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Modification of Rotavator and Bed Re-Maker

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Abstract: ***India is an agriculture country from eairlier. In Indian farming, the preparation of seedbeds for deep tillage using additional machinery and tillage tools are increased. Rotary tiller or rotavator is one of the tilling machine most suitable for seedbed preparation. In a Rotary tillage machine blades are critical parts which are engaged with soil to prepare the land and mix to fertilizer. The present working model with tillage blade is analyzed to new design constraints with change of its geometry for the maximum weed removal efficiency by presenting its practical results. There is need to utilize and increase fertility of available land to increase productivity of crop. In this machine added the extra part such are adjustable wheel, bed re-maker shape, height of silencer, clearance between two blades etc. due to that the problems in existing model had overcome. So the usual maintenance of soil is required .The main purpose of maintenance (controlling weeds, managing plants residues etc.) is to create a favorable environment for the sustained growth of crop. From the field performance. Design modification and analysis of rotavator blades [1]. Variations of torque and specific tilling energy for different rotary blades [2]. Preliminary investigations in to the performance of different shaped blades for the rotary tillage of wet rice soil [3]. Design of tillage tool. In soil dynamics in tillage and traction [4]. 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 useful for maintaining beds already formed. 'Pulverizer and Bed re-maker' perform both operations like pulverizing and bed maintenance at same time. It is of 1.5 feet width.***

Keywords: Rotavator, rotary tillage tool, design analysis, stress, deformation, Agricultural accessories, bed re-maker.

I. INTRODUCTION

Now a day's Indian farmers are unhappy about money spent for soil bed preparation because of raise in fuel price and rotavator blade replacement cost. So the farmers focused more in reducing the land preparation cost and increase in yield. The rotavator tiller is mainly used in agriculture for loosening of upper layer soil to create seedbed. The rotavator has higher soil mixing capacity compared with other plough machine and it has good weed cutting capability and it lead to the water-air, thermal and nutrient of the soil is improved. The rotavator can be easily adjusted for various working depths for soil bed preparation. Rotary tillage machine which is used in soil-bed preparation and weed control in arable field and fruit gardening agriculture. Blades are main parts of rotavator, which directly engage with the soil to prepare the seedbed for cultivation plant. Many types of rotavator blades are available in market.

Those are C shape, L shape, J shape. The L- shaped blades are better when compared with C or J type blades. Because the L-shaped blade is most widely used in the agriculture land. During growth of plant the unnecessary weed are also grown up in surrounding land. These weeds absorb some nutrients from the soil and also reduces the growth of plant. Because of this production of fruits get decreases. So our farmers gets loss in production. Soil needs pulverization, aeration and maintenance of weeds surrounded soil for effective growth of plant.

To overcome such type of problem we have planned to fabricate one agrigarden machine for removing weed 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 suitable land for sowing seeds, for eradicating weeds, mixing manure or fertilizer into soil, to break up and renovates pastures for crushing clods ect. The rotavator is the most efficient mean 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. The bed maker is a simple implement used in the making of beds for accurate and efficient plantation of crops.

Whereas bed remake is used to push the tilled soil towards crops which helpful to maintain the bed. Our system named as 'MODIFICATION OF ROTAVATOR AND BED RE-MAKER' will performs both operations i.e. pulverizes the soil and bed for crops at a time in cash crops farms to maintain the soil.

II. IMPLEMENTATION

From the observation on the blades failure, vibration, exhaust height, soil pulverizing depth etc, it is understood that all the problems are related to material property of blade and design of rotavator. The problem are due to uneven loads and forces.

A. Design Details

Design a shaft of diameter - 25 mm
Design a shaft of length - 60 mm
Design a blade of thickness - 4mm
Design of length of blade - 150mm
Design of width of blade - 25mm
Design widh of bed re-maker - 304.8mm
Design working height - 310mm

B. 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.

Sr. No.	Material Name	Poisson Ratio	Elastic Modulus (N/mm^2)	Density (Kg/cm^2)
1	High Carbon steel	0.2	1.97×10^{-5}	7.48×10^{-9}
2	Cast Iron	0.28	1.20×10^{-5}	7.28×10^{-9}
3	Mild Steel	0.3	2.10×10^{-5}	7.89×10^{-9}

Table B.1 :- Material Properties

Sr. No.	Type of soil	Soil resistance(kg/cm^2)	Optimum moisture content(%)
1	Sandy soil	0.2	3.5
2	Sandy loam	0.3	5.8
3	Silt loam	0.35-0.5	5.8
4	Clay	0.4-0.56	7.18
5	Heavy loam	0.5-0.7	13.30

Table B.2 :- Soil Properties

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C. Rotavator Assembly

It consist of following parts

1) *Chassis :* A chassis is the frame or structure that support are affixed to the rotavator, wheels and bed re-maker. It sustain the load of whole body and engine it absorb the vibration of the rotavator.

Fig. :- Chassis

2) *Blades :* The L-shaped blades will be most common due to L-shaped is usually superior to other in heavy trash. They are better for killing weeds. The material composition of tine is generally carbon (0.52%), manganese (0.72%) and silicon (1.56%).

Fig. :- Blades

3) *Bed Re-maker :* Bed re-maker used to maintained the furrow space between the bed. Also tilled the soil create by the rotavator push by the bed re-maker to the either side of the crops. The fig. shows the V-shape design of bed re-maker which affixed behind the chassis.

Fig. :- Bed Re-maker

4) *Casing :* Casing is one of the type of cover provided over the rotavator tool component. If to overcome the action of spreading soil, casing is needed to provide over the rotavator tool and also reduces the chances of human hazard.
5) *Adjustable wheel :* The adjustable wheel is provided placed before the rotavator tool to adjust the height of rotavator to reduces the friction action of rotavator blades with road surface and also guiding the forward path to the rotavator.

Fig. :- Adjustable Wheel

6) *Adjustable depth skid :* It is fixed on the adjustable frame to fix up a distance a gap between soil and blade contact i.e. depth skid.

Fig:-Adjustable Depth Skid

D. Working

Rotavator is a rotary tiller has tillage tool with sharp edges which are empowered by chain drive through which rotary motion of engine shaft transmitted to rotary tiller. The rotary tiller rotated at 314 rpm which is best suited as the requirement. Rotavator is needed to pulverize the soil upto desired level (i.e. upto 2”). Rotavator is the machine designed for preparing land suitable for sowing seed due to rotary motion of tiller tool. Rotational speed 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 forward direction is guided by the adjustable wheel which placed just front of the rotavator. The adjustable wheel also make the machine travelable. The working width of rotavator is adjustable. The position of bed-remaker is exact behind of the wheels of the rotavator. Bed-remaker used to maintain the beds. Mounting of v-shape which used push the tilled soil towards crops. When the engine starts running the rotating movement of the engine shaft transmitted to the rotavator blades through the chain drive. The blades are situated on the flange which is mounted on the front axle (shaft of rotavator). The speed of rotavator increasing and lowering through the accelerator provided on handle which can controlled by operator. Due to which rotavator rotated and move forward and it pulverizes the soil upto required depth.

Fig:-Modification of rotavator and bed-remaker

E. Calculation

Chain and sprocket calculation

Design Power (Pd) = $Pr \times K_1$

= 7.1×1.2 (for moderate shock and 10 hr duty)

= 8.52HP

N_1 = 930rpm, N_2 = 314rpm, T_1 = 17

Chain no.=50, pitch=15.875

Pitch Dia. Of spr. (Dp_1) = Pitch(P)/sin(180/T_1)

= 15.87/sin(180/17)

Dp_1 = 86.39 mm

Vp.=$3.14 \times Dp_1 \times N_1/60 \times 1000$

= $3.14 \times 86.39 \times 930/60 \times 1000$

= 4.20 m/s

Teeth on second sprocket (T_2) = $T_1 \times N_1/N_2$

= $17 \times 930/314$

T_2 = 50

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

= 15.875/sin(180/50)

Dp_2 = 252.82 mm

Length of Chain (Lp) = $T_1+T_2/2+2C/Pitch+Pitch(T_1 - T_2)^2/40C$

Where, $\theta = \pi - (Dp_2 - Dp_1)/C$

$\theta = 120 \times \pi/180 = 2.09$ rad

$\theta = \pi - (Dp_2 - Dp_1)/C$

$2.09 = \pi - (252.82 - 86.39)/C$

C = 158.26mm

Let,

C = Dia. of larger sprocket +1/2×Dia.of smaller sprocket

$C_{min} = Dp_2+1/2 \times Dp_1$

$C_{min} = 252.82+1/2 \times 86.39$

C_{min} = 296mm

Lp = $17+50/2+2 \times 296/15.875+15.875 \times (17-50)^2 /40 \times 296$

Lp = 72.25mm

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

= 15.875×[0.6+cot(180/17]

= 94.44mm

Outer Dia. Of larger sprocket = 15.875 × [0.6+cot(180/50)]

= 261.85mm

Width of Sprocket = 0.58×P – 0.15

= 0.58×15.875 – 0.15

= 9.05 mm

Torque (T) = $60 \times P \times K_l/2 \times 3.14 \times N_2$

= $60 \times 6.35 \times 1.5/2 \times 3.14 \times 314$

= 289 N-m

Power = $2 \times \pi \times N_2 \times T/60$

= $2 \times \pi \times 314 \times 289/60$

= 9502.89 watt

= 9.502KW

III. CONCLUSION

In this paper, design of rotavator blade is investigated and design modification are done by introducing shape, size, cutting edge of the blade. Hence, the problems on the blade were identified and solved. By changing the design of rotavator blade we can increase the working hours of the blade and by using and by different material we can increase the wear resistance of the blade. It is observed that it carefully breaks the surface's crust to improve water, air and nutricent penetration and absorption. This helps the crops to their growth 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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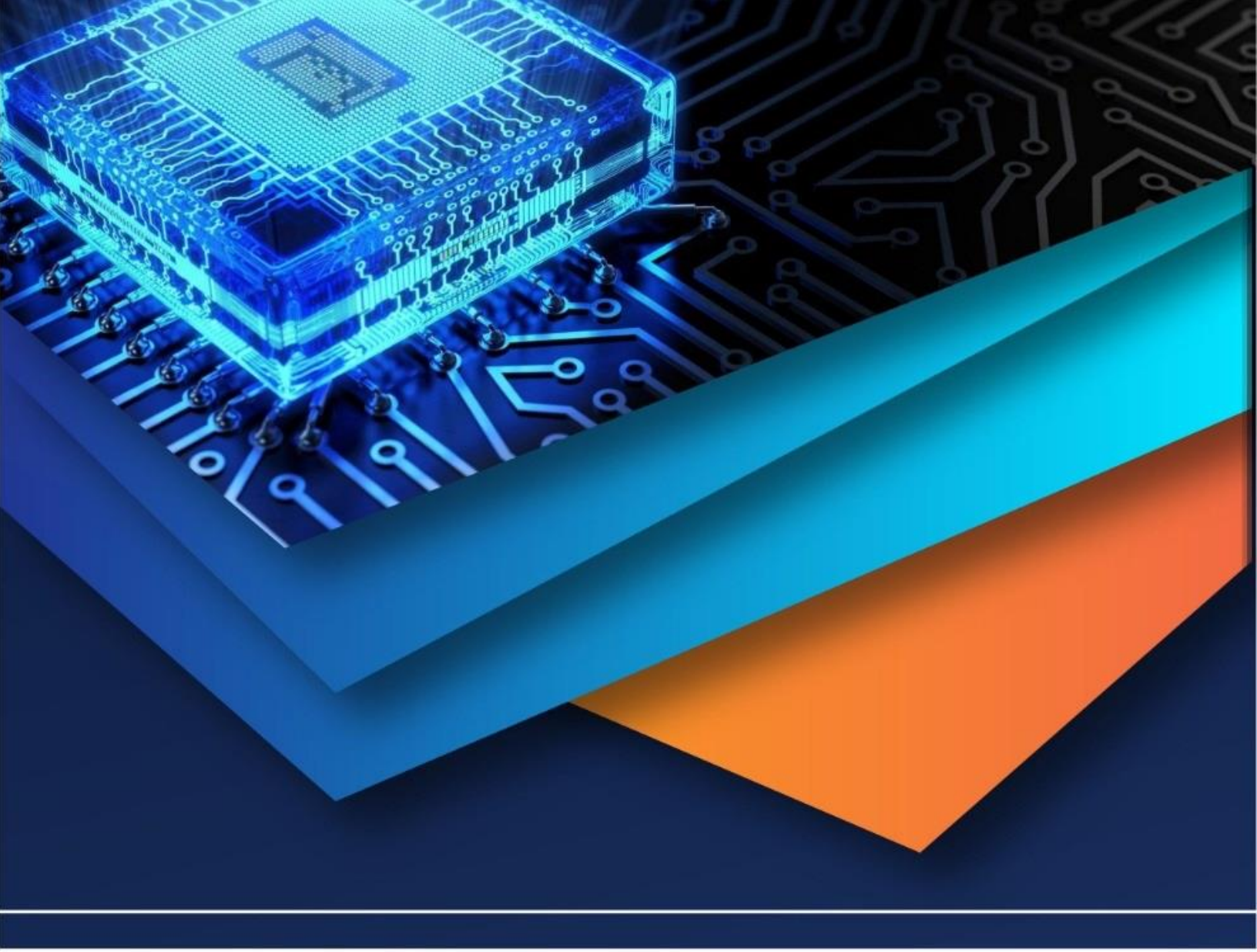
REFERENCES

[1] Jeevarathinam.A & Velmurugan.C (2014). "Design modification and analysis of rotavator blades", Journal of Mechanical and Civil engineering, pp.4350
[2] SirisakChertkiattipol, Tanya Niyamapa, "Variations of torque and specific tilling energy for different rotary blades", International Agricultural Engineering Journal, 2010.
[3] Beeny, J.M., and D.C. Khoo. (1970). "Preliminary investigations in to the performance of different shaped blades for the rotary tillage of wet rice soil". J.Agric. Engg. Res, 15(1):27-33.
[4] Gill, W.R., and G.E. Vanden Berg. (1996). "Design of tillage tool. In soil dynamics in tillage and traction". 211-294. Washington, D.C.,U.S.GPO.
[5] Zhang Libin, Jiang Jiandong, Li Yanbiao, "Agricultural rotavator power requirement optimization using multi objective probability parameter optimization", International Agricultural Engineering Journal,2008.
[6] Arline S. Rutherford, "Broad Bed maker Technology Package Innovation in Ethiopian Farming System", International Livestock Research Institute, 2008.
[7] Sirisak Chertkiattipol, Tanya Niyamapa, "Variations of torque and specific tilling energy for different rotary blades", International Agricultural Engineering Journal, 2010.
[8] Sirisak Chertkiattipol, Tanya Niyamapa, WanwisaJantaradach, and KridsadaSaensuwan, "The performance of rotary power tiller using prototype rotary blades in dry-land field", Maejo International Journal of Science and Technology, 2008
[9] Jeevarathinam.A, Velmurugan.C, "Design Modification and Analysis of Rotavator Blade", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE).



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