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DESIGN AND DEVELOPMENT OF PLASTIC MULCH LAYING MACHINE IN AGRICULTURE

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ABSTRACT— The use plastic mulch in agriculture has been increased dramatically in the last 10 years throughout the world. This increase is due to the benefits such as 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. So a problem is arisen for laying mulch.

The plastic mulch laying machine is a combination with engine, mainframe with hoeing blades, hole punching wheels, drip role holder and chain drive 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.

The plastic mulch laying machine may also resolves the problem of skilled labour and time consumption of laying mulch, drip and hole punching at the exact position. This may give immediate solution in cultivating methods in agricultural sector.

Keywords: mulch, drip, hole punching, hoeing blades, weed management, high yields.

1. INTRODUCTION

Mulching is a long-time practice of gardeners to prevent loss of moisture and to control weeds. It is also increasing in favour 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.

Drip irrigation is a type of micro-irrigation that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation. Hole punching on the laid on mulch for the plantation on the prepared bed.

The developed plastic mulch laying machine will lay the mulch in combination with the drip pipe on the prepared plantation bed. This will lay without damaging of the mulch and also it will punch the holes at the required measurements.

2. OBJECTIVES

1. The laying of plastic mulch, drip pipe and hole punching will done in one pass.
2. Reduction in time consumption and number of skilled labours.
3. The cost of the developing machine is less compared to the other existing machine.
4. Developed machine will be mostly used by the farmers for producing high yield crops with the minimum investment.
5. It may gives advancement in cultivating methods for the professional growers.
6. Reducing the investment of the small farmers.

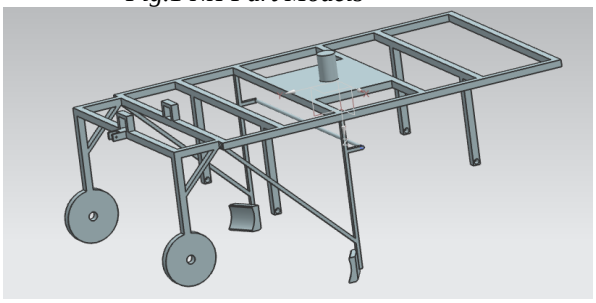
3. DESIGN OF PLASTIC MULCH LAYING MACHINE

NX (UniGraphics) is the design software used to design the Plastic Mulch Laying machine. NX is computer aided design, manufacture, and analysis feature based model software. The designer can do design, assembling-manufacture the components, and analysis of a product in a single software. The design of helmet components can

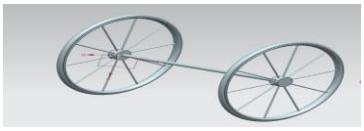
prepare individually as a part files. The individual components can be grouped in assembly workbench. The following figures show the details of individual part models and their assembled product.

3.1 Components of Plastic Mulch Laying Machine

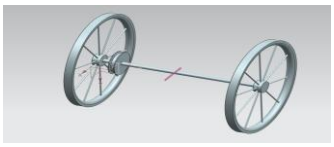
Fig.1 NX Part Models



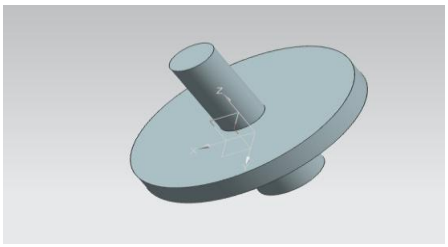
1.1 Main Frame with Hoeing Blades



1.2 Front wheel setup



1.3 Rear wheel setup

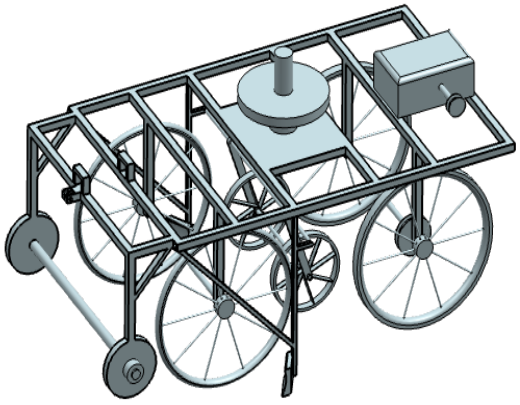


1.4 Drip Role Placing Disc

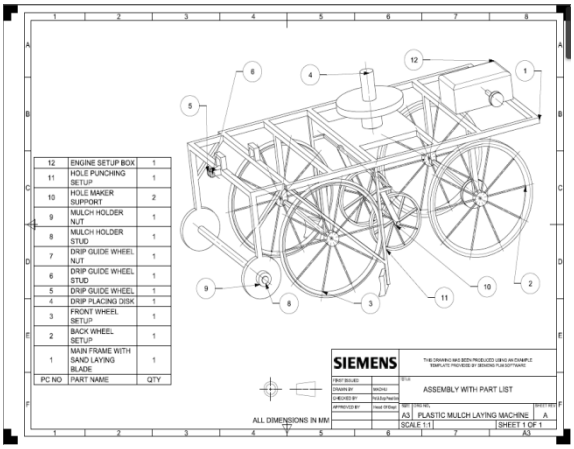
1.5 Hole Punching Setup

3.2 Assembly and Draft of Plastic Mulch Laying Machine

Fig. 2 NX Assembly and Draft Files



2.1 Assembly File



PC NO	PART NAME	QTY
12	ENGINE SETUP BOX	1
11	HOLE PUNCHING SETUP	1
10	HOLE MAKER SUPPORT	2
9	MULCH HOLDER NUT	1
8	MULCH HOLDER STUD	1
7	DRIP GUIDE WHEEL NUT	1
6	DRIP GUIDE WHEEL STUD	1
5	DRIP GUIDE WHEEL	1
4	DRIP PLACING DISK	1
3	FRONT WHEEL SETUP	1
2	BACK WHEEL SETUP	1
1	MAIN FRAME WITH SAND LAYING BLADE	1

2.2 Draft File

4. FABRICATION OF PLASTIC MULCH LAYING MACHINE

An L-angular rod is taken and welded according to the required shape as shown in the figure below. The machine is developed for the mulch width of one meter length. A 100cc I C Engine is used for motion of the machine. The chain drive mechanism is used for motion transmission from the engine to the rear wheel setup. Drip role placing disc is mounted on the top. The hole punching at required length will done by the wheel with sharpen punch mounted on diametric extreme of wheel. The key components use used in fabricating machine are L-angular rod, chain drive mechanism, I C Engine, bearings, wheel and axle etc. The operations used for fabricating machine are welding. Drilling, fitting, and finishing operations. The developed prototype of plastic mulch laying machine is shown in the following figures.

Fig.3 Prototype of Plastic Mulch Laying Machine

5. ADVANTAGES

1. The laying of plastic mulch, drip pipe and hole punching will done in one pass.
2. Drip pipe will be laid along with the mulch.
3. Hole punching will be done at the required measurements.
4. Welded frame to keep components from sliding unlike many others brands that use bolts, which can loosen and slide.
5. Easy adjustments for use with different plastic widths.
6. Operational time will be less compared with manual laying.
7. No need of more skilled labours.
8. Hoeing is not required.

6. APPLICATIONS

1. Cultivation of high yield vegetables such as tomatoes, chillies, brinjals, capsicum, and some other.
2. Plantation of fruits such as watermelon, muskmelon, and some other hybrid crops.
3. Gardening of variety of flower plants such as marigold. Rose etc.,
4.

7. CONCLUSION

The developed machine lays plastic mulch at exact position on the prepared plantation bed and secures it with soil. The laying of plastic mulch, drip pipe and hole punching will done in one pass. The Plastic Mulch Laying machine simple device which may available at low cost compared to other existing machinery. This machine may be more useful for the small-scale farmers who will concentrate on high yield variety crops.

For the professional growers the time consumption for laying of mulch, drip, and hole punching will be less by this machine. Due to this machine number of skilled labours will be reduced. Thus, the plastic mulch laying machine may give immediate solution for the advancement in the cultivating methods in agricultural sector.

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