DESIGN AND FABRICATION OF COTTON STALKS
CUTTING AND CRUSHING TOOL FOR POWER TILLER

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Abstract

In the present agricultural world there is a requirement for speedier rate of creation in agrarian. As we probably are aware Agriculture is the foundation of India. In India all agriculturists confronting issues of work lack. Step by step work compensation is expanding. In India Cotton crop is developed in large amount. In the wake of yielding of cotton, the primary issue look by the agriculturists is to cut the cotton stalk. Presently a day what farmers did is cut the cotton stalk physically gather at one place and wait till the stalk get dry and after that consume that harvest. This process consume large amount of time and manpower. So our aim is to design and fabricate a power tiller operated tool which can cut and pounded of cotton stalk. In the wake of smashing the squashed yield spread on the farm. With the goal that this squashed yield is dumped into the soil and it utilized as natural manure. So profitability of soil will expand.

Keywords- cutting, power tiller, crushing, cotton crop, productivity of soil.

1. Introduction

Cotton is one of the main business crops in India. India is positioned first in the World in territory under cotton development (8.74 million hectare), while in term of creation this positioning is third at 11.62 million bundles (160kg each).[1] The major activities in the development of cotton are done generally include parcel of work drive.

The proposed system is based on the concept of cutting and crushing of cotton stalks. The concept of cutting and crushing of cotton stalks after yielding of cotton is focused. Present invention relates generally to Mechanical Engineering field and more particularly to Agricultural component. The said invention focuses on the concept of cutting and crushing of cotton stalks after yielding of cotton. This invention helps in reducing the manpower to cut the cotton stalk manually. Crushed cotton stalks will be used as organic compost for the soil.

In India Cotton crop is cultivated in large amount. After yielding of cotton, the main problem faces by the farmers are to cut the cotton stalk. Now a days what farmer did is pluck the cotton stalk manually collect at one place ,wait till the stalk get dry and after that burn that crop. This invention aims to design and fabrication of power tiller operated tool for cutting and crushing of cotton stalk. It reduces the manpower required to cut the stalks. Also time required for manual operation is reduce. In this, 9 HP power tiller is used to power the machine. After starting of the engine machine moves in forward direction, With the help of guide ways all the branches of stalk comes together and cuts with the help of two disk cutter. one cutter rotates in clockwise direction while the other cutter rotates in counter clock wise direction so that the crop which cut will automatically entre to the crusher. Then the round crusher which has tiny blades rotates and crushed that crop into small volume.Following Characteristics present in cotton stalks.[1]

| S.N. | Nutrition Content | Nutrition content/acre | Usefulness |
|------|-------------------|------------------------|------------|
| 1    | Nitrogen          | 34 kg                  | If helps in growth of crops and it also protects the leaves of the crops from becoming yellowish. |
| 2    | Phosphorous       | 16 kg                  | It also helps in growth of the roots of the crop. |
| 3    | Potassium         | 11 kg                  | It protects the edges of old leaves from becoming yellowish. |
| 4    | Sulphur           | 39 kg                  | It protects the bunch of leaves from turning yellowish. |
| 5    | Copper            | 03kg                   | It protects the leaves of the crop from becoming dehydrated. |
| 6    | Iron              | 56gm                   | It protects the upper layer of the leaves falling on the ground. |
2. Proposed Model

After the yielding of cotton crop, to cut that cotton crop and crush for dumping into the soil this power tiller tool is used. This power tiller tool runs on 9 HP Diesel engine. The power tiller tool is placed at the field. After starting of the engine the power tiller tool moves in forward direction. With the help of guide ways all the branches of stalk comes together and cuts with the help of two disk cutter. one cutter rotates in clockwise direction while the other cutter rotates in counter clockwise direction so that the crop which cut will automatically enter to the crusher. Then the round crusher which has tiny blades rotates and crushed that crop into small volume. Crusher rotates, so that all crop gets crushed into very small volume. After crushing of that crop, the small volume of crushed crop thrown out with help of small hopper so that all crushed particle spread on the field.

The working of cutter is considered first. When the engine start, it will run at idle speed. This power is transmitted with the help of gear box. When the accelerator lever is moved, it starts transmitting power through the transmission shaft to the gear box of cutter. Shaft on the crusher blade is attached to the gear box with the help of chain and sprocket. After the cotton stalk is cut with the help of cutter it pass through the crusher blades which cut this crop into very small volume. This small volume of cotton crop is spread on the farm. After some time this crushed crop is dumped into the soil and used as an organic compost for the farm.

3. Design Calculation

Design Of Crusher Blade
Crusher Blade
Thickness of blade 5mm
Length of blade 20cm
V=36000
Volume of Flywheel = \( \frac{D^2 \times t}{\Lambda} = \frac{D^2 \times t}{\Lambda} \times 20 = 1413716.694 \text{ mm}^3 \)
[Material of flywheel cast iron
[\( \rho = 7200 \times 10^{-9} \text{ Kg/mm}^3 \) ]

Weight of Plate
\[ M = \rho \times V \]
\[ = 7200 \times 10^{-9} \times 1413716.694 \]
M = 10.17 Kg
\[ W = m \times g \]
\[ = 10.17 \times 9.81 \]
W = 99.85 N

Weight of Blade
\[ M = \rho \times V \]
\[ = 7200 \times 10^{-9} \times 36000 \]
M = 0.2595 Kg
For 6 Blade
\[ M = 0.2595 \times 6 \]
\[ = 1.55 \text{ Kg} \]
W = 15.25N
Total weight = 115.10 N

Design Of Gear
Bevel gear

Spur gear back
\[ m = 4 \]
\[ d_P = 95 \]
\[ d_T = 335 \]
\[ t_P = 19 \text{ teeth} \]
\[ t_T = 67 \text{ teeth} \]
material = SAE 1045 H.T
b = 30 mm (face width)
pressure angle = \( \alpha = 20^\circ \) full depth
m = 5
\(d_p = 60\)
\(d_d = 200\)
\(t_p = 12\) teeth
\(t_d = 40\) teeth
material = SAE 1045 H.T
\(b = 21.66\) mm (face width)
pressure angle = \(\theta = 20^\circ\) full depth

**Crusher**

**Shaft (Lower)**

Length = 372 mm
Diameter = 30 mm
Bearing thickness = 21 mm
Outer diameter of bearing = 41 mm
Number of bearing = 2

**Bevel Shaft**

Length = 140 mm
Diameter = 30 mm
Bearing thickness = 23 mm
Outer diameter of bearing = 50 mm
Number of bearing = 1

**Cutter Shaft**

Length = 290 mm
Diameter = 38 mm
Bearing thickness = 23 mm
Outer diameter of bearing = 52 mm
Number of bearing = 8
Cutter Drum (Flywheel)

Diameter of drum = 120 mm
Protruding blade = 40 mm
Total drum diameter = 200 mm
Length of drum = 150 mm

4. Conclusion

Hence we were able to successfully design and fabricate the machine using to given dimensions and were able to achieve the following objectives

- effective use of organic west with the help of effective microorganism (EM) as a organic fertilizer in the farm
- To minimize manpower
- Reduction in cost and time for cutting.

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