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Research Article

DESIGN AND FABRICATION OF SEED SOWING MACHINE FOR ZERO TILL FARMING

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Abstract

Recent literature on no-till is revised with particular emphasis on research results. Increased interest in notill, as well as minimum or reduced tillage, is the result of changes in the economic circumstances of crop production, the opportunity to increase the area of more profitable autumn-sown crops and increased concern about environmental damage associated with soil inversion by ploughing .The relative costs of fuel and herbicides have changed appreciably in recent years making no-till more attractive commercially. While effective weed control is an essential aspect of no-till, current herbicide technology may not yet fully achieve this. Considering all these we have developed a seed sowing machine for no till farming by making a design change in seed sowing machine.

Keywords: India, Tillage, No-till, Organic farming, Natural farming, Seed Sowing machine, Soil erosion.

INTRODUCTION

No-till farming (also called zero tillage or direct drilling) is a way of growing crops or pasture from year to year without disturbing the soil through tillage. No-till is an agricultural technique which increases the amount of water that infiltrates into the soil, the soil's retention of organic matter and its cycling of nutrients. In many agricultural regions, it can reduce or eliminate soil erosion. It increases the amount and variety of life in and on the soil, including disease-causing organisms and disease organisms. The most powerful benefit of no-tillage is improvement in soil biological fertility, making soils more resilient. Farm operations are made much more efficient, particularly improved time of sowing and better traffic ability of farm operations.

Weed control

Controlling the weed is the challenging factor in no till farming Weed control is component of pest control which attempt to stop weeds

Weed control plan consist of many methods which are divided into

- Biological
- Chemical
- Cultural
- Physical/mechanical

Adoption of no-till introduces important changes to the incidence of weeds, crop diseases and pests, as well as the problem of volunteer cereals

Incidence of weeds under no-till

Weed populations under no-till show marked differences from those after ploughing with new or previously unimportant weeds often becoming dominant after a period of no-till in which weed seeds are retained near the surface and their dormancy and germination characteristics will be quite different than if buried during ploughing. They can often be better controlled by ploughing than by the herbicides used in no-till. Many no-till research projects have been conducted with monoculture crop systems which have accentuated weed and pest problems. Rotations and cover crops are considered to be essential components in reducing weed problems and the dependence on herbicide usage in no-till systems

Herbicide usage: The availability of herbicides suitable for control of a wide range of dicotyledonous and monocotyledonous weed species is a paramount requirement for any no-till system. The introduction of glyphosate (Roundup) in 1971 brought many advantages but its effectiveness is reduced by low temperatures and frequent rainfall after application and additional herbicides may be needed.

LITERATURE REVIEW

Lall *et al.* (1978) reported that wheat yields from no-tillage plots significantly higher than conventional tillage, attributing the improved yields to higher moisture content, lower soil temperature and higher biological activities in soil. Allen *et al.* (1980) stated that limited tillage was successful for managing continuous grain sorghum with furrow irrigation. Sweep and rod weeder could perform spring cultivation for controlling weeds and volunteer plants in sorghum crop. It was also observed that the time and fuel energy requirement for limited tillage were only about half of that for conventional tillage.

PAR DESCRIPTION

Pulley

A pulley or pulley wheel is a wheel on an axle or shaft that is designed to support movement and transfer of power between

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the shaft and cable or belt. A pulley may have a groove or grooves between flanges around its circumference to locate the cable or belt. The drive element of a pulley system can be a rope, cable, belt, or chain. In this sowing machine both pulley and pulley wheel are used, driver pulley wheel and driven pulley are used with different diameter

Specifications:
Diameter of driver pulley wheel = 3.5 cm
Diameter of driven pulley = 17.5 cm

Ground wheel

In its primitive form, a wheel is a circular block of a hard and durable material at whose center has been bored a circular hole through which is placed an axle bearing about which the wheel rotates. The shaft is fitted in the centre by the use of bolt and nut. When the ground wheel rotates, shaft also rotates. The ground wheel is fitted on the centre side of the frame with the help of supports.

Specifications:
Diameter Of Wheel = 60 mm

Ball Bearings

Ball bearings are mouted on the shaft for rotation of shaft. Ball bearings are comprised of four major parts: a large ring (outer ring), a small ring (inner ring), balls between the rings (steel balls), and a cage to prevent the balls from hitting each other. The main function of a ball bearing is to reduce friction and facilitate smooth rotation of an axis. Modern ball bearings test the very limits of precision. As an example, one of the key elements to making an ultra-precise ball bearing is the degree to which the groove where the balls roll can be made into a perfect circle. It is important to maintain smoothness and minimize friction.

Specifications:

Diameter of bearing = 40 mm

Shaft

A drive shaft is a mechanical component for transmitting torque and rotation, usually used to connect other component of belt drive that cannot be connected directly because of distance or the need to allow for relative movement between them. As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, whilst avoiding too much additional weight as that would in turn increase their inertia.

Specifications:
diameter of shaft = 150 mm

Frame

A frame is often a structural system that supports other components of a physical construction and/or a boundary that limits the construction's extent. The frame along with its mounts protects and often complements the artwork. Art work framed well will stay in good condition for a longer period of time.

Specifications:
Length of the frame = 56cm
Breadth of the frame = 36cm
Height of frame = 27 cm

Hopper

A storage container used to dispense granular materials through the use of a chute to restrict flow, sometimes assisted by mechanical agitation. And then connected to the spring hose through which the seed disperse.

Specifications:
Width of hopper =8cm
Height of hopper = 17 cm

Handle

Handle is a component attached to the machine, which is used to move the machine component in agricultural lands.

Specifications:
Length of handle= 15cm

Spring pipe

Spring pipe is connected to the hopper to disperse Seeds through it. Using of spring pipe is for the purpose of providing an adjustable sowing of seeds. The pipe can be adjusted and the seeds can be sowed in a desirable place. It travels from hopper to bottom frame and made to face on the land to disperse seeds.

Belt

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel. In a two pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts), or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts). Here v- belt is used.

Furrow Opener

The furrow openers are provided in a seed drill for opening a furrow. The seed tube conducts the seed from the feed mechanism into the boot from where they fall into the furrows.

Type of furrow openers

There are different type of furrow openers, which are:

a) Shovel type,
b) Shoe type and
c) Disc type (single disc, double disc).

Different components designed are as follows

1. Hopper
2. Shaft
3. Pulley and wheel

Design of hopper

It is arranged to feed the seeds. Hopper is made with a capacity of ½ kg of seeds. The hopper is made in contact with a spring pipe for sowing seeds. The designed view of Hooper is

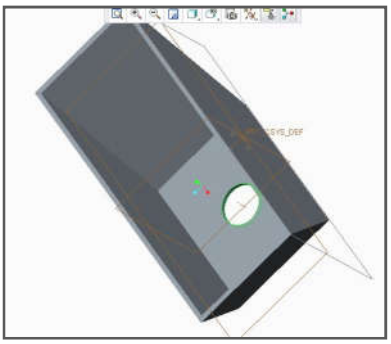

Fig 1a. Hopper

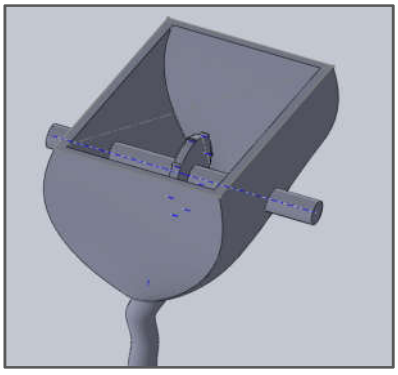

Fig. 1b. Hopper

Design of Shaft

A shaft is a rotating element which used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque set up with the shaft permits the power to be transfer to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears are mounted on it. These members along with the force exerted upon them causes the shaft to being is used for the transmission of torque and bending moment. The various member are mounted on the shaft by means of keys or spines

Total length of the shaft = 66cm=0.660 m
Assuming power, p = 1 kw N= 200
Shears stress = 42 mpa from psg data book
(Mt) = (1x10^3 ×60)/ 2x3.14×200
(Mt) = 47.77 N-m

Design of pulley and pulley wheel

Two pulleys (pulley and pulley wheel) are used in this sowing machine. The driver pulley runs by rotation of ground wheel and driven pulley rotates. Cast iron is used for the pulleyand. The driving belt (v-belt) is connected over the pulley and pulley wheel

Specifications:
Dia of pulley :3.5cm
Dia of pulley wheel :17.5 cm

Design calculation

Total distance between pulley and pulley wheel = 630mm
Pully wheel radius =87.5mm
Pulley wheel = 17.5mm
To find centre distance:
C.D=total distance – (R-r)
=630-(87.5+17.5)
=630-105
= 525mm

To find the length of belt:

$$\mathbf{L=2C+\pi/2(D+d)+(D-d)^2/4C}$$
$$= 2*(525)+3.14/2(175+35)+(175-35)^2/(4*525)$$
$$=1050+1.57(210)+19600/2092$$
$$= 1050+329.7+9.3690$$
$$= 1389.06mm$$
L = 1390 mm(approx.)

To find the arc of contact:

$$\mathbf{\Theta=2c0s^{-1}(D-d/2C)}$$
$$=2\ COS^{-1}(175-35/2*525)$$
$$=2COS^{-1}(0.133)$$
$$\theta = 164.6\ deg$$

Working

Manual power is used as power source of this seed sowing machine. When the machine is moved manually, Power is given to the wheel of vehicle. Pulley wheel is connected to the middle of the wheel shaft. Another pulley is used to transmit

the power to the shaft by means of v –belt which is connected to the bearings. Hopper is used for the manual feeding of seeds. Hopper is connected to the spring pipe at a particular distance which is equivalent to the perimeter of driving wheel. When vehicle moves in forward direction it tends the shaft to rotate and seed is manually fed in the land. Simultaneously seeds are sowed into the land.

View of seed sowing machine

Comparision of till and no till farming:

Conventional farming (Till farming)	Non conventional farming (No till farming)
Tillage Is Used	Tillage Is Not Used
Number of farmer is high	Only one farmer
Operating cost are low	Operating costs are high
It leads to soil erosion	It decrease the soil erosion
It disturb soil	It disturb the soil lesser than till farming
Crops produced are not organic	Crops produced are organic
It kill the earthworm	It does not kill earthworm
Since pesticides are used	Pesticide are not used
More human effort	Less human effort

Conclusion

The proposed system can be carried out in farming process in a single machine. By using manual rotation machine, it is found to be more compact and less complex. Though it is designed for the need of small time farmer, it can be used for agriculture. In addition MOTOR can be used for the sowing process. This system will handle the sowing process by using spring hose attached. Hence it does not require large amount of man power which is required in traditional manufacturing system.

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