

DESIGN & FABRICATION OF MINI SOIL TILLER AND WEEDER

^{#1}Khandare Suresh Vasudev, ^{#2}Kale Ajaykumar Vardhman
^{#3}Gawai Shubham Anil, ^{#4}Khandare Sarthak Rajiv, ^{#5}Prof. Amar. A. Kale



¹surajkhandare280@gmail.com
²ajaykumarkale99@gmail.com
³shubhamtushar786@gmail.com
⁴sarthakkhandare35@gmail.com
⁵kaleamar4@gmail.com

^{#1234}Student, Mechanical Engineering Department,
^{#5}Prof, M.Tech(CAD-CAM)

J.S.P.M.'s Bhivarabai Sawant Institute of Technology and Research,
Wagholi, Pune, Maharashtra, India.

ABSTRACT

Comparative study for portable weeders and power tillers in the Indian market is discussed. Various methods used for weed removal in crops are also discussed. Main focus of this is to study various equipment's used for mechanical weed removal. This study revealed that most of the Indian farmers, majority of which are small scale farmers can afford only portable weeders. These small scale farmers as such don't use mechanical weed control methods. Chemical and manual weeding is predominantly used by these small scale farmers. The literature survey indicated that portable weeders are relatively less expensive in operation and maintenance but are also less versatile. Power tillers are considerably more expensive but are also very much more versatile and can operate in variable soil conditions. Due to these constraints most smaller farmers resort to chemical and manual weeding. These methods are labor intensive and as such a major constraint in crop production. Research has been carried out in many countries to involve technologies such as image analysis, GPS navigation, etc. in mechanical weeding machines. But most of these efforts are yet to leave a lasting effect in market place. Hence it is necessary to develop more efficient and cost effective methods of mechanical weeding so as to lessen the use of chemical and manual weed removal methods.

KEYWORDS: Motor, Battery, Shaft, Casing, Bevel gear, Roller, Handle

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I. INTRODUCTION

Agriculture is the backbone of Indian economy. India being developing nation agriculture and industries based on agriculture products has prime importance in the national economy. Majority of the Indian population depends on agriculture and agro-based industries and businesses. Lack of mechanization or automation is one of the major roadblocks to improving the productivity of agriculture. One of the major reasons for lack agricultural productivity is weeds.

Weed is an everyday term usually to describe a plant considered undesirable. The word weed is commonly applied to unwanted plants in human-controlled settings, such as farm fields, gardens, lawns, and parks. Weeds compete with the beneficial and desired vegetation in crop lands, forests, aquatic systems etc. and poses great problem in non-cropped areas like industrial sites, road/rail lines, air

fields, landscape plantings, water tanks and water ways etc. Weeds are an important factor in the management of all land and water resources, but its effect is greatest on agriculture.

The losses caused by weeds exceed the losses caused by any other category of agricultural pests. Weeds may be unwanted for a number of reasons. An important one is that they interfere with food and fiber production in agriculture, wherein they must be controlled in order to prevent lost or diminished crop yields. Other important reasons are that they interfere with other cosmetic, decorative, or recreational goals, such as in lawns, landscape architecture, playing fields, and golf courses. Similarly, they can be of concern for environmental reasons whereby introduced species out-compete for resources or space with desired plants. Weeds have long been a concern, perhaps as long as humans have cultivated plants.

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.

Weed removal by mechanical method is one the methods frequently used these to remove weeds from the agricultural fields. Research has been conducted on economical methods for weed removal without damaging the crops. Weeding Machines designed and developed with intent of being operated in specific crops like tomatoes, corn, and rice. These machines are mostly intra row weeding machines which remove weeds within multiple crop rows at once.

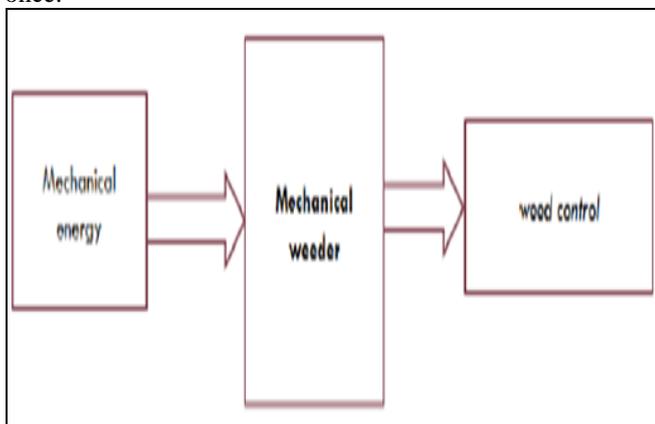


Fig.1: Block Diagram of System

Weeding machines like three row walking type one were developed and successfully to remove weeds from rice. Sensors like laser sensors are used some machines to differentiate the weeds from crops and increase the effectiveness of weeding. Various plant-recognizing systems like light interceptors, vision based systems are being researched for intra-row weeding. Some of these machines even use advanced algorithms to identify the various types of weeds. Number of novel techniques like GPS, RTK (real time kinematics) was incorporated into weeding machines to control and operate the machine.

The rate and effectiveness of weed removal depends on number of parameters related to machine performance parameters and soil properties such as types of cutting blades used, machine efficiency, moisture content, etc. Studies have been conducted on the effect of moisture content and the type of cutting blades like flat blades, spike tooth blades and curved blades on the performance of weeding machines. Mechanical weeding was found to be less effective when soils are wet during or after the weeding operation.

Chemical weeding involves the use of herbicides. Herbicides control weed plants either by speeding up, stopping or changing the plant's normal growth patterns; by drying out the leaves or stems; or by making it drop its

leaves. Chemical Control with herbicide application can provide the most effective and time-efficient method of managing weeds. Numerous herbicides are available that provide effective weed control and are selective in that grasses are not injured. 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.

Mechanical weeding is the use of powered tools and machinery to manage weeds. It is suitable for larger infestations because it reduces the weed bulk with less manual effort. Mechanical control consists of methods that kill or suppress weeds through physical disruption. Such methods include pulling, digging, disking, plowing and mowing.

Manual control is the use of the hands or handheld tools to deal with weeds. Extensive amount of cheap manual labor is necessary for manual weeding. Manual weeding is commonly employed by smaller Indian farmers for weed removal.

Mechanical weeders range from basic hand tools to sophisticated tractor driven or self-propelled devices. These may include cultivating tools such as hoes, harrows, tines and brush weeders, cutting tools like mowers, as well as implements like thistle-bars that may do both. Two wheeled pedestrian or walking tractors are a smaller alternative that can power a similar range of implements. Most machines large in size not affordable for medium and small scale farmers.

Machines meant solely for the purpose of weed removal are not easily available in India. Although some agricultural manufacturers are making efforts and made certain equipment available which are mainly intended for weed removal in farms. These machines are again primarily intended for use before sowing and when are small. These machines are also quite costly and operate on diesel or petrol powered engines. Inter-row weeders are also available which remove weeds from multiple rows of crops at once.

Operational cost of these is lower than other available equipment but even these machines can only be used for weed removal when crops are small. With most mechanical weeding implements, operator skill, experience and knowledge are critical to success. Drawbacks to mechanical weed control include low work rates, delays due to wet conditions, and the subsequent risk of weed control failure as weeds become larger Hence it is important to develop machines and implements which can perform mechanical weeding in an efficient and cost effective manner to represent a viable alternative.

II. LITERATURE SURVEY

[1] Md. Aqib Naque^[1] et. al The soil tiller and weeder is one of the many farm mechanization in promoting soil tiller and weeders especially considering the fact that the majority of farmers are having small land. It reduces human effort.

The implements are mostly self guided. Working of the project is based on engine and chain sprocket mechanism which moves the cutter or tiller. It is a great saver of time and expenses on field operations. Thus it will have very effective uses on the farm field either for tilling as well as for weeding. Development of high capacity energy efficient versatile machines and combination machinery for increased labor productivity, reduced unit cost of operation, improved timeliness of operation and suitable for custom hiring. The soil tiller and weeder is one of the many farm mechanization. Unlike tractors, soil tiller and weeders are nonconventional so far as the displacement of labours is concerned. In promoting soil tiller and weeders especially considering the fact that the majority of farmers are having small land. So they can hardly afford costlier tractors. therefore, the soil tiller and weeder should become a useful machine in the internal cleaning of crops which having small distance between them like groundnuts, sugarcane, soya bin crops, cultivation of paddy, in particular, and other crops in general for the smaller farmers. Its main objective is to reduce the manpower as in today's scenario labors are very hard to find as well as it reduces the working time. As it could be far better than the conventional using of labors or bull for tilling purpose. The aim of the project work is that it helps the students to their extended imagination, engineering skills and fundamental knowledge. This semi automatic machine is developed to reduce the time and effort required for production up to the great extent. also this machine manufacturing cost is less as compared to other. By selecting above topic we are understand, familiar and know the details of agricultural technology, with the help of this semi automatic machine we are trying to reduce labor cost, time of a middle class and small sector farmers. This is our little effort to make comfort to our farmers also this machine is manufactured in less cost as compared to other.

[2] **Rajapakse N. N.^[2] et. al** Lack of man power has been identified as one of the major problems for the sustainability of the Sri Lankan paddy industry. Hence transplanters and seeders were well developed as a step for mechanization. However, weeding method is still not well developed up to mechanization. Therefore, our main objective is to design and fabrication of a power weeder. Weeding ability will be optimized by weeding three rows simultaneously. The machine is designed to use in the fields, cultivated by using mechanized seeder or mechanized transplanter introduced by Farm Machinery Research Centre (FMRC), Sri Lanka. The double-action weeding drums will be driven by a small 1.3 kW gasoline engine that can enable removal of weeds, while facilitating the forward motion of the machine. In addition, the conical shaped weeding drums will be designed to loose-up soil without harming the paddy. Totally six drums will be used, in such a way that rear three drums have high angular velocity with respect to the front drums. A novel maneuvering method for row changing when the machine is in paddy fields also introduced in the design. More than 5-fold improvement of weeding efficiency in terms of weeding time is expected in this design. Further, a significant improvement of weeding quality is also expected in this design. Cost effective method for weed controlling. Attracting the young generation for paddy industry because

of mechanization. Well improved, unique row changing mechanism would increase the effectiveness of the power weeder. A novel double action weeding drum is introduced in this design to facilitate the effective weeding while providing the necessary traction for the forward motion of the machine. Helical shaped teeth is formed in the weeding drums to enhance the shearing effect for weeding while losing up the soil. The weeding drum is formed into conical shape to push the mud towards the paddy plants to ensure the proper growth. Two drums operate at differential speed is used to further improve the shearing process. Three sets of such drums were fixed in parallel to remove weeds in three paddy rows simultaneously.

[3] **Philip Oguntunde and Olawale John Olukunle^[3] et. al** The operations involved in the crop production cycle include land clearing, land forming/ land leveling, tillage, and crop establishment, harvesting and post harvest operations. Crop establishment is necessary to eliminate the effect of weeds, pests and disease infestation and to provide suitable conditions for optimum yield. More than 3000 species of weeds had been identified all over the world. The cost of weed management is enormous; however the opportunity cost of weed management is higher. Weed control measures must be put in place to check the growth and propagation of weeds. Chemical and manual weed control methods are viable alternatives; however, whereas environmental impact of herbicides made chemical method unsustainable, drudgery limits the size of farm of an individual in sub-Saharan Africa. Introduction of an effective mechanical weeder is expected to encourage subsistent farmers leading to increased production and hence reducing poverty. To achieve this objective, a row crop weeder was developed in the Federal University of Technology, Akure in Nigeria. A row crop Weeder was designed, fabricated and tested at the Department of Agricultural Engineering, Federal university of Technology, Akure. The machine though designed, as a weeder was adapted as a mower for a variety of grasses. The machine performed excellently as a weeder and as well as a mower. It works as a mower when cutting height is between 2 cm and 4 cm; however it works well as a weeder between cutting height of 2 cm below the ground and 1 cm above the ground level. The machine would be very useful for peasant farmers as well as small to medium scale farm holders.

[4] **Waghmode R.S.^[4] et. al** The present research has dealt with solar rotary tiller design for the power tiller that is made for using in primary and secondary tillage. Comparative study for portable weeders and power tillers in the Indian market is discussed. Various methods used for weed removal in crops are also discussed. This study revealed that most of the Indian farmers, majority of which are small scale farmers can afford only portable weeders. The soil tiller and weeder is one of the many farm mechanization in promoting soil tiller and weeders especially considering the fact that the majority of farmers are having small land. It reduces human effort. The implements are mostly self guided. Working of the project is based on solar panel and it generates energy to run this machine which moves the cutter or tiller. It is a great saver of time and expenses on field operations. Thus it will have

very effective uses on the farm field either for tiling as well as for weeding. Development of high capacity energy efficient versatile machines and combination machinery for increased labor productivity, reduced unit cost of operation, improved timeliness of operation and suitable for custom hiring. Today in the world fuel prices rises day by and the pollution may also. To control this pollution and to save the petroleum product and bio product this project is design and developed. This system requires heavy initial investment but it gives the energy output for life time with low maintenance etc. In this machine bicycle power tiller is used. In this unit there is a using of manual push type power tiller. There is steady static blade is used at rear side of tiller with shaver blade. But in this machine we modify the tooling system steady into rotary which is driven by electric dc motor of rpm 150 and 7.2 n-m torque. This motor is powered by battery pack. This rotary tool is rotate in reverse direction of entire machine which is effective for earth moving in between two lines of crops in farms.

[5] **M.G. Jadhav and J.K. Sawale**^[5] India is a largest populated country, which contains 65% population depending on agriculture. Generally Indian farmer use to traditional way that is spray carry on backpack and weeding is done by bulls. Which become times consuming and costly this both problems over come by using multi nozzle pesticides sprayer and weeder machine. For better yield of crop multi nozzle spraying and simultaneous weeding is must this papers attends to design such a flexible sprayer and weeder. This work gives continuously flow of liquid at required pressure, height and gives freedom of easy engaging and disengaging weeder. This paper suggest a model of manually operated multi nozzle spryer with weeder according to crop which will gives optimum results in less time. Pushing mechanism required less effort and three wheel mechanisms gives proper balancing of machine. The principles of motion of trolley which transmit its rotary motion from chain and sprocket arrangement and reciprocating piston into the cylinder for pumping the pesticides which is used to the manually operated organic fertilizers cum pesticides sprayer. It is upgraded design of manually operated weeder and sprayer which will be helpful for small land farmers. It consumes less time and saves money as compared with conventional spraying and weeding. It covers twice area of spraying than manually spraying. Moist soil weeder efficiency increases due to proper penetrating and dig out of soil. It does spraying and weeding simultaneously and that of conventional does separately. So this requires less time. This machine does not require any fuel or power so maintenance is less. This model removes problem of back pain. As per our requirement we can separately use weeder or sprayer. For preventing weeds from growing to the surface fibrous cloth material, bark or newspaper laid on top of the soil is a weed mat also called artificial mulch. Mulching may broadly be categorized into live mulch and dead mulch. Mulching is best-suited to wide-row field crops, e.g. cotton, sugarcane, maize, fruit crops, e.g. citrus, banana, grape and plantation crops, e.g. tea, coffee, rubber etc.

[6] **Olaoye, J. O. and T. A. Adekanye**^[6] Weed control is one of the most difficult tasks in agriculture that accounts

for a considerable share of the cost involved in agricultural production. 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. Manual weeding is common in Nigerian agriculture. It is the most widely used weed control method but it is labour intensive. 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 arotary power weeder was developed. 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 weeds and also keeps the soil surface loose ensuring soil aeration and water intake capacity. A rotary weeder was designed and constructed to be powered by a 5 hp-petrol engine and to be operated on a three ground wheels (pneumatic). The results of the performance evaluation of the developed weeder indicated that the engine speed influenced the weeding efficiency of the rotary weeder and rough weeding was observed at a higher speed of 3506 rpm. The forward speeds of 0.4 m/s to 0.5 m/s and engine speeds of 1804 rpm to 2261 rpm resulted in weeding efficiency of 54.98% to 59.05%. This was determined by counting the number of weeds before and after using the developed weeder on the 3 blocks (replicated three times). That higher engine speed leads to higher weeding efficiency. However, the relationship between forward speed and weeding efficiency, it was observed that operating the weeder at higher speeds above 0.8 m/s was characterized with rough weeding.

[7] **Sridhar.H .S**^[7] 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. 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.

III. PROBLEM STATEMENT

The bullock implements require the hand and body pressure to achieve depth and alignment of the implement in use, whereas in soil tiller and weeder, the implements are mostly self guided. This reduces human drudgery to a great extent. The comparative higher output of operation by the soil tiller and weeders as compared to bullocks reduces the operational time and achieves timeliness in operation. Cost wise the soiltiller and weeder should be an obvious choice of smaller farmers, if they are intending to have a mechanical power source for farm- operation. Soil tiller and weeder reduce the drudgery of collecting the waste grass between crops in the field during operations as compared to operations by bullocks. The soil tiller and weeder make the manual of that wastage grass by cutting it in small piece and thoroughly mixed with soil during operation.

Hence we the group of engineer has decided to make a system called as mini soil tiller and weeder to reduce the human effort as compared to operation by bullocks.

IV. METHODOLOGY

The following methodology was used:

- Development of the concept
 - No or minimum damage to the paddy
 - Easy maneuvering on wet fields
- Dynamic analysis and mechanical design
 - Kinematic analysis
 - Power transmission and drive systems design
 - Design of mechanical components
 - Assembly of components
- Fabrication of components
- Field testing and improvements
- The cost analysis

V. RESULT & DISCUSSION

The result from this project outcomes are assurance of much efficiency, less time consuming, worker friendly machine respective to the conventional method of tilling. It assures you of maximum work done with minimum work effort.

VI. CONCLUSION

From above result it is clear that to get full performance we need to chose the motor of higher power. We in a team of four have to work together for the success of our project. It will be a great experience for everyone. We divided the whole project work and will perform individually for given task; at last we combined all work. While manufacturing we will work together. We will learn how to handle pressure while working as a team.

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