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Design and Fabrication of Multipurpose Weeder Machine

S.L. Sathe, S.M. Vasekar, A.A Shinde
Department of Mechanical Engineering, SVERI's, College of Engineering, Pandharpur, Maharashtra, India

ABSTRACT
Weed removal is one of the major activities in agriculture. Chemical method of weed control is more prominent than manual and mechanical methods. However, its adverse effects on the environment are making farmers to consider and accept mechanical methods of weed control. Chemical weeding is the most extensively used method of weed removal but these chemicals used for weeding are harmful to living organisms and toxic in nature. Research has been carried out to use some combination various methods of weeding. The need of replace the use of herbicides with more sustainable weed control techniques encouraged the definition of innovative physical weed control strategies. Mechanical and thermal means were used to control weeds and removal by mechanical method is one the methods frequently used these to remove weeds from the agricultural fields. Research has been conducted on economical method s for weed removal without damaging the crops. This project aims in the design and fabrication of a machine, which is used to remove the weeds, land cultivation and pesticides, and fertilizers sprayers too which makes it multipurpose Machine.

Keywords-Design-fabrication-multipurpose machine- Plant Damage – Weeding efficiency

I. INTRODUCTION

Weed is essentially any plant which grows where it is unwanted or in the wrong place at the wrong time and doing more harm than good. It is a plant that competes with crops for water, nutrients and light. This can reduce crop production and decrease the value of land, increase cost of cleaning. Weed control is one of the most difficult tasks in agriculture that accounts for a considerable share of the cost involved in agricultural production. Weeding is the removal of unwanted plants in the field crops. Mechanical weed control is very effective as it helps to reduce drudgery involved in manual weeding, it kills the weed and also keeps the soil surface loose ensuring soil aeration and water intake capacity. Farmers generally expressed their concern for effective weed control measures to arrest the growth and propagation of weeds. Chemical method of weed control is more prominent than manual and mechanical methods. However, its adverse effects on the environment are making farmers to consider and accept mechanical methods of weed control. A Manual weeding is common in Nigerian agriculture. Today the agricultural sector requires nonchemical weed control that ensures food safety. Consumers demand high quality food products and pay special attention to food safety. These mechanisms contribute significantly to safe food production. Consumers require high quality food products and special attention towards food safety Weed management is as old as agriculture itself, but the methods and concept of controlling weeds have changed over the years. The process of removing unwanted

plants in the field crops is called weeding. The process of removing unwanted plants in the field crops is called weeding. This project aims in the design and fabrication of a machine which is used to remove the weeds, land cultivation and pesticides and fertilizers sprayers too which makes it multipurpose Machine.

II. LITERATURE REVIEW

Weed removal is one of the major activities in agriculture. Chemical method of weed control is more prominent than manual and mechanical methods. However, its adverse effects on the environment are making farmers to consider and accept mechanical methods of weed control. Chemical weeding is the most extensively used method of weed removal. But these chemicals used for weeding are harmful to living organisms and toxic in nature. Research has been carried out to use some combination various methods of weeding.

In order to perform this project, literature review has been made for various sources like journals, books, articles and others. This chapter includes all-important studies, which have been done previously by other research work. It is important to do the literature review before doing the project because we can implement if there are information that related to this project. The most important thing before starting the project we must clearly understand about the topic that we want to do. So, by doing the literature review we can gain knowledge to make sure we fully understand and can complete the project. A review of the article was performed to identify studies that are relevant to the topic.

Decreasing income per acre of cultivation, and economic frustration are some of the key factors hurting a farmer's confidence in continuing farming. It has always been a problem to successfully and completely remove weeds and other innocuous plants. This work involved the design and construction of mechanical weeder, after discovering that tools such as cutlass and hoes require high time consuming and high labour force. As a solution to these problems, mechanical battery operated type weeder was designed and constructed. The use of mechanical weeder will reduce drudgery and ensure a comfortable posture of the farmer or operator during weeding. This will resultantly increase production. It is against this background that a rotary power weeder was developed. Results of field performance evaluation showed that the field capacity and weeding efficiency of the rotary power weeder were 0.0712 ha/hr and 73%.

An engineer is always focused towards challenges of bringing ideas and concepts to life. Therefore sophisticated machines and modern techniques have to be constantly developed and implemented for new products. Automatic weeding machine is a project used to remove unwanted plants/weeds, which grows around the crops. Technology will continue to develop and improve in the coming years. These technologies do not entirely replace the need for hand labor, but they can make subsequent hand weeding operations less costly and more efficient. Weed is a plant that is considered undesirable in a particular situation; it is basically “a plant in the wrong place”. Weeds are needed to be controlled because it reduces crop quality by contaminating the commodity. Weeds reduce farm productivity, they invade crops, smother pastures and in some cases can be harmfull for the livestock. They aggressively compete for water, nutrients and sunlight, resulting in reduced crop yield and poor crop quality. Weed control is one of the most difficult tasks on an agricultural farm. Mechanical weed control is easily adopted by farmers once they get convinced of its advantages.

III.METHODOLOGY

Indian farmers use traditional method, there is large scope for development in agricultural sector. In traditional method weeding process are done by the bull which become costly for farmers having small farming land its time consuming and requires separate setup. Therefore, to overcome above problems, we have design and develop the flexible equipment which will be beneficial to the medium and small scale farmer for the weeding operations.

The weeding tool is attached at backside of frame. For proving force on the tool handle is welded on the tool. All the engine control is maintain from this handle. When the engine is started, the driven axle is rotated with the help of chain drive due to which wheels are also rotate. The torque ratio is obtained by gearing arrangement which is supplied manually. High torque ratio is obtained at low gear. As the wheel rotate machine start moving removing the unwanted grass from the farm. Engine speed is maintained by adjusting gear and acceleration. In this way weeding operation is performing.

Weeding is an important but equally labor incentive agricultural unit operation. Weeding accounts for about 25% of the total labor requirement (900-1200 man h/ha) during a cultivation season. The labor requirements for weeding depend upon on weed flora, weed intensity, time of weeding and efficiency of worker. Delay and negligence in weeding operation affect the crop yield up to 30 to 60 percent. In India about 4.2 billion rupees are spent every year for controlling weeds in the production of major crops.

In IC engine operated weeder machine, we used 2 stroke IC engine of 145cc and torque of 9.81 N/M at 5000 rpm. It has 2 wheel situated on driving shaft, driving shaft is drive by engine means of gear and chain arrangement. On both ends of the driving shaft the wheels are attach with the help of bearing. And the bearing are fixed to the frame. The weeding tool is attached at backside of frame. For proving force on the tool handle is welded on the tool. All the engine control are maintain from this handle. When the engine is started, the driven axle is rotated with the help of chain drive due to which wheels are also rotate. The torque ratio is obtained by gearing arrangement which is supplied manually. High torque ratio is obtained at low gear. As the wheel rotate machine start moving removing the unwanted grass from the farm. Engine speed is maintain by adjusting gear and acceleration. In this way weeding operation is perform.

A) WEEDER

A hand weeder is a weeding tool used by gardeners to remove or cut weeds. Weeds are dangerous to gardens, absorbing the nutrients in the soil and leaving little to nothing for the other plants. A hand weeder will help effectively and efficiently remove these weeds. Mechanical methods of weed control are simple and easily understood by farmers. The tools and implements for mechanical weed control are mostly manual and animal operated. Manual method is most effective but is slow. It is popular in regions where labour wages are low and labour is easily available during the season. The additional cost of weeding using implements is comparatively less than the gains due to extra yields obtained. First weeding operation is mostly done between and along the rows. Remaining operations are done mostly between the rows. Hand hoes are generally used for removing weeds between plants in a row.

Figure 1: Weeder Tool

B) CULTIVATOR

Cultivators should be used for mixing soil that's already been broken up, such as when compost or fertilizer is added after tilling and before planting. Cultivators can also be used after planting to control weeds. A cultivator is a piece of agricultural equipments used for secondary tillage. One sense of the name refers to frames with teeth (also called shanks) that pierce the soil as they are dragged through it linearly. It also refers to machines that use the rotary motion of disks or teeth to accomplish a similar result. Cultivators of the toothed type are often similar in form to, but the chisel plows goals are different. Cultivator's teeth work near the surface, usually for weed control, where as chisel plow shanks work deep beneath the surface, breaking up the hardened layer on top. Cultivators are usually either self-propelled or drawn as an attachment behind either a two-wheel machine or four-wheel machine. For two-wheel tractors, they are usually rigidly fixed and powered via couplings to the machine.

Figure 2: Cultivator

C) MS WHEEL

This Mild Steel Wheel, which we make from mild steel strips, is used to do the movement to the machine, which are powered by the engine, which we used. The offered Agriculture Cage Wheel is a device designed to increase the traction performance of a tractor in paddy and wet fields. Arm links of the cage wheel are made to open wide. Due to its accurate design and configuration, pulverization of the soil can be achieved. It is made out of the first-rate alloyed metal that is capable of standing heavy loads, pressure, and rust, therefore, this Agriculture Cage Wheel is sure to last for an extended period. The cage wheel helps provide good traction in wet and paddy soil and mixes soil optimally. It is used to adequately mix the black dirt as the area is being prepared for crop planting. Heavy-duty steel angle bars are used to construct the machine cage wheels. Due to

their adaptable design, they are suited for mounting on all varieties of machine. The cage wheels are also employed for fragmenting large stones. Sturdy and strong. Simple to install on tractor rear axles. The ideal cage wheel design makes it possible to use the greatest draught possible in wetland conditions. Utilization is more cost-effective thanks to better specific fuel consumption.

Figure 3: MS Cage Wheel

D) PUMP

1. 12X8 Battery Operated
2. High Pressure Diaphragm Pump.
3. Spray 20-25 Times When Fully Charged.
4. In Line Filter to Prevent Nozzle Clogging.
5. Wide Carry Straps for Easier & More Comfortable Carrying.

The Battery Sprayers make use of technology to provide relief to farmers. The sprayer is provided with a rechargeable battery instead of the conventional handle-lever system. The sprayer requires minimum effort and generates high pressure. The electric sprayer works with individual or triple nozzles www.entrepreneurindia.com With the constantly increasing crop production, the need for pest protection and crop nutrition have become necessary aspects of farm management. Therefore, agriculture spray is a suitable and cost-effective way to manage both of these critical aspects. Agriculture sprayer is one of the important agriculture equipment. The Agricultural Sprayers Market is significantly growing across the globe. Mostly pressure sprayer is used to apply liquid pesticides. Pressure sprayer comes with two types includes low pressure sprayer and high-pressure sprayer. Low pressure sprayer is used to spray pesticides on the crop whereas high pressure sprayer is used to spray pesticides into the soil as well.

Figure 4: Spray Pump

E) FERTILIZER SPREADER

This project is very useful for agricultural service to spread out the fertilizer automatically over the land. It mainly consists of reservoir tank, bevel gears. Circular spreader disc, supporting mechanism, vanes, bearings, bearing housing. Resisting plate, mixing blades, It is a tractor driven automatic fertilizer spreader in which the power is transmitted from Machine.

The rotating shaft of machine is connected to engine through which power is transmitted to machine shaft. Spreader disc connected to machine shaft below the hopper and above the bevel gear. The vanes are attached over the plate in four directions to spread out the fertilizer when centrifugal force is created outside the dies. When the tractor shaft rotate the machine shaft rotate in which mixing blade spreader disc also rotate due to fertilizer flow in downward direction and disc spread the fertilizer through the vanes.

Figure 5*:* Fertilizer Spreader

IV. ANALYTICAL WORK

A) Handle

Handle is used for balancing weeder in field operation. Round pipe is used for the handles with required dimensions & Accelerator is fitted on handle & connected to carburetor by using wire. The overall length of handle 1066 mm with two bends from point of attachment and have a height of 750 mm from ground level. The handle is attached on main frame at the rear of the machine with help of four pieces of nut and bolts of having diameter 10 mm. With help of handle, the machine can be steered.

B) Wheel

This Mild Steel Wheel, which we make from mild steel strips, are used to do the movement to the machine which are powered by the engine which we used.

The offered Agriculture Cage Wheel is a device designed to increase the traction performance of a tractor in paddy and wet fields. Arm links of the cage wheel are made to open wide. Due to its accurate design and configuration, pulverization of the soil can be achieved. It is made out of the first-rate alloyed metal that is capable of standing heavy loads, pressure, and rust, therefore, this Agriculture Cage Wheel is sure to last for an extended period. The cage wheel helps provide good traction in wet and paddy soil and mixes soil optimally.

C) Wheel shaft

It is shaft on which wheels are mounted. Wheel shaft was selected as 90cm long 4.5 mm wide wheel shaft is fitted the frame and engine load is mounted on the shaft.

The length of the chain is given by

$$Lp = 2\frac{36+(14+44)+(44-14)^2/36}{2}$$

LP = 72+36+1.2

Lp= = 109.2 pitches

Lp= 110 Pitches (appro.)Design of Chain length

Speed of wheel shaft calculated by following equation, (Sharma, 2013).

$N_1T_1=N_2T_2$

N_1= Speed of engine. (400 rpm)

T_1= No of teeth on engine sprocket. (14 Teeth)

N_2= Speed of wheel shaft. T_2= No of teeth on wheel shaft. (44 teeth)

Speed of wheel shaft= 2.15 m/s

D) Technical specification of the Engine

Sr. No.	E)	Particulars	**Specification**
1	F)	Type	Air cooled,2 stroke, Horizontal Spark ignition engine
2	G)	Fuel	Petrol engine
3	H) I)	Fuel tank Capacity	3.5
4	J)	Starting	Recoil start
5	K)	Engine weight	17 kg
6	L)	Recommended speed	400 rpm

TABLE I TECHNICAL SPECIFICATION

PARAMETER	SPECIFICATION	COST
Engine	52CC, 2Stroke engine,1.5 liter fuel tank.	6000Rs.
Frame Material	1.5 inches MS Strips	700 Rs.
Spray Pump	12 liter storing capacity	1500 Rs.
MS Steel Sheet	2mm Thickness	300 Rs.
Hopper	hopper	200 Rs.
Total		**8700Rs.**

TABLE II SPECIFICATION OF PROJECT COST

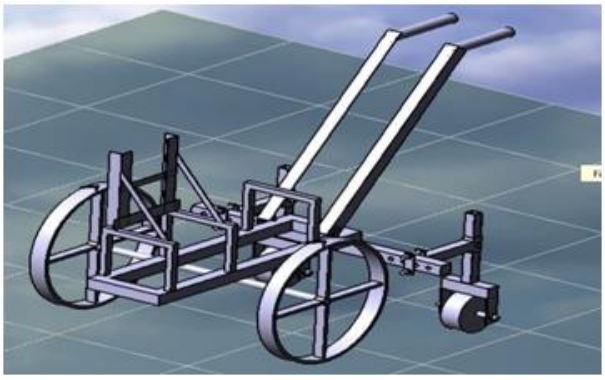

Fig 4.1 3D CATIA Model

V. RESULT AND DISCUSSION

Agriculture is the backbone of India, and weed removal being one of the primary processes in the field, there is a necessity for weed to be removed in all the fields to increase the quality of crops and to decrease the effect of weeds on crops. A weed may be defined as any plant or vegetation that interferes with the objectives of farming or forestry, such as growing crops, grazing animals or cultivating forest plantations. A weed may also be defined as any plant growing where it is not wanted. For example, a plant may be valuable or useful in a garden or on a farm or plantation but if the same plant is growing where reduces the value of agricultural produce or spoils aesthetic or environmental values, then it is considered a weed.

Fig. 4.1 Welding Process

Fig. 4.2 Cutting Process

Fig. 4.3 a) Assembly

Fig. 4.3 b) Assembly

VI. CONCLUSION

In this paper we will try to reduce the human effort with the help of two stroke IC engine. The engines presented here serve the purpose of an economical lighter and flexible mechanism, which could develop to perform multiple activities. The design presented is subject to entire needs of the small farmer. Hybrid vehicle reduce emission, increases efficiency and improve fuel economy also reduce pollution. This machine performs weeding for the more Acers of the land than the conventional one. Our machine is more efficient, economical, more effective and less time consuming than that conventional weeder machine.

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