

“DESIGN AND DEVELOPMENT OF SPIRAL WEEDER MACHINE”

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Abstract: In This project work is about integrating the mechanical system to the agriculture fields for the agriculture operations. Hence it's a multi-operational device that can be effectively used in fields.

The weed control operations are mainly done by three methods such as basic operation, hand weeding and using herbicides. In basic operation, weeds are removed by using an indigenous plow after 35-40 days. By hand weeding, weeds are removed by hand which is more effective but it is expensive, labor intensive as well as time-consuming. Nowadays herbicide usage is increasing.

The device is cost-effective, feasible & sustainable. It effectively reduces labor work & saves time. By using modern wisdom, these traditional implements needed to be standardized keeping in the mind economy of the rural people.

Index Terms - Agriculture Field, Weed Removal, Etc

I. INTRODUCTION

Introducing advanced technology for ploughing & weed removal, a ploughing machine is done with using bike DC motor which gives more mileage & meanwhile it produced at lower price, this equipment is useful to farmers for plowing, weed removal & so on, the tool holder which is provided at rear end is flexible to adopt different types of agriculture tools for different agriculture operations, this machine is very cheap in cost & can serve a needful to the farmers.

If a suitable herbicide and application method is available for the control of weeds it will always out-compete the electrical method from a cost and effectiveness point of view. However, given that the herbicide list is constantly being reduced the possibilities offered by alternatives such as electrical weeding need to be evaluated.

Weed control is one of the most difficult tasks in agriculture that accounts for a considerable share of the cost involved in agriculture production. Farmers generally expressed their concern for the effective weed control measures to arrest the growth and propagation of weeds. A weed is essentially any plant which grows where it is unwanted. A weed can be thought of as any plant growing in the wrong place at the wrong time and doing more harm than good (Parish, 1990). It is a plant that competes with crops for water, nutrients, and light. This can reduce crop production. Some weeds have beneficial uses but not usually when they are growing among crops. Weeds decrease the value of land, particularly perennial weeds which tend to accumulate on long fallows; increase cost of cleaning and drying crops. Weeds waste excessive proportions of farmers' time, thereby acting as a brake on development.

Weeding is an important but equally labor-intensive agricultural unit operation. Today the agricultural sector requires non-chemical weed control that ensures food safety. Consumers demand high-quality food products and pay special attention to food safety. Through the technical development of mechanisms for physical weed control, it might be possible to control weeds in a way that meets consumer and environmental demands.

II. OBJECTIVES

The first distinction to define a mechanical weeder can be about the power source, so we may have manually or engine powered weeders. This feature has different implications:

- It can influence the operational speed, i.e. an engine powered is usually much faster than a manual one.
- The engine-powered implements have a strong, direct impact over operational drudgery, saving its operator (or more than one) from an otherwise very tiring process, necessary when manual tools are involved.
- It increases the relative importance of skills and competencies in using the weeder. Power weeders are one step towards the standardization of practices, e.g. it has a fixed max rotational speed, fixed direction of movement, and it goes from one side of the field to another.

III. DESIGN AND DRAWING OF WEEDER MACHINE

3.1 Design

POWER REQUIRED TO MOVE THE WEEDER MACHINE

$$\text{Power (P)} = V \times I \quad \text{-----(1)}$$

Where,

V is the voltage of the motor

I is the current required to run the motor

$$V = 12 \text{ Volts}$$

$$I = 3.2 \text{ Ah}$$

$$P = 12 \times 3.2$$

$$P = 38.4 \text{ W}$$

The power output of the DC motor (P) is 38.4 W

TORQUE REQUIRED TO MOVE THE MACHINE

$$P = \frac{2\pi NT}{60} \text{-----(2)}$$

Where,

P is the power, P = 38.4 W

N is the speed of the motor N = 40 RPM

T is the torque,

$$38.4 = \frac{2 \times \pi \times 40 \times T}{60}$$

$$T = \frac{38.4 \times 60}{2 \times \pi \times 40}$$

T = 9.1 N-M

The torque required to run the weeder machine (T) is 9.1 N-M

CHAIN SPROCKET MECHANISM FOR HORIZONTAL DIRECTION

Number of teeth on driver sprocket, T₁ = 10

Number of teeth on driven sprocket, T₂ = 34

Motor speed, N₁ = 38 RPM

Cutter speed, N₂ = ?

$$\frac{\text{Number of teeth on driver sprocket}}{\text{Number of teeth on driven sprocket}} = \frac{\text{Cutter speed (X)}}{\text{Motor speed}} \text{-----(3)}$$

$$\frac{10}{34} = \frac{X}{38}$$

X, the speed of the cutter, N₂ is 11 RPM

The horizontal speed of the weeder machine is 11 RPM

3.2 DRAWING

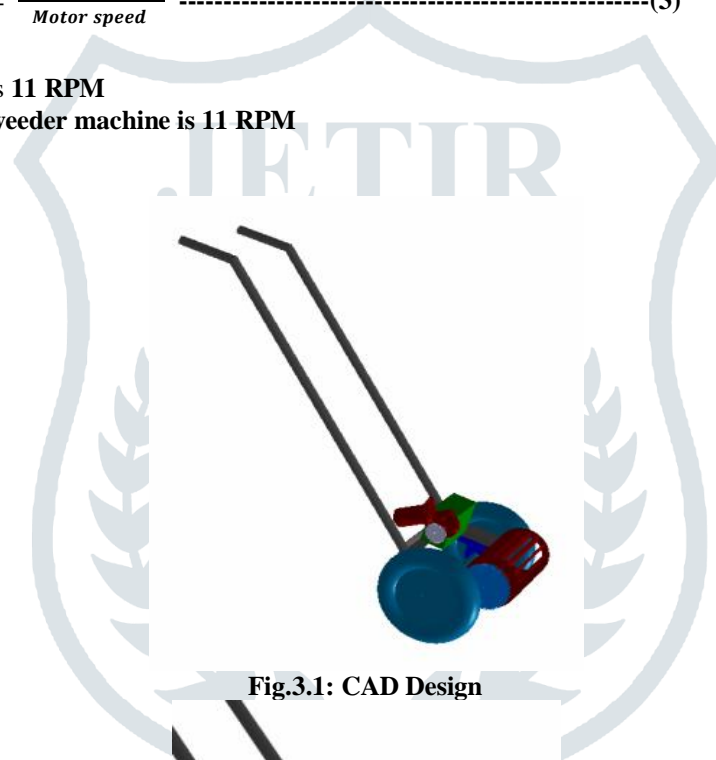


Fig.3.1: CAD Design

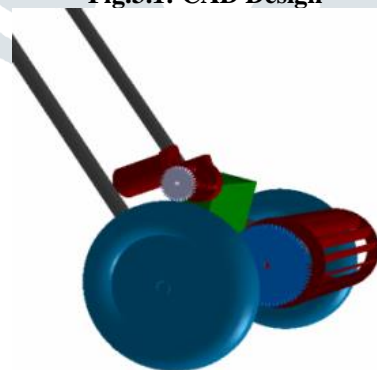


Fig.3.2: CAD Design

CHAIN SPROCKETS**Fig.3.6: Chain Sprocket**

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape, etc.

Specifications:

- Number of teeth on small sprocket: 8
- Number of teeth on large sprocket: 34
- Pitch of the sprocket teeth: 10
- The material of sprocket: High-speed steel (HSS)

CHAIN**Fig.3.7: Chain**

Roller chain or bush roller chain is the type of chain drive most commonly used for transmission. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It consists of a series of short cylindrical rollers held together by side links. It is driven by a toothed wheel called a sprocket. It is a simple, reliable, and efficient means of power transmission.

Specifications:

- Sheet thickness of chain: 2 mm
- Length of the chain :
- Material :

CUTTER**Fig.3.8: Cutter**

High-speed steel (HSS or HS) is a subset of tool steels, commonly used as cutting tool material. It is often used in the power-saw cutter, weed remover, and drill bits. It is superior to the older high-carbon steel tools used extensively. The high-speed cutter is placed in front of the weed remover by the welding joint and it is rotated by means of the chain drive mechanism. Shearing tool is provided at the cutter sheering area at the angle of 15 degrees

Specifications:

- Cutter diameter: 4 inch
- Shaft diameter: 16 mm
- Blade thickness : 3 mm
- Material: mild steel
- Grade: EN8
- Shearing angle: 15 degree

PLUMBER BLOCK BEARING**Fig.3.9: Plumber block bearing**

A pillow block usually refers to housing with an included anti-friction bearing. A pillow block refers to any mounted bearing wherein the mounted shaft is in a parallel plane to the mounting surface, and perpendicular to the centre line of the mounting holes, as contrasted with various types of flange blocks or flange units.

Specifications:

- Inner bearing diameter: 20 mm
- Outer bearing diameter: 28 mm
- The thickness of bearing: 4 mm
- Bearing housing material: cast iron
- Bearing material: stainless steel

DIGGING TOOL



Fig.3.10: Digging tool

Specifications:

- Material: mild steel (grade: IS277)
- The thickness of the tool : 3 mm
- Type: adjustable

FINAL MODEL



Fig.3.11: Final Model

IV. WORKING METHODOLOGY

Coming to the working of solar-powered weed cutter, it has panels mounted in a particular arrangement at an angle of 55 degrees in such a way that it can receive solar radiation with high intensity easily from the sun. These solar panels convert solar energy into electrical energy as studied earlier. Now, this electrical energy is stored in batteries by using a solar charger. The main function of the solar charger is to increase the current from the panels while batteries are charging, it also disconnects the solar panels from the batteries when they are fully charged and also connects to the panels when the charging in batteries is low. The motor is connected to the batteries through connecting wires. Between these two mechanical circuit breaker switch is provided. It starts and stops the working of the motor. From this motor, the power transmits to the chain drive mechanism and this makes the cutter to rotate and shearing occurs and this makes to cut the weed.

This machine is powered with solar grid cells which charge the battery and battery power consumes DC motor. This is equipment used for manual plowing the land by using the bike DC Motor that is electric DC Motor and as well as it can remove the weeds which grow in different crops so that the machine can be used for multipurpose and reliable this device has a bike DC Motor which will work on petrol and serve the farmers in better way As the DC Motor operates it drives the wheel by using sprocket & chain mechanism, As this device moves in forwarding direction the wheels rotate and move in forwarding direction the DC Motor is mounted on the frame and back side of the equipment is flexible to adopt different tools for different agriculture operations.

Due to this, a huge amount of labor effort can be reduced and within less time more weeds can be removed with less cost and easy operation. Then finally one labor is required to remove the weeds which are not removed by powered weeder around the plants. Depending on the requirement of the farmer, tools can be designed & fabricated & can be mounted on the tool holder.

V. ADVANTAGES, DISADVANTAGES, AND APPLICATIONS

5.1 ADVANTAGES

- Easy in operation.
- Low cost, Lightweight.
- Power saving, adaptable.
- No skilled operator required.

- e. Simple construction.
- f. Automation can be implemented.
- g. High performance, Multi-operational, Time saving.
- h. Pure mechanical, easy maintenance.
- i. One labor is enough for operation.
- j. Working is very easy compared to the primitive work method.
- k. Environmental friendly.

5.2 DISADVANTAGES

- a. Working time is long.
- b. Manually operated.

5.3 APPLICATIONS

- a. Weeder machines are widely used in all sports grounds. Weeder machines are more efficient and alternative to the domesticated grazing animals.
- b. It is commonly used to cut small grass and it can also be used to cut the small plants
- c. It is also used to cut the parthenium plants.
- d. Used to clean the house garden.
- e. Used for nurseries.

VI. CONCLUSION

This work is about integrating the mechanical system to the agriculture fields for agriculture operations. Many operations including plowing, weed removal, ground softening, etc can be performed. Different agriculture tools can be adopted by applying different mechanisms to the machine. Hence it's a multi-operational device that can be effectively used in fields.

The device is cost-effective, feasible & sustainable. It effectively reduces labor work & saves time. It accelerates the farm work, affordable by a farmer & is farmer friendly. Proper designing in accordance with the farmer requirements surely popularizes this tool & implements in the near future. Applying the innovative ideas & advanced technology to the farms is necessary to revolutionize the Indian agriculture thereby erasing the old manual methods, By using the modern wisdom, these traditional implements needed to be standardized keeping in the mind economy of the rural people.

VII. SCOPE OF FUTURE WORK

- a. By improvising the fabricated materials into highly rigid materials, this will strengthen the structure and withstands the higher load.
- b. With an application of high capacity motor thick plants can remove on. With the high capacity of motor and battery, the speed of the cutter will increase, this causes the work to done quickly
- c. By maximizing the size the solar panel it can recharge the battery more quickly

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