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Design and Fabrication of Agricultural Rotary Weeder

Rajat Bhosale, Akshay Herkar, Avinash Herkar, Narayan Shinde

Mechanical Engineering, Savitribai Phule Pune University, Pune, Maharastra, India

ABSTRACT

Weed plant competes with crop plant for soil nutrients, moisture, light and space, thereby reducing the production and increasing cost of maintaining the farm. Many methods of weed control (Mechanical, chemical, cultural, biological) have been tried with varied degrees of success but our traditional farmers cannot adapt them due to their finance, skill, knowledge involved and the land holding system and very much less efficiency of the existing technologies. The weeder consists of main frame / handle, soil cutter (wedge), spikes, wheel bearing, epicyclic gear train along with gear box to increase the torque for high load application. The weeder is quite simple, effective and the result is immediately observed.

Keywords: Rotary hoe, Reduction gear box, Parallelogram linkage, cam and follower mechanism, inter row weeding techniques.

I. INTRODUCTION

Weed control is one of the most important aspects in the present day agriculture. Among the control methods are mechanical, chemical, biological and cultural (Biswas, 1984). The mechanical control of weeds is most widely used. It is the simplest method of weed control being followed by man since agriculture came into practice. The chemical method involves scientific knowledge on the subject and the health hazards involved scares some of our traditional farmers coupled with the cost.

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 [1]. Weeds waste excessive proportions of farmers' time, thereby acting as a brake on development [2]. Weeding is an important but equally labor intensive agricultural unit operation. There is an increasing interest in the use of mechanical intra-row weeder because of concern over environmental degradation and a growing demand for organically produced food. 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, such as precise inter-and intra-row weeder, it might be possible to control weeds in a way that meets consumer and environmental demands. Njoku [3] reported that uncontrolled weeds growth reduces yield of the principal crops while untimely weeding reduces the returns from the overall investments in the production of crops. However, 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 (where drying is necessary). Weeds accounts for about 50-70% reduction in yield; particularly in the humid tropics where torrential rainfall significantly interrupt work on the farms in the season. The situation necessitates the introduction of an appropriate machine for effective weeding control.

Manual weeding is common in India. The use of sort handle hoe is effective and it is the most widely used weed control method. It is reported that manual weeding is labor-intensive, accounting for about 80% of the total labor required for producing food in India [4]. Farmers using only hand hoe for weeding would find it difficult to escape poverty, since this level of technology tends to perpetuate human drudgery, risk and mystery. The use of herbicides has possible effect on desert encroachment and other adverse impact.

II. METHODS AND MATERIAL

A. Literature Review

Subrata Kr. Mandal al. (2011) this paper presented there is scope for these power tillers to be used as seedbed preparation and inter culture operation in wide spaced row crops like cotton and sugarcane. In order to assess the performance of lightweight power tiller, one such model was evaluated at Central Mechanical Engineering Research Institute, Durgapur under various soil conditions. The model was extensively used for seedbed preparation, inter culture operation etc. This paper was presented the results of the study. The field capacity found to be 0.1 ha/day (10 hrs.). The fuel consumption was 1 lit/hr.

Mohammad Muneer Uz Zaman (2015) this paper was helps to design a machine which would uproot the weed s and unwanted crops from the field completely. Similarly, grass cutter can also be utilized for cutting off the crops as it has nylon rope tightened at the end of it which expands outwards and rotate at a high speed as the power is given. Basically, we have merged two different machines one is a rotary tiller and the other one is grass cutter. Merging two machines to work together as a single unit gives out the output as we have expected. According to this paper, to nearby fields we came to conclusion that the tilling process which is traditionally done by use of animals or Employing labor according the size of the field is very time consuming and the cost of tilling the field traditionally is quite high. So, our machine fulfills the promise of helping out our farmers with the help of technology.

Bernardo D Radeo et al (1993) In this paper a mounting the rotor assembly at the rear end of the power tiller and attaching a glass fiber float underneath the chassis solved the problems such as steering difficulty, machine weight imbalance and uncontrollable pudding depth encountered in the front-mounted rotor assembly. Result showed that bolt on attachment showed great potential even in extreme soil conditions. The performance of the designed rotor assembly in the Mount Pinatubo affected areas 25 cm ash deposit‘s, was compared with the imported puddles, harrow and improved floating tiller. The rotor assembly efficient mixed pure soil and ash in wet and moist-plowed conditions better than the conventional harrow.

Masood Ur Rahman et al (2015) in this paper the study was conducted on a self-propelled locally made rotary hoe to overcome a problem of frequent transmission failure. The machine is used for mechanical weed control and hoeing. It was observed that the worm gear used in its transmission often failed due to surface wear of gear teeth. Worm gears made from three different copper alloys were tested against soil resistance in sandy loam soil bin. The gear compositions were determined using atomic absorption. The gears under test exhibited significant difference in surface wear among each other. As compared to gear bronze commercial gun metal and gun metal showed surface wear of 245% and 109% respectively. The highest surface wear was observed in commercial gun metal whereas lowest surface wear was observed in gear bronze. It was concluded that gear bronze may be the best material composition for use in the worm gear of the rotary hoe transmission box as compared to the other two alloys tested.

Sirisak Chertkiattipol (2008) in this paper study was the performance of rotary power tiller .Rotary tiller is advantages over the conventional implement due to initially to the main effect of the direct application to soil engaging tool rotating around a horizontal transverse axis. Achieves both plowing and harrowing in a pass of Machine on the field. The reduction in traction demanded of tractor driving wheels due to the ability of the soil working blades to provide some forward thrust. There are the three types of rotary blades i.e. Japanese C- shaped blade, European L-shaped blade and European C- shaped blade. This types of rotary tiller attached behind two- wheel tractor and this arrangement of rotary blades on rotor shaft and soil-cutting pattern of rotor tiller.

Zenon Pirowski et al (2009) in this paper, among other things, there were formulated requirements for shares of rotating and field ploughs in terms of casting material and construction of cast itself. Austempered ductile iron (ADI) was selected as casting material for testing shares of casts. This paper was suggested to replace beaten and welded elements of agriculture machines used to cut through soil by austempered ductile cast-iron. Such material and technological conversion should enable a longer life of these elements without an increase of production costs, and as a result it should increase competitiveness of the produced elements.

Jeevarathinam.A et al. (2014) in this paper was described the design modification and development of rotavator blade through the (CAD) interrogation method by modifying the design and also by modifying the material properties. Rotary tiller or rotavator is one of the tilling machines most suitable for seedbed preparation. In a Rotary tillage machine, Blades are the critical parts which are engaged with soil to prepare the land and to mix the fertilizer. These blades interact with soil in a different way than normal plows which are subjected to impact that create cyclic forces which result in fatigue failure of the blade. This actually decreases the service life of a blade. Therefore, it is necessary to design and develop a suitable blade.

Shridhar H S (2013) developed single wheel multi use weeder and it is manually operated. Weeder performs only normal weeding that is it only cut small size weed, it cannot work where stones and any obstacles are there. Some advantages of weeders are it is manually operated, offers zero hazardous, not require special type of maintains. [3]

Mr. Mahesh Gavali, Mr.Satish Kulkarni had work on available portable weeders and power tillers in Indian market. They work on comparative analysis between them. They give information about different weeding method and which method is mostly acceptable by farmers. They give comparison basis on power source, power transmission method, engine power etc. [4]

Subrata Kr. Mandal and his team work on soil blade interaction. For study of soil blade interaction they create soil bin. In soil bin all soil parameters like density, type of soil, moisture contain, hardness this are manually controlled. They obtained relation between moisture contain, speed, torque. [5]

Tillage is one of important operation in agriculture. In tillers rotary blades plays main function, rotary blades contact with soil in a different way than normal plows and due to this blades are subjected to fatigue and wear. So it is important to increase efficiency of blades or life of blade. Subrata Kr. Mandal, Somnath Mukherjee and Bhattacharya work on optimization of rotary blades, for this they were use different geometries of blade and its parameters. [6]

III. RESULTS AND DISCUSSION

A. Concept of Mechanism

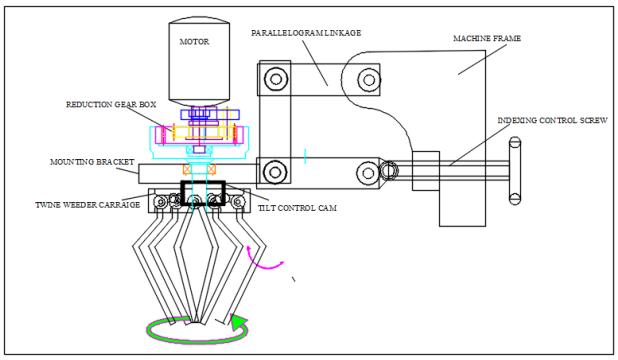

Figure 1. Design of the Kinematic linkage for weeder

Kinematic linkage design and drawing of mechanism for weeder flex- fine. Here the weeder arms or twines are developed with a special angular profile such that they approach the weed roots at an angle where in minimal force is required to remove the weed.

Working of the mechanism is such that when motor rotates the gear box drives the twine carriage such that the followers on the twines move resting against the tilt control cam which makes the twines to oscillate while rotating about central axis this action helps to reach the roots of the weeds thereby resulting in desired uprooting of weed and effective weeding.

The parallelogram linkage is used for indexing activity meaning to increase the reach of the rotary weeder to given location with help of indexing control screw.

B. Objectives of Project

1) Development of light weight agriculture rotary cultivator hoe mechanism with flex fine harrow.
2) Development of shaft mounted indexer mechanism to tilt the hoe to desired angle for ridges.
3) Development of parallelogram linkage for motion of rotary hoe to desired location for proper weeding action.

C. Scope of Project

1. Increases weeding efficiency.
2. Prevents damages to plants as proper reach of the weeder using parallelogram indexer linkage is achieved.

3. High torque of device permit weeding action effortlessly.
4. Simple system to implement.
5. Very low running cost.
6. Application to open field vegetable, horticulture, floriculture farming sector.

IV. CONCLUSION

1. Weed growth can be controlled.
2. The time and money wasted in conventional process is saved.
3. The crops damage and wastage is zero.
4. The operating cost of machine is less.
5. It is affordable to all types of farmers.
6. The inter row weed control is possible.
7. Easy to change direction of machine while working.
8. Machine is environment friendly.

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