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Development of Single wheel multi use manually operated weed remover

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ABSTRACT: *Every year in INDIA, an average of 1980 Cr of rupees is wasted due to weeds. Our country faces the total loss of 33% of its economy from Weeds. The Losses are due to some of the following reasons, total loss of 26% from Crop Diseases, total loss of 20% from Insects and Worms, total loss of 6% from Rats. Has been Surveyed. Shrinking farm lands, acute labour shortage, decreasing income per acre of cultivation, and economic frustration are some of the key factors hurting a farmer's confidence in continuing farming. Weeding control is done by: mechanical weeding, thermal weeding: flaming, biological control, chemical control, and by farming pattern. It has always been a problem to successfully and completely remove weeds and other innocuous plants. Invariably, weeds always grow where they are not wanted. This work involved the design and construction of mechanical weeder, after discovering that tools such as cutlass and hoes require high drudgery, time consuming and high labour force. As a solution to these problems, mechanical weeder was designed and constructed. The mechanical weeder was made of two implements attachment i.e. the primary cutting edge which is in front to loose soil above and the secondary cutting edge which is behind to do cutting and lifting of weeds. The overall machine field efficiency was 98.67%. The Single Wheel Weeder being manufactured is the equipment, which is used for very special purpose when the weeding is required at narrow places or between rows. The blade is thin but very sturdy and tough besides, it is very safe to use and offers zero threat of hurting to the user, Other than the wheel, there is nothing mechanical in this single wheel weeder but, it works wonderfully under the condition where it is put into. This hassle free equipment requires no special maintenance. It is necessary to design the weeder which minimize the human effort and provide efficient work output. The tool which is designed is able to fulfill the present requirement for the weed control. The present design is directed to an improved manual tilling, mulching and weeding tool.*

Keywords: *Mechanical weeding, field performance, Drudgery.*

I. Introduction

Manual weeding requires huge labour force and accounts for about 25 per cent of the total labour requirement which is usually 900 to 1200 man M hours/hectares [9]. This operation is mostly performed manually with cutlass or hoe that requires high labour input, very tedious and it is a time-consuming process. Moreover, the labour requirement for weeding depends on weed flora, weed intensity, time of weeding, and soil moisture at the time of weeding and efficiency of worker. Often several weeding operation are necessary to keep the crop weed free. Reduction in yield due to weed alone was estimated to be 16 to 42 % depending on crop and location which involves one third of the cost of cultivation [8].Weeding and hoeing is generally done 15 to 20 days after sowing. The weed should be controlled and eliminated at their early stage. Depending upon the weed density, 20 to 30 percent loss in grain yield is quite usual which might increase up to 80 per cent if adequate crop management practice is not observed. Manual and mechanical techniques such as pulling, cutting, and otherwise damaging plants, may be used to control some invasive plants, particularly if the population is relatively small. These techniques can be extremely specific, minimizing damage to desirable plants and animals, but they are generally labor and time intensive. Treatments must typically be administered several times to prevent the weed from re-establishing, and in the process, laborers and machines may severely trample vegetation and disturb soil, providing prime conditions for re-invasion by the same or other invasive species. It is necessary to design the weeder which minimize the human effort and provide efficient work output. The tool we going to design is able to fulfill the present requirement for the weed control. Accordingly, the present invention is directed to an improved manual tilling, mulching and weeding tool.[1] Since weeds can be killed easily when they are at early stages of growth. This practice can also reduce labor and cost substantially Small holder farmers need low cost implements which can be purchased or made locally. Therefore the objective of this project was to develop a small hand weeder to be used for getting rid of young weeds growing between crop rows; and this implement must be relatively cheap and could be made locally. Before the existence of chemical weed control, mechanical weed control was the best option to solve issues related to manual weeding. In mechanized agriculture, there were times where weeding tools were pulled by draft animals such as buffaloes and horses, which now in the developed world have generally been replaced by tractors. There are various types of mechanical weeding implements in the market that use three main techniques: burying weeds, cutting weeds and uprooting weeds. The burial of weeds through the action of tillage tools, and is usually done during land preparation.[2].The earliest and the simplest weed control method is manual weed control. This method was and is accomplished by a person bending down and using their hands to pull weeds out of the soil. This method then advanced to hand tools, from using a stick to using a hand-hoe. The labor required for weeding is expensive, time consuming [4] To achieve a high yielding vegetable production, good agricultural practices are required. One of the most important practices is to properly manage weeds. Weeds affect crop yield due to competition to acquire plant nutrients and resources [4]. Weeds have very fast growth rates compared to crops, and if not treated and managed, they may dominate the field. There are various methods for controlling weed infestation in crop production. Some farmers adopt agronomic practices that improve crop competitiveness such as Planting vigorous crop seeds at relatively shallow depths and planting

right after a weed control operation. This method is used to prevent the weed seeds from germinating before the crop is planted and to ensure that crop plants emerge before the weed plants. This practice will not only ensure a maximized crop yield and reduce weed infestation, but also minimize any economic losses [3]. The above practice should be applied for controlling weeds if the canopy closes and does not allow much light onto the ground surface where weeds will germinate and grow. However, weed control is still required during the crop production cycle. Rice and groundnut are very sensitive to weed as Competition in the early stage of growth and failure to control weeds in the first three weeks after seeding, reduce the yield by 50 per cent [5].In traditional method of rice cultivation, weeds are mostly removed from the field with manual process as they are seen more as a negative factor for crop growth. But in SRI (System of Rice Intensification), weeds are seen as growth promoters when they are appropriately managed. As the weeds are more in SRI due to intermittent wetting, it is important to manage the weeds regularly. Based on a model developed by International Rice Research Institute, the Acharya N G Ranga Agricultural University of Andhra Pradesh, developed 'cono weeder'. Few innovative farmers did several experiments for different soil situations and easy operation. Even multi-row weeders were developed by some farmers. At this point of time WWF Dialogue Project and WASSAN have organized an innovators workshop on SRI implements in July, 2005. After analyzing various issues the Workshop made the following recommendations regarding weeders human drudgery, risk and misery. The most common methods of weed control are mechanical, chemical, biological and traditional methods. Out of these four methods, mechanical weeding either by hand tools or mechanical weeders are most effective in both dry land and wet land [7]. Weeding and tilling that reduce the time spent on weeding (man hours), cost of weeding and drudgery involved in manual weeding. Weeds can cause several damages to the farming enterprise. These include: decrease in crop yield, impairment of crop quality, harboring of plant pests and diseases, increase in irrigation costs, injury to livestock and decrease in land Values [6] That 50 to 70 % of yield reduction is caused by poor weed control.

II. Aim of Project

The aim of the project is to design, construct and test manual weeder, to provide the best opportunity for the crop to establish itself after planting and to grow vigorously up to the time of harvesting.

2.1 Statement of Problem

Weeding with the use of tools like cutlass and hoe requires high labour force in a commercial farming system hence mechanical weeder is necessary to reduce the labour force. Environmental degradation and pollution caused by chemical is reduced by the use of Mechanical weeder. Low effective operation, low work effort and high time requirement for different types of hoe or cutlass, can be overcome with the use of mechanical weeder [9].

2.2 Justification

Presently in India, weeding with simple tools such as cutlass, hoe etc is labour intensive and intensive and time consuming. Thus, there is a need for the design of manually operated weeder for intensive and commercial farming system in India. One of the problems in crops and vegetables production is poor weed control; hence there is need of mechanical weeder to increase the production of these products. The cost for employing a Labour force when using simple tools is very high in commercial farming system. This can be reduced using mechanical weeder.

III. Materials and Methods

Part: Frame: The material used was metallic circular pipe of 1200mm and supported pipe of different Dimensions. Part: Secondary cutting edge: This part was made of a metallic flat bar of 170mm in length, and extra bar length 230mm sharpen at the one end. Part: Handle: The handle was made up of circular metallic pipe of different dimensions. Part: Primary cutting edge: There were 3 blades which are sharpen in front and at the bottom placed vertically on a flat bar of 108mm in length and teeth to teeth 6.5cm.Part: Funnel: The total height is 900mm and diameter 105 Φ[9].

3.1 methodologies

Weeding efficiency (Functional efficiency) was determined by removing manually the weeds in 1m x 1m area of the farm, the weeds was weighed and recorded. The process was repeated in five randomly selected locations on the farm. The average weight of the weeds in 1m x 1m area was calculated for the types of soil. The average weight of the weeds in 1m x 1m area after pass of the weeder through the farm was deducted from the actual weight of the weeds in 1m x 1m area. Thus, functional efficiency was determined from the relation:

$$Functional\ Efficiency = \frac{Weight\ of\ weeds\ removed\ using\ weed\ remover}{Actual\ weight\ of\ weeds\ removed\ manually} X100$$

The functional efficiency was carried out on different types of soil at the same average speed. The machine performance was evaluated using actual field capacity and design field capacity of the machine.

3.2 design requirements:

Physical and operational characteristics Safety: It provides safety to users, Life in service: The product will last approximately long duration, Ergonomics: Easy to operate by everyone, of all physique conveniently, Weight: The product must less in weight, Materials: The material used is mild steel.

IV. Concept

Figure 4.1 Concept idea

This Concept involved the development of mechanical weeder, after discovering that tools such as cutlass and hoes require high drudgery, time consuming and high labour requirement. As a solution to these problems, mechanical weeder was designed and developed. The mechanical weeder was made of two implements attachment i.e. the primary cutting edge which is in front to loose soil above and the secondary cutting edge which is behind to do cutting and lifting of weeds. An extra attachment of funnel and circular pipe for fertilizing and seeding of ragi after cultivation. The tool developed will be able to fulfill the present requirement for the weed control. Accordingly, the present development is directed to an improved manual tilling, mulching and weeding tool.

V. Compared With The Traditional Methods Of Weeding On 1m X 1m Area Of Land

Table 1: weeding test result on semi moisture land

AREA	WEIGHT OF REMOVER WEED USING HAND PULLING(Kg)	TOTAL WIGHT OF REMOVED WEED USING WEED REMOVER(Kg)
1	0.05	0.06
2	0.03	0.04
3	0.07	0.07
4	0.10	0.10
5	0.08	0.08
Total	0.33	0.35
Mean values	0.066	0.7

Functional efficiency for semi moisture land = 94.29%.

Table 2: weeding test result on dry land

AREA	WEIGHT OF REMOVER WEED USING HAND PULLING(Kg)	TOTAL WIGHT OF REMOVED WEED USING WEED REMOVER(Kg)
1	0.30	0.31
2	0.32	0.42
3	0.20	0.28
4	0.32	0.44
5	0.28	0.30
Total	1.42	1.75
Mean values	0.284	0.35

Functional efficiency for dry land = 81.14%.

Table 3: time spent when tested on semi moisture land

METHODS	LABOUR REQUIREMENT	TIME SPENT (Min)
Manually operated Weeder	**1**	**1.0**
Cutlass	**1**	**4.49**
Hoe	**1**	**3.32**

Hence by comparing weed remover and Cutlass it has been observed that weed remover is almost ***4.5 times faster than Cutlass*** and more than ***3 times faster than Hoe*** on semi moisture land.

Table 4: time spent when tested on dry land

METHODS	LABOUR REQUIREMENT	TIME SPENT (Min)
Manually operated Weeder	**1**	**1.5**
Cutlass	**1**	**6.12**
Hoe	**1**	**5.1**

Hence by comparing weed remover and Cutlass it has been observed that weed remover is more than***4 times faster than Cutlass*** and more than ***3 times faster than Hoe*** on dry land.

VI. Conclusions

In conclusion, it was found during observations after the development and testing of this particular manually operated weeder that the overall benefits accruing and associated with the use of the equipment includes:

1. It was faster than the traditional method of removing weed.
2. It cannot work where there was stone or any obstacle.
3. Improvement could be brought in their postures, thereby facilitating them to walk comfortably along the rows while weeding with this manual weeder.
4. Less labor needed and it is more economical than hand weeding.
5. Here do not use any fuel and power, Hence maintenance cost is very less.

VII. Scope of Future Work

Through observation, this work was good for local farmers and small scales Agro-base industries that need a better treatment and operations carried out on farms.

1. The weight of the weeder can be reduced by using lightweight materials and by reducing the size of wheel.
2. Since the weeder was designed for low cost, the weeder was made manual but it can be made automatic by placing a motor.
3. By using some advanced attaching mechanisms, the time required for assembling can be reduced for additional attachments.
4. Fixing the extra attachment of leveler.

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