effort required to develop a weeder will meet the demand of farmers. The efficiency of weeder should be satisfactory and it is easy to operate. Hence, the motorized Cono weeding machine has been designed and fabricated successfully. It was faster than the traditional method of removing weed. Less labour needed and it is more economical than hand weeding. The fabrication of Low-cost Weeder is done with locally available material. The overall performance of the weeder was satisfactory.

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