Design and Fabrication of Power Operated Tiller Machine

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Abstract:-Weed control is one of the most difficult tacks on anagricultural farm. Three method of weed control are commonly known in agricultural. These are mechanical, chemical and biological control. Due to chemical control method soil get polluted and it is harmful to our body. Biological method is less effective than other method so these methods are not useful. Mechanical weed control not only uproots the weeds between the crops rose but also keeps the soil surfers loose, ensuring better soil aeration and water intake capacity weeding by power tiller reduce the cost of labor and also save time. Various type of mechanical weed has been developed. In human operated weed muscular power is required and so it cannot be operated for long time. The Traditional method of hand weeding is time consuming. In order to assess the possibility of mechanization of weeding operation, the power operated has to be produced the power produced by us is lesser in cost less time consumable easy to operate.

Keywords*: Rotary, Tiller blades, Soil, mechanical, weeding.*

1.INTRODUCTION

India being farming major, the need for modern technologies in agriculture routines is undisputed. Power tiller are engine operated low power machine used for bed preparation. They are compact, handy and medium duty machine. Currently, power tiller of capacity 8 hp-10 hp and weighting up to 350 kg are widely manufactured across the country. The power tiller presented in this project is specializing in weeding operation, suitable for black soil of sugarcane cultivation. This project deals with design and development of Chain and Sprockets, Shafts, Belt Drives, Bearing, Transmission Case and Chassis etc. to change the engine speed to tilting speed of the Power Tiller **.** This power tiller that we present here in this report is meant for operation of weeding in sugarcane farms with minimum inter row distance of 1.2 meters. This machine is easy to operate, cheap, portable and simple in construction and maintenance with easily available spare [4].

2.LITERATURE REVIEW

Prof. Patil digvijay pandurang "Mechanical Power Weeder Design and Development'' They found that the plants growing when not required will affect the life of the other plans as a result turns in to the failure of the farmer. In India, major percentages of people are dependent on the farming for even their day to day expenses. Every stage of the farming has several reasons for failure and must be completed in the specified time for effective cultivation.The complete design stages of the machine have been discusses in this paper. The machine will found useful for the farmers due to cost effectiveness. [1]

Prof.Shabbir.J et al "Design,Devel1opment and fabrication of mini cultivator and tiller" Form this research paper we find that main advantage of this technology was that any farmer in India can easily handle this mini cultivator.As increasing the traction and torque for tilling process achieving by depth of 4-7 inch. The transportation of tiller can be replaceable to bladed wheel with normal tyre. This machine was affordable to farmers and capable of performing multifunction like Plowing, Differential Cultivation, Wrapper, and Pudding etc.[2]

Prof Aravind Raj et al. " Design and Fabrication of Rotary Tiller Blade'' In this paper they found that working width and optimal diameter of rotary tiller proportionate to the power tiller. They are tried to achieved the maximum field efficiency for the rotary tiller and to reduced the consumed materials in the manufacturing of this machine. These rotary tiller having width of 70 cm with 3 flanges on the rotor shaft & four blades on each flange. The power tiller only pull the rotary tiller at first heavy gear. The optimal value of rotor's diameter

considering the values of maximum tangent force determined about 3.94 cm. This paper presents a theoretical method for rotary tillers design [3].

Prof Abhijit garje. et al."Design, Development and Operation of 3.5HP Power Tiller " In this paper they studied that machine chain and sprocket are used for power transmission whereas in other machines gears are used for cost reduction. As machine was simple in construction, accurate manufacturing and standard components are used, so machine required less maintenance. It was designed on the basis of optimum material consideration. The working capacity of this machine was 2.5 Acre per day.Petrol requirement for per day is 10 litters. Single operator can operate this machine easily [4]

Prof Wagmode R.S. et al. "Solar Power tiller" This paper content solar energy other than fuel Now-a-days fuel prices increases with increase in pollution. This project is design and developed for controlling this pollution and to save the fuel products. Initial investment of this system is high, but it is very ecofriendly.[5]

3. Objectives

1. Design Power Operated Tiller Machine.

2. Fabrication of Power Operated Tiller Machine.

3. Make Adjustment For Seed Sowing on Power Operated Tiller Machine.

4. FRAME MODEL

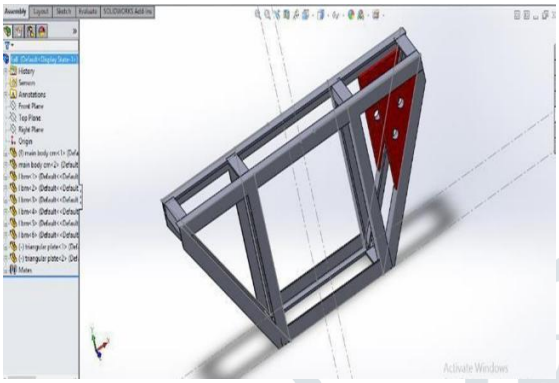

Fig.1.Frame Model

5. DESIGN

5.1 Assumption

5.1.1 Power requirement

Assumption for power requirement is as follow

Soil resistance has a considerable effect upon the power requirement of tiller. Also width of cut and speed of operation influences power requirement of tiller. For calculating power requirement of the tiller, maximum soil resistance was taken as 0.8 kgf/cm^2. The speed of operation of the tiller was consider as 0.7m/s to 1m/s. Total width of coverage of tilling blades was in the range 20 to 30 cm. The depth of operation was consider as 5 to 8 cm. transmission efficiency is 79% Power developed = hp

Where,

SR= soil resistance, N/m^2

d = depth of cut, m

W = effective width of cut, m

V = speed of operation, m/s

Soil Resistance (S.R) = 0.8

Kgf/cm^2 =78480 N/m^2

Hence power requirement is estimated as

Pd=2.5248 hp

Total power required

Pt =

Pt= 3.1959 hp =2.3831 kW

The total power required for power tiller 3.1959 hp i.e.3.5 hp 5.2 *Design Calculation*

5.2.1 Diameter of flexible shaft

For designing of rotor shaft, the maximum tangential force which can be endured by the rotor should be considered.

The maximum tangential force occurs at the minimum of blades tangential speed is calculated by following maximum tangential force

f_t=

Where,

Ft= maximum tangential force, kg,
cs= reliability factor,
Nc= power of engine in hp,

c= traction efficiency for the forward rotation of rotor shaft as 0.9,

z= coefficient of reservation of engine power (0.7-0.8), u= minimum tangential speed of blades, u=

u =1.47445 m/s

Where,

N = Revolution of rotor, rpm,
and R = Radius of rotor, cm.
Ft=73.24 kg

After substituting values for revolution of rotor shaft (176 rpm) and its radius as 8 cm in above equation, tangential peripheral speed was obtained as 1.47445 m/s. Using the tangential peripheral speed and other parameters in equation and the maximum tangential force was determined to be 73.24 kg.

The maximum moment on the rotor shaft (M_s) is calculated through the following:

M_s= Ks * R
M_s =73.24 * 8
M_s =585.92 kg-cm
In the above equation, R is the rotor radius (cm).

The yield stress for rotor is made by rolled steel (AISI 302) was 520 MPa. The allowable stress on the rotor (τall) was calculated by the following equation τ_{all}=

Where,
τ_{all} = Allowable stress on rotor shaft, kg/cm^2,
k = Coefficient of stress concentration (0.75),

f = Coefficient of safety (1.5), and σ_y = Yield stress, 520 MP

$\tau_{all=150.02\ MP=\ 1530.6\ kg/cm^2}$,

By substituting above values in the following equation, rotor shaft diameter was calculated as:

D=12.492=14 mm

In order take into account fluctuating load during the operation, diameter of the rotor shaft was selected higher than the calculated value as 14 to 16 mm.

6. SCOPE

1. The farmers need alternatives for weed control due to desire to reduce chemical use and production cost. For some crop situation there are no selective herbicides. Since hand weeding is costly, an automated system could be feasible and mechanical weed control system can reduce or eliminate the need for chemicals. Currently no such a system exist for removing weeds located in the seed line between crop plants.

2. Biological control can be used for insects that damages the health of the weed. Plant, animal and micro-organisms may be used for destruction of weeds. This method rquire more time to work so this method not suitable for weed control.

3. Manual control is the use of the hands or handheld tool to deals with weeds extensive amount of cheap manual labor is necessary for manual weeding.

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