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FABRICATION OF SOIL PULVERIZER AND BED RE-MAKER

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ABSTRACT

Agriculture is becoming critical day by day, due to urbanization and modernization availability of land is decreasing. There is need to utilize and increase fertility of available land to increase productivity of crop. So the usual maintenance of soil is required. The main purpose of maintenance (controlling weeds, managing plant residues etc.) is to create a favorable environment for the sustained growth of crop. Cultivator, Rotavator, Harrow etc. an agricultural accessories are available. Comparing with other accessories rotavator is highly efficient and simple in structure. Rotavator may have 'L', 'C' and 'J' shape. Bed re-maker is helpful for maintaining beds already formed. 'Pulverizer and Bed-remaker' perform both operations like pulverizing and bed maintenance at same time. It is of 2 feet width.

***Keywords*: Rotavator, Agricultural accessories, bed re-maker.**

I. INTRODUCTION

During growth of plant the unnecessary weed are also grown up in surrounding land. These weeds absorb nutrients from the land and also restrict the growth of plant. Because of this production of fruits get decreases. So our farmers get loss in production. Soil needs pulverization, aeration and maintenance of weeds surrounded soil for effective growth of plant.

A rotary tiller, also known as a rototiller, rotavator, rotary hoe, power tiller, or rotary plough, is a motorized cultivator that works the soil by means of rotating tines or blades.

In the cultivation of small fruit plants, weed removal is one of the main problems. There is no weed remover that is conveniently available in the market for removing weeds. So weed removing takes place manually. But this process takes more time and not economic also. To overcome this problem we have planned to fabricate one agrigarden machine for removing weeds with one more facility of bed re-making.

Rotavator stir and pulverize the soil, either before planting or after the crop has begun growing. Rotary tiller is a tillage machine designed for preparing land suitable for sowing seeds (without overturning of the soil), for eradicating weeds, mixing manure or fertilizer into soil, to break up and renovate pastures for crushing clods etc. It offers an advantage of rapid seedbed preparation and reduced draft compared to conventional tillage. It saved 30-35 % of time and 20-25 % in the cost of operation as compared to tillage by cultivator. It gave higher quality of work (25-30 %) than tillage by cultivator.

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The Rotavator is the most efficient means of transmitting engine power directly to the soil with no wheel slip and a major reduction in transmission power loss. A rotavator is a mechanical gardening tool with power blades attached to a spinning surface to plough soil and give optimum tillage. Different rotavator are designed to suit different gardening needs.

For pulverizing rate, different pulverizing evaluation indices of various soils are mainly obtained by means of experiments, which did not form a very complete theoretical system and had limited guiding significance to actual operation In order to understand the influence of tool design parameters and the influence of soil conditions on performance, Gill and Vanden Berg (1968) emphasized that mathematical description of the tillage process can be accomplished only when all the elements of the tillage process are expressed quantitatively.

The Bed Maker is a simple implement used in the making of beds for accurate and efficient plantation of crops. Whereas Bed Remaker is used to push the tilled soil towards crop which helpful to maintain the blade. Our system named as 'soil pulverizer and Bed-remaker' will performs both works at a time in cash crop farms to maintain the soil.

II. PROBLEM IDENTIFIED

The challenge of fabricating rotavator or soil pulverizes for agricultural purpose is that its design must be according to tool geometry, soil properties, etc. Rotavator blades come in so many different sizes and shapes. As a result, a design must follow the forces acting on soil tillage tools in relation to tool geometry, physical properties and the nature of soil disturbance ahead of the tool (Godwin and O'Dogherty, 2006; Gill and Vanden Berg, 1968).

2.1 Design Details

Design a shaft of diameter- 24 mm

Design a shaft of length- 610 mm

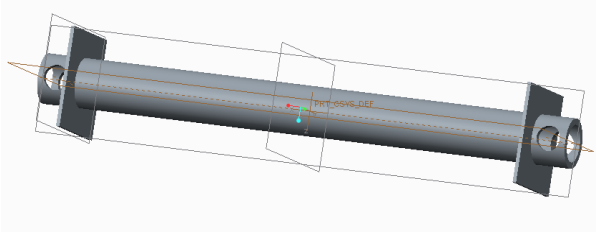

Fig 1: Shaft

Design a blade of thickness- 1mm

Design of length of blade- 180mm

Design of width of blade- 40mm

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Fig 2: Blades

Design a rotavator

Fig 3: Rotavator

Design width of bed re-maker- 520mm

Design working height- 340mm

Fig 4: Bed-remaker

2.2 Material Properties

The materials are taken from the manufacturing database of rotavator production system specification drawn by industry. Following are few properties of mostly used materials.

S. No.	Material Name	Elastic Modulus (N/mm^2)	Poisson Ratio	Design ($tone/mm^2$)
1	High Carbon Steel	1.97×10^{11}	0.29	7.48×10^{-9}
2	Cast Iron	1.20×10^{5}	0.28	7.20×10^{-9}
3	Mild Steel	2.10×10^{5}	0.3	7.89×10^{-9}

III. WORKING

It is a combination of both 'Rotavator' and 'Bed re-maker'. Rotavator is use to pulverize the soil upto 2" due to rotary motion. Rotavator is driven by chain drive which is attached to the petrol engine(IC engine). Rotation of rotavator is controlled by means of accelerator. The forward rotation of rotavator used to till the soil as well as it help to moves in forward direction. The working width of rotavator is adjustable. The position of bed-remaker is exact behind of the rotavator. Bed-remaker used to maintain the beds. Mounting of v-shape bed re-maker is exactly behind of the rotavator which used push the tilled soil towards crops.

Fig 5 : Overall View Of Pulverizer And Bed-Remaker

IV. CALCULATION

Chain and sprocket 's calculation

Design Power =Pr *Kl

Pd = 7.7*1.2 (for moderate shock and 10 hr duty)

= 9.24 Hp

N_1=1000rpm , N_2=300rpm T_1=23

Chain no.=50 , pitch=15.875

Pitch Dia. Of spr. (Dp_1) =P/sin(180)/T

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=9.24/sin(180)/23

=67.85 mm

Vp.=3.14*D*N/60

=3.14*67.85*1000/60

=3.55 m/s

Teeth on second sprocket (T_2)=T_1*N_1/N_2

= 23*1000/300

=76

Pitch Dia. Of larger sprocket(Dp_2) = P/sin(180/T_2)

=9.24/sin(180/76)

=223.59 mm

Length of Chain (Lp) = T_1+T_2/2 + 2C/P + P(T_1+T_2)/40C

=23+76/2+2*609/9.24+9.24*(23+76)/40*609

= 185 mm

Outer Dia. Of smaller sprocket = P*[0.6+cot(180/T_1]

= 9.24*[0.6+cot(180/23]

= 72.76 mm

Outer Dia. Of larger sprocket = 9.24*[0.6+cot(180/23)]

= 228 mm

Width of Sprocket = 0.56*P – 0.15

= 0.56*9.24 – 0.15

= 5.02 mm

Torque = 60*P*Kl/2*3.14*N

T = 60*9.24*746*1.5/2*3.14*300

= 329 Nm

Power = 2*3.14*T*N/60

= 2*3.14*329*300/60

= 10.304 Kwatt

V. CONCLUSION

In this paper, an agricultural equipment known as rotavator is studied with reduced size, L-shaped blades and one additional facility of bed re-making. The various analyses were made on the rotavator to determine the various stresses acting on it. Before conducting the trial, soil properties, material properties, analysis of each part, were made. After trial it helps to evaluate the stresses acting on blades which used to solve the problems identified.

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