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Mechanical portable power weeder machine

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Abstract
Agriculture is the backbone of Indian economy and weed removal is one of the major activities in agriculture. Weed control is the one of the most important problem that will reduce the farmer interest to continue cultivation. The farmer acute labor shortage, decreasing income per acre of cultivation, and economic frustration are some of the key factors hurting a farmer's confidence in continuing farming. Hence mechanical weeder is necessary to reduce the labor force. Environmental degradation and pollution caused by chemical is reduced by the use of Mechanical weeder. We have developed mechanical power weeder. The design and manufacturing process of mechanical power weeder is explained in this paper.

Keywords: Mechanical weeder, weed, cultivation, chemical weeding

1. Introduction
Weed control is becoming an expensive operation in crop production. Majority of Indian farmers use hand-hoe for weeding which requires 40-60 laborers for weeding one hectare of land. The effects of various shapes of blades of bullock-drawn blade harrow on depth of operation, weeding efficiency and crop yield was studied. Six different blade shapes viz., convex, concave, 1200 V shape, 1600 V shape, serrated edge and Tyne cum blade were compared with straight blade. Maximum draft of 450 mm wide blade harrow was 286N. Power requirement of the blade harrows was 0.20-0.27 kW. Human energy predominantly used one other for almost all operation in Indian agriculture. Even in specialized operations rice transplanting, horticultural plantation of crops, hoeing and weeding, picking of cotton, human power is still only source of energy.
Mechanical weeding is preferred to chemical weeding because weedicide application is generally expensive, hazardous and selective. Besides, mechanical weeding keeps the soil surface loose by producing soil mulch which results in better aeration and moisture conservation. Keeping in view of the above facts, an engine operated weeder is designed, developed and tested in field.
Low effective operation, low work effort and high time requirement for different types of hoe or cutlass, can be overcome with the use of mechanical weeder. There is an increasing interest in the use of mechanical intra-row weeders because of concern over environmental degradation and a growing demand for organically produced food. Today the agricultural sector requires non-chemical weed control that ensures food safety.

2. Objectives
1. The objective of the project is to design, construct and test automatically operated portable weeder, to provide the best opportunity to farmer's to easily control and removing the weed from farm.
2. Weeding with the use of tools like cutlass and hoe requires high labour force in a commercial farming system hence mechanical weeder is necessary to reduce the labour force.
3. Environmental degradation and pollution caused by chemical is reduced by the use of Mechanical weeder. Low effective operation, high work effort and high time requirement for different types of hoe or cutlass, can be overcome with the use of mechanical weeder.
4. Presently in India, weeding with simple tools such as cutlass, hoe etc. is labour intensive and intensive and time consuming. Thus, there is a need for the design of manually operated weeder for intensive and commercial farming system in India.
5. For this study we are developed mechanical power weeder by power of TVS engine

3. Components of the Portable Power Weeder Machine
Various components images used for manufacturing for mechanical power weeder is shown

I.C Engine

Engine type: 4 Stroke,
Displacement: 109.7 cc,
Maximum Power: 6.1 KW @7500 Rpm,
Maximum torque: 8.1 NM @ 5000 Rpm
Bore x Stroke: 53.5 MM x 48.8 MM,
Compression Ratio: 9.45:1,
Transmission: 4 Speed Constant Mesh,
Weight: 27 Kg.

Fig 1: Four stroke I.C engine

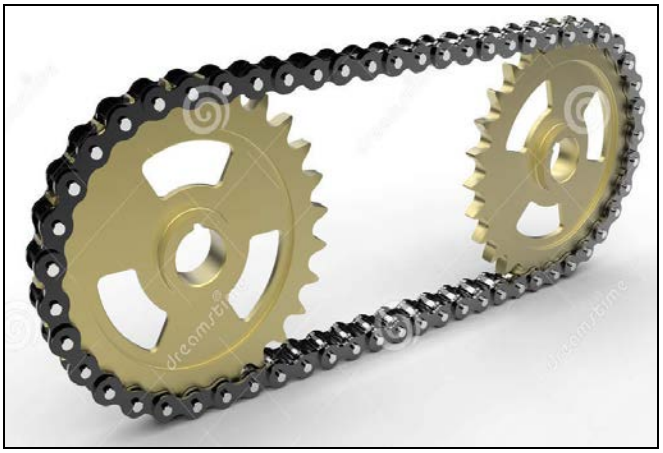

Fig 2: Chain with sprocket

Fig 5: Carburetor

Fig 3: Deep groove ball bearing

Fig 6: Weeding Tool (a)

Fig 4: Fuel Tank

Fig 7: Weeding Tool (b)

Table 1: Brought out items

S. No	Particulates	Quantity	Material
1	IC Engine- TVS star city (110cc) Power 6.1 KW@7500rpm	1	-
2	WHEEL-Diameter(d)= 340 mm Width(b)= 80 mm	2	Rubber
3	Fuel tank (Capacity – 4 lit)	1	-
4	Bearing	2	Case Hardened Steel
5	Chain- Length(L)= 880 mm	1	Carbon Steel
6	Chain Sprocket, Diameter(D)= 144mm	1	Alloy Steel 55c8
7	Control's-Clutch, Brake, Gear shifting lever	1	-

4. Assembly of Power Weeder Machine

Fig 8: Portable power weeder machine

1. Assembly of machine consist the mounting of engine on the frame & chassis is mounted on wheel. Then the engine is assembled on chassis by using nut, bolt & somewhere by weld.
2. Manufacturing of engine includes following procedure, Blades are cut by grinding cutter & Bending of blade is done manually. These blades are attached with the frame by adjusting setting.
3. Chain is fitted between sprocket of engine shaft and wheel shaft sprocket.
4. The gear box is made according to speed reduction ratio of wheel & then larger pulley is fixed on the frame with engine fitting.
5. Fuel tank of capacity 3.5 liter is fitted on chassis on the top of engine by using strips.
6. Round pipe is used for the handles with required dimensions & Accelerator is fitted on handle & connected to carburetor by using wire.
7. Switch & electrical connections are made for on/off the engine & Switch is mounted on handle of machine.

5. Calculations for Power Required To Power Weeder Machine

Power required to weeding blade

Power = Soil resistance × Area × Velocity

Soil Resistance (S.R) = 1.05 Kgf/cm^2

$= 1.05 \times \frac{9.81}{0.0001}$ N/m^2

= 103005 N/m^2

Area (A) = Depth of Cut (mm) × Width of Cut (mm)

= 5 × 0.25

= 27.5 ×10^{-3} m^2

Linear Velocity (V) = $\frac{\pi DN}{60} \times \mu$

Where,

μ = Coefficient of Friction = 0.1

N = 500 R.P.M.

Linear Velocity = $\frac{\pi \times 340 \times 500}{60 \times 1000} \times 0.1$

= 0.89117 m/s So,

Power = Soil resistance × Area × Velocity

Power = 103005 × 27.5 × 10^{-3} × 0.89117

= 2524.38 W

= $\frac{2524.38}{746}$ hp

= 3.3838 hp

Total Power

$P = \frac{Power}{\eta}$

$= \frac{3.3838}{0.80}$

= 4.22 hp

Where,

η = Transmission efficiency.

Power required for wheels

Power required for wheels is determined using Air Resistance and Rolling Resistance

So, Power required for wheels is 0.031 hp

Total power required for weeder machine is,

$P_{total} = P_{Blade} + P_{Wheels}$

= 4.22 + 0.031

≅ 4.25 hp

So, maximum power required considering some accessories power and losses,

P_{total} ≅ 4.25 hp

6. Cost Summary

Table 2: Cost Summary

S. No	Particulates	Cost (Rs)
1	Brought out items	13260 /-
2	Raw material cost	1760 /-
3	Fabrication	4510 /-
Total		19530 /-

7. Results and Discussion

1) Time required to weeding of 1 Acre area is 30 minutes, For 750 ml of fuel consumption.
2) The average weeding capacity of machine is 1.5 Acre area and time required for 1 liter fuel consumption is 45 minutes.
3) Machine works for 3 hours and 30 minutes once the fuel tank is fully filled.
4) Machine weeds 5.30 Acre area for whole fuel consumption (i.e. 4 liter).
5) Weeding efficiency of this machine is 80 %.

8. Conclusion

(a) We have developed mechanical power weeder using 4 stroke TVS engine. We have predicted actual performance of these machine and found satisfactory results. These machine is useful for indivisual farmer's
(b) Weed removing and collecting machine add the modernization in the agricultural field. This machine will make the farmers becomes independent and not rely on the laborers for removing weed.
(c) Only one person can efficiently operate this weeding machine.
(d) It takes less weeding time compared to manual weeding.
(e) Deeper working depth and a slow travel speed can achieve good weed control.
(f) It is portable weeder system which can be driven by manually or automatically.

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