

DESIGN AND MANUFACTURING OF MANUAL MULCHING MACHINE

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ABSTRACT

Mulching as a practice to conserve soil moisture, check weed control, moderate soil temperature and provide a microclimate to the plant is age-old. In order to improve the growing condition of crops there are various methods that improve productivity, reduces water required to grow up the crops. But mulching paper which is also known as agriculture film is one of the best methods to cover the soil and maintain the required atmosphere around the crop. This mulching paper is available in different types but plastic mulching is famous requires fewer efforts so we have decided to work on automatic mulching paper laying machine which also has an attachment for the drip laying. In dry areas maintaining moisture in the soil is very important for crop life. Mulching the plastic paper film near the root area of plants is for eliminating the rise of weeds also to retaining water and avoid de-moisturizing the soil but this process requires lots of capital and time. So 'Mulching paper laying machine with hole punching' will reduce the labour cost and time, It will do both the jobs i.e. laying mulching paper and hole punching on the ground at a time. The plastic mulch laying machine is a combination with a body, a mainframe with hoeing blades, hole punching wheels, drip role holder and punching mechanism. The machine lay the mulch in combination with the drip pipe on the prepared plantation bed. This will lay mulch on the bed without damaging of the mulch and also it will punch the holes at the required measurements. The product may be widely used for the agriculture in cultivating of tomatoes, watermelons, muskmelons, and some other hybrid variety crops. It will be effortless for the farmer by reducing the capital cost and time of laying the mulching paper using the most convenient method as well as placing the drip irrigation pipe in one pass of the machine.

Key Words: Mulch, Hoeing blades, Hole punching, Mulching Paper.

1. INTRODUCTION

Mulching is a process of covering the soil and makes more favorable conditions for plant growth and development. Mulching is the practice of covering the soil around plants to improve the growing conditions for the crop. Mulching can do with organic or inorganic materials. That aims to cover the soils and forms a physical barrier to limit the evaporation of water from the soil, automatic control of weeds, preserve a good soil structure, and protecting the crops from soil contamination. Naturally available mulches are those derived from animal and plant materials, if they are used accurately they can give all profits which a plastic mulch give. Natural mulches help in maintaining soil organic matter and provide food and shelter for earthworms and another desirable soil biota. However, natural mulching materials are not available in sufficient amounts, their quality is inconsistent, and they require more lab us for spreading. Natural mulches do not always provide sufficient weed control, they may also carry weed seeds and repeatedly slow down the soil warming in the spring season and such condition can delay the growth and ripening in warm season vegetables. To meet the growing needs of the farmers and to increase the profitability by using more efficient types of machinery in the least capital cost, the manual mulching machine can be the one. The use of plastic mulch in agriculture gives benefits such as an increase in soil temperatures, easy of weed management, moisture conversation, reduction of certain insect pests, high crop yields, and more efficient use of soil nutrients. Historically

natural mulches such as straw, compost, hay and wood chippings have been used but over the last 40 years, paper and plastics have been tried. Because of its poor wet strength and price, the paper has been found less effective and more costly than plastic. The result is that plastic mulch film the primary choice for agricultural application. Plastic mulch film is widely used on high-value crops, such as Tomatoes, Melons, Cucumbers, Squash, Peppers and Strawberries increasingly on lower value crops such as Corn and Ginger. For arable soils, the most effective conservation practices for reducing water loss through surface evaporation are those that provide some degree of surface cover for the soil. A cover can be best provided by mulches or by tillage practices that leave plant residues on the soil surface. Mulching is a long-time practice of gardeners to prevent loss of moisture and to control weeds. It is also increasing in favor as municipalities restrict the use of water for lawns and landscapes. Mulch is a layer of organic or inorganic material placed over the root zone of a plant to benefit the roots and the soil. Organic materials may include wood chips, bark, pine needles, straw, leaves, or grass clippings. Mulch changes the environment in which the plant is growing. These changes have the most influence on crop development during periods when growing conditions are less than ideal. The weather conditions that commonly result in plant stresses are low rainfall, cool air temperatures, and cool soil temperatures etc.

2. PROBLEM STATEMENT

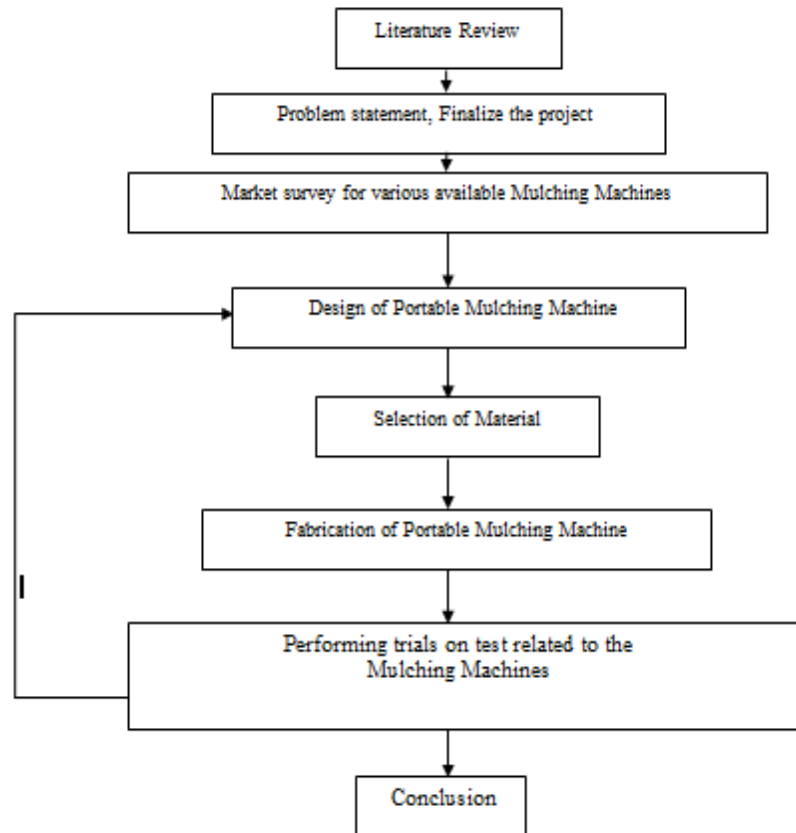
To Design the manual mulching machine which can lay the mulching paper and drill a hole and can sow a s in a single pass.

3. OBJECTIVES

1. To lay plastic mulch and punch a hole on paper in one pass.
2. To complete all above operations in minimum time.
3. To reduce the cost of machine which eventually reduces the investment of small farmers.

4. METHODOLOGY

In order to achieve our objective we have framed flow chart of our project, following are the of steps involved in it



5. LITERATURE REVIEW

Amay Tipayale et.al [1] designed an advanced mulching paper laying machine, which can lay the mulching paper on the beds of the soil as well as the drip pipe with it. This system does not need more human labour, mulching paper reduce the wastage of water and stops the growth of grass. Also in these method researchers uses some mechanical means so that working time is reduced compared to the conventional method.

Chitra Madhu Sudhan Gowd & Prof. B. Durga Prasad [2] developed a machine which lays plastic mulch at the exact position on the prepared plantation bed and secures it with soil. The laying of plastic mulch, drip pipe and hole punching will be done in one pass. The machine was developed for the mulch width of one meter length. A 100cc IC Engine was used for motion of the machine. The chain drive mechanism was used for motion transmission from the engine to the rear wheel setup.

Lawrence et.al [3] designed a pneumatic dibbling machine for plastic mulch which can be adjusted according to the hole requirements for onions and potato's. Hole placement accuracy data were collected for both onions and potatoes. The potato tests were performed for a within-row spacing of 30 cm (12 in.) and produced 96% of the planting holes within 10% of the target spacing distance. The onion tests were performed for a within-row plant spacing of 15 cm (6 in.) and produced 98% of the planting holes within 10% of the target spacing distance.

Zemanek et. Al; done Economic effectiveness of mulching machines operations. It deals with main factors influencing the decision on machine innovation. The machine is chosen on the basis of technical and economic parameters, way of utilization and external economic conditions of the agricultural enterprise. The paper presents a model solution to the choice of an appropriate machine set for mulching of inter-rows in orchards and vineyards on 5 sets determined for identical operation.

6. COMPONENTS AND DESCRIPTION

The major parts that are effectively employed in the design and the fabrication of the mulching paper spraying machine are described below:

6.1 Bearing

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is mild steel. Ball and roller bearings are used widely in instruments and machines in order to minimize friction and power loss.

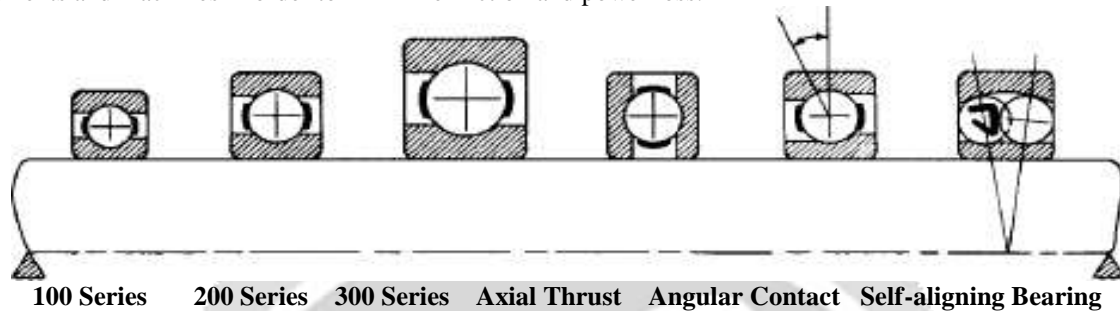


Fig.6.1 Single-Row Radial Bearings

6.2 Frame

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

6.3 Guiding Wheels and Punch Wheel

A bicycle tire is a tire that fits on the wheel of a bicycle or similar vehicle. They may also be used on wheelchairs and hand cycles, especially for racing. Bicycle tires provide an important source of suspension, generate the lateral forces necessary for balancing and turning, and generate the longitudinal forces necessary for propulsion and braking.



Fig.6.2 Guiding Wheels



Fig.6.3 Punch Wheel

6.4 Hub

A hub is the center part of a bicycle wheel. It consists of an axle, bearings and a hub shell. The hub shell typically has two machined metal flanges to which spokes can be attached. Hub shells can be one-piece with press-in cartridge or free bearings or, in the case of older designs; the flanges may be affixed to a separate hub shell.

6.5 Axle

The axle is attached to dropouts on the fork or the frame. Quick release - a lever and skewer that pass through a hollow axle designed to allow for installation and removal of the wheel without any tools (found on most modern road bikes and some mountain bikes). Nut - the axle is threaded and protrudes past the sides of the fork/frame. (Often found on track, fixed gear, single speed, BMX and inexpensive bikes) Bolt - the axle has a hole with threads cut into it and a bolt can be screwed into those threads. (found on some single speed hubs, Cannondale Lefty hubs) Thru axle - a removable axle with a threaded end that is inserted through a hole in one fork leg, through the hub, and then screwed into the other fork leg. Some axles have integrated cam levers that compress axle elements against the fork leg to lock it in place, while others rely on pinch bolts on the fork leg to secure it. Diameters for front thru axles include 20 mm, 15 mm, 12 mm, and 9 mm. Rear axles typically have diameters of 10 or 12 mm.

6.6 Spokes

The rim is connected to the hub by several spokes under tension. Original bicycle wheels used wooden spokes that could be loaded only in compression, modern bicycle wheels almost exclusively use spokes that can only be loaded in tension. There are a few companies making wheels with spokes that are used in both compression and tension. One end of each spoke is threaded for a specialized nut, called a nipple, which is used to connect the spoke to the rim and adjust the tension in the spoke.

6.7 Mulching Paper

New Biodegradable Mulching Paper. Mulch is a layer of material applied to the surface of an area of soil. It is designed to conserve moisture, improve the fertility and health of the soil and control weed growth. Soil mulching also reduces the need for pesticides, fertilizers and irrigation. The technique of mulching is the easiest practice that you can undertake for your garden that will produce unimaginable results. Mulch comes in two basic forms organic and non-organic. The most frequent items used in organic mulching are grass, straw and bark. While the most frequently used items in non- organic mulching are stones, small chips of brick and even plastic. Taking the mulching task into your own hands can save you huge costs compared to having it done professionally.



Fig.6.4 Mulching Paper laying on Bed

7. WORKING

The main purpose of the machine is to lay the mulching paper on the beds of the soil and punching the holes. It can help to reduce the capital cost and time of laying the mulching paper using the most convenient methods well placing the all operation in one pass of the machine. When the operator operates the machine by the handle and pushes it's to the front towards the bed. Though the wheels start rotating and at the same time paper is placed under the front wheels because of that the mulching paper roll is also started rotating and starts unwound. The mulching paper operated through the roller operated mechanism. As the machine moves forward the paper is also continues un-winding and lay on the beds. As we know the paper cutting wheel is mounted on the front wheel which rotates with the axle it also starts making holes on the paper and as the machine speed varies at the same rate the cutting wheels speed varies and hence the hole are made at specified fixed length at any speed. The cutting wheels are operated using the self-weight operated mechanism in which due to the gravitational force the operation of punching holes can be done. The drum provided with the hook arrangement when the punching will be done the drum will attach there when it will work the get disengaged there. After completion of the mulch paper laying process, the ploughing blade help to plough the soil on the sides of the bed that causes the mulch paper tightly hold and no chances of the get realise it will keep the paper up to 7 to 10 cm. By this process, the manual mulching machine works.



Fig.7.1 3D CAD Model



Fig.7.2 Actual Model

8. ADVANTAGES

1. Increase in Crop Yield.
2. Reduction in Weed growth.
3. A good alternative to Costly Machines.
4. Multifunction like Drip and Hole Making attachment.
5. Good crop yield in low water availability areas.
6. Simple working and easy to use and even unskilled worker can use it.
7. Prevents soil erosion
8. Manipulate light, temperature and moisture.
9. Protects the crops from insects.
10. Warms the soil for Optimum Growth of Crops.

9. APPLICATIONS

1. In the application of mulches to cultivated fields it has been customary to lay the mulches, which comprise long strips of paper of appropriate width done up in rolls, by hand to cover either the planting area of the plant rows, or to cover the area between the planting rows and, in order to prevent the mulches from being blown away by the wind or disturbed by other conditions.
2. This system is widely used in the field of horticulture.
3. Normally used in the fields of fruits.

10. CONCLUSION

The laying of plastic mulch film entails considerable time, labour expenditure and is extremely tiring. Laying of plastic mulch film by means of machines increases efficiency and results in less expenditure on labour. The increasing demand for horticultural produce and health consciousness among people it has become imperative for us to produce more as well as good quality produce to sustain in the international market. Plasticulture is crucial to Indian agriculture in view of the changing technological scenario for boosting crop yields and productivity. To minimize the time consumption and capital requirement during laying operation and to increase the efficiency, with low cost, it demands appropriate technology. Since the majority of farmers are small and marginal using the manual as a source of power, an effort he has been made to developed manual plastic mulch laying machine. The developed manual plastic mulch laying machine was fabricated for laying mulch film on the pre-prepared bed for different vegetable crops.

11. REFERENCES

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