Sugarcane Plantation with Inner Seed Sowing Machine

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Abstract: Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. Sugarcane planting and seed sawing planting is a very labour intensive job and involves considerable human drudgery. For the growth of Indian economy, mechanization is necessary. The present review provides brief information about the various types of innovations done in seed sawing equipment's and sugarcane plantation machines. The planting, cultivation and harvesting of sugarcane is highly energy, time and labour intensive. Suitable techniques, systems and implements have therefore to be developed to minimize the above.The basic objective of this machine is to combines both machine of plant the one eye sugarcanes with equal space (i.s. 1 feet's or 2 feet's) and sawing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed in between farrow. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agro-climatic conditions to achieve optimum yields. Seed sowing devices plays a wide role in agriculture field.

Keywords:*Sugarcane, Planters, Performance, Costs, Sett, Seed, Sowing, Mechanism*

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1. Introduction

Agricultural sector is changing the socio-economic environment of the population due to liberalization and globalization. About 75% people are living in the rural area and are still dependent on agriculture. About 43% of geographical area is used for agricultural activity. Agriculture has been the backbone of the Indian economy. As Indian population is growing continuously, the demand for producing crop per hector is also increasing, this requires efficient and high-capacity machines. So mechanization in agricultural industry plays an important role in Indian economy.

The basic function of this machine is plant the sugarcane and sowing operation is to sow the seed and fertilizer in rows at required depth and to maintain the distance between the seeds, sugarcane and provide proper compaction over the seed.

Sugarcane plantation with inner seed sowing machine is a device that plants or sows the crops, it digs a furrow places the seed or seeds and sugar cane into the furrow and covers it. This machine ensures uniformity in sugarcane and seed broadcasting and saves time and money.

Under intensive cropping, timeliness of operations is one of the most important factors which can only be achieved if appropriate use of agricultural machines is advocated. Manual method of sugarcane planting and seed planting, results in low sugarcane placement and seed placement, spacing efficiencies and serious back ache for the farmer which limits the size of field that can be planted. To achieve the best performance from a sugarcane planter, the above limits are to be optimized by proper design and selection of the components required on the machine to suit the needs of crops.

A simple, highly energy efficient mechanism needs to be developed to combat all above difficulties.

1.1 State of the art survey

In Indian scenario, a number of two row, three row and multirow planters were developed by some of the leading agricultural equipment's manufacturers. Following section will explain some of them w.r.t their advantages and drawbacks.

1.1.1 Tractor operated two row ridger type sugarcane planters

In this planter, the perform operations involved in cane planting are sett cutting; furrow opening; placement of seed setts, fertilizer and chemicals; soil covering over setts and tamping of soil, in a single pass. It is tractor operated equipment mounted with three point linkage. The equipment is hydraulically controlled for its lifting and lowering. Power is derived through tractor PTO for operations of sett cutting

and fertilizer metering while tractive power is used for other operations.

- **Source of Power:** 49 HP tractor
- **Effective field capacity:**4-6 ha/day
- **Labor requirement:**2

2.Material Selection

Selection of material is based on stiffness, cost, availability and suitability of materials for heat treatment. Hopper is made up of G.I sheet of 20G material. The tiller is made by square steel pipe of 16G lightweight material. The other parts which are essentially required for make the metering mechanism and ground wheel are mild steel. All parts are suitably heat treated and necessary precautionary steps are takento prevent corrosion.

Sr. No.	COMPONENTS	QTY	MATERIALS
1	Drive Wheel	1	Mild Steel
2	Hopper	1	GI Sheet
3	Fertilizer Box	4	GI Sheet
4	Bolts and Nuts	1	Mild Steel
5	50×16 mm Plate	1	Mild Steel
6	25×25 mm Angle	1	Mild Steel
7	50×50 mm Angle	1	Mild Steel
8	Seed Distributer	4	Plastics
9	Fertilizer Distributer	4	Plastics
10	Bevel Gear Pairs	6	Hardened Steel
11	Chain Drive	3	Medium Carbon Steel
12	Sprocket	4	Low Carbon Steel
13	Shaft $Ø20^{\pm 0.-02}$ mm Length 1200 mm	1	Mild Steel
14	Shaft $Ø15^{\pm 0.-02}$ mm Length 1245mm	1	Mild Steel
15	Shaft $Ø20^{\pm 0.-02}$ mm Length 400mm	2	Mild Steel
16	Sugarcane Storage trey	2	Plastics
17	Disc	4	MS Plate
18	Bushing	6	Mild Steel

3. Specification of the Developed Machine

- **Drive:**Wheel driven Source of power: 49 HP tractor
- **Type of furrow opener:**Ridger
- **Number of furrow openers**: 2
- **Row to row distance:** 75/90 cm
- **Type**: Tractor rear mounted
- **Attachment:** Planter attached to three point linkage.

4. Methodology

Dry method of planting should be followed. Sets should be placed 5 to 7.5 cm deep into soil. Care should be taken to place eye buds on side and covered with thin layer of soil and then irrigation should be given to the field. But our project will plant sugarcane and also plant inner seeds such as corn with the help machine so Area coverage with this machine is 4-6 ha /day.

The methodology and experimental techniques adapted in studying performance and evaluation inter row cultivator. The **Sugarcane Plantation with Inner Seed Sawing Machine** was more feasible than the traditional method of sugar plantation and seed sowing for selected crops. Tools in (hardware) this machine various types of seeds are planted automatically and plantation of sugarcane operation simultaneously done that is cultivator, blade, Fertilizer, Intercultural seed and compost sowing, (Furrower plantation), furrower and plantation set this are tools used in machine for plantation of sugarcane.

4.1 Planting Technique:

The traditional method of sowing of crops was as shown in Fig. A and this method of planting was as shown in the Fig. B and the intercultural operation was carried out in the field. In traditional method inter cultural operation was carried out with the help of bullock in the traditional way, and in the planter sown field with the help of tractor drawn inter row cultivator.

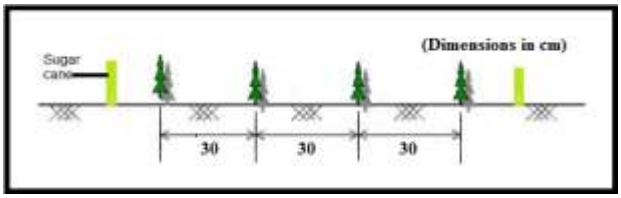

Fig. 4.1 (A) Traditional Method of sugar plantation and Sowing for corns

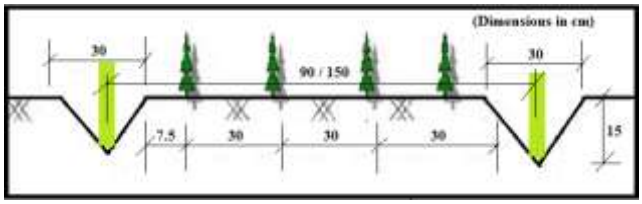

Fig. 4.1 (B) By Using This Method of sugar plantation and Sowing for Green Gram and Soybean

The performance of Broad Furrow Planter inter row cultivator was evaluated by taking the laboratory tests and field tests.

4.2 Spacing

Depending upon the soil type and method of irrigation, appropriate spacing should be adopted as given below.

Table No. 1Spacing

Soil type	Method of irrigation	Furrow Spacing	Method of placement of set	Spacing between two sets
Coarse tomedium textured soils	Surface	90 cm	Parallel to furrow	22.5 cm
Fine textured Soils	Surface	150 cm	Across the furrow	22.5 cm
All kinds of soils	Drip	Pairedrow 75 cm X150cm	Parallel to Furrow	22.5 cm

4.2.1 Seed rate

Single, two and three eye bud methods of planting are in practice. To avoid heavy risk of gaps in single eye bud and over population by three eye bud planting methods, two eye bud method is recommended. About 25,000 two eye budded sets will be required to plant one hectare area. Only upper half or two third cane should be selected for planting as shown below.

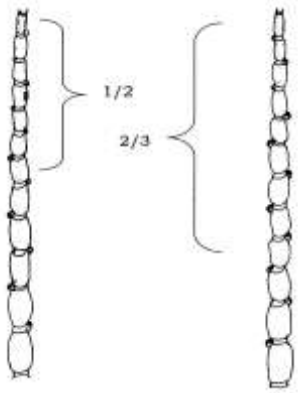

Fig. No. 4.2.1 (A) - How to Select Sugar Cane

While preparing set, care should be taken to maintain minimum distance (one third inter node) above the eye bud and maximum distance below the eye bud (two third inter node) so as to obtain high germination.

In wider furrows (150 cm), sets should be placed across the length of Furrow as shown below.

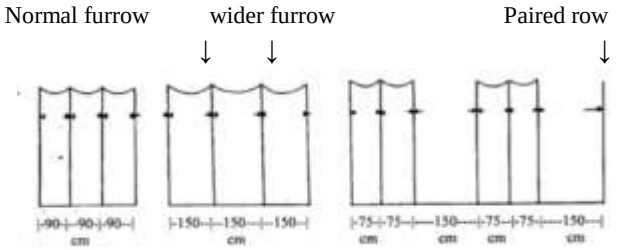

Fig. No. 4.2.1 (B):-Appropriate Spacing

In 75 or 90 cm furrows sets should be placed 22.5 cm apart as shown below.

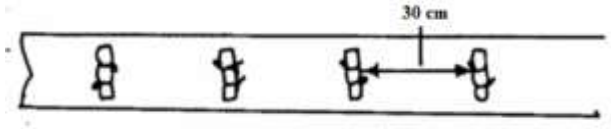

Fig. No. 4.2.1 (C):- Sugarcane Plantation Distance

5. Sequence of operations

5.1 Feeding of Sugarcane

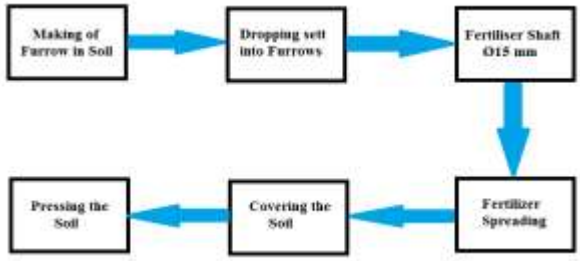

Figure 5.1: Flowchart Showing Sequence of Operations

Before loading the sett on the planter, the canes that are to be planted needs proper preparation. The brief sequence of operation involved in this machine are making of furrow in soil through plough, cutting the prepared cane setts through a blade, dropping them into soil (cavity formed by plough), Insecticide and fertilizer spreading, covering the sett and pressing the soil with roller.

5.1.1Energy Flow Diagram

The energy flow diagram shows the however sequence of operations can be carried out by energy flow of the machine as shown in below.

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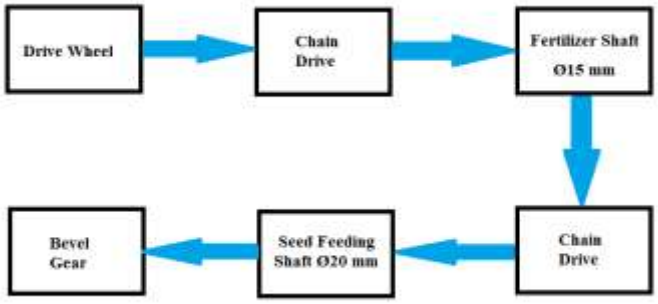

Figure 5.1.1: Energy Flow Diagram for Sugarcane

5.2 Feeding of Seed

Simultaneously seed sowing operation can be done so as same flow diagram for seed sowing.

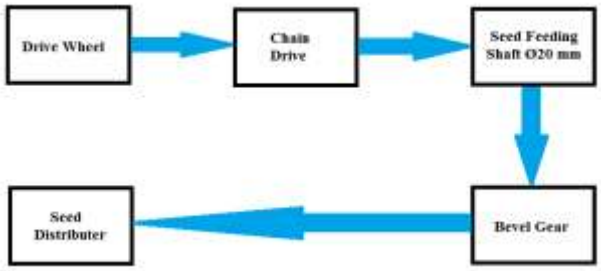

Figure 5.2: Energy Flow Diagram for Seed Sowing.

6. Description of the Machine

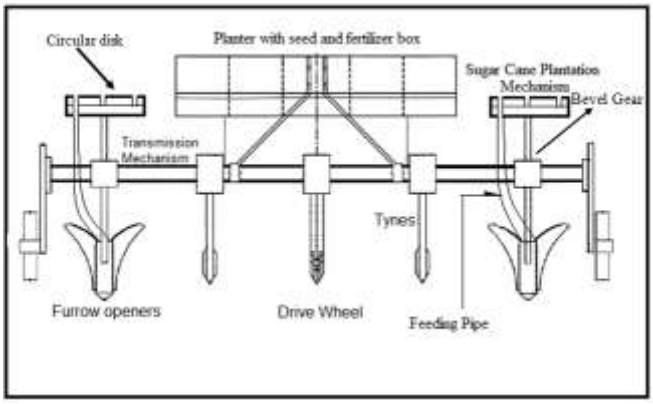

Figure No. 6: Design of Sugarcane Plantation with Inner Seed Sowing Machine.

First of all the sugarcane to be planted needs to well prepared by shaving all their leaves, roots if any so that the eyes on the cane are well exposed. Then these well prepared canes are loaded on the planter as per requirement. One person can be deployed for feeding the canes to the planter mechanism.

Once the planter is attached to the tractor, it will be ready to plant the cane. The plough provided at the bottom of the planter digs the required cavity of about 1ft deep for planting the canes. The canes are feed manually one by one to the cane feeder mechanism. When tractor moves forward the drive wheel placed on soil then this rotating by the tractor speed.

When tractor moves forward the drive wheel placed on soil this also moves with respect to tractor speed then drive wheel can rotated to the chain sprocket by the chain drive this chain drive can rotate the shaft of Ø 20 mm. the shaft can be transmitted power to distributer plate i.e. sugarcane distribution plate. This distributor plate can be rotated by the bevel gear, in this there are two sets of disk mounted on both side of fertilizer box in this two disk mounted on one shaft one disk is fixed to the fertilizer box and other one is connected to the shaft of Ø20 mm and length 40mm the disk having four holes are at 90® to each other the design of holes as that of the sugarcane can placed 1 feet in between sugarcanes.

This distance can be calculated as follows,

We know the circumference of the circle is,

$P = \pi * D$ ……. (1)

L = 30 cm (i.e. 1 feet)

Where, P = circumference of circle.

L = distance between sugarcanes.

The disk is divided into 4 parts,

$P = L \times 4$

$P = 30 \times 4$

= 120 cm ……. (2)

Equation (1) becomes,

$120 = \pi * D$

$D = 120/\pi$

= 38 cm

D = 38 cm

Thus center distance between two holes is 38 cm at face to face (i.e. diameter of hole produced is 38 cm).

Similarly dimensions of fixed disk in this disk only one hole is provided of Ø 10 mm and this hole is attached to the furrows with the help of rubber pipe of 5 inch.

The disk are attached over each other when movable disk is rotate the one piece of sugarcanes are placed in the disk hole then hole of movable disk is matched with fixed disk hole. When matching of holes of movable and fixed

disk then piece of sugarcane will passing to the rubber pipe this rubber pipe is attached to the furrow and sugarcane placed on soil at back side of furrows then soil are covered with back cover plates.

Simultaneously, inner seeds sowing mechanism will provided by the chain drive to the shaft. This shaft can be rotate the seed distributor plates with the help of bevel gear and also fertilizer can placed in between seeds. The seeds are sawing in between furrows in that four tynes attached to frame by U-bolts. The seeds are placed in tynes with the help of pipe witch seeds are moves into pipe of 2 inch.

7. Field Test

7.1 Depth of Placement

Planter was operated in the field without levelers. Depth of placement of setts in the furrowswas evaluated. Depth was measured at five different places and average was calculated. Depth of placement of setts was controlled by the U-bolts arrangement on the tractor.

7.2 Speed of Operation

Planter was run a fixed distance of 90 meter in the field and time required to cover this distance was noted. Simultaneously time required for turning the planter was also noted. As such five observations were taken to get the accuracy.

7.3 Theoretical Field capacity (TFC)

Speed of operation and theoretical width of the planter was noted down for following:

$$\text{Theoretical Field capacity} = \frac{\text{Theoretical Width (m) x Speed of operation (km/hr)}}{10}$$

7.4 Actual Field Capacity (AFC)

The plot of 0.2 hectare was selected and time taken to cover this area was noted. Time taken for turning, hopper filling and other operational obstructions was also noted.

7.5 Field Efficiency

$$\text{Field efficiency} = \frac{\text{AFC}}{\text{TFC}} \times 100$$

8. Design calculations and Equation

8.1 Design of chain and sprocket:

Chain 08B $z_1 = 17$, $n_1 = 300$ rpm

Step 1: Rated Power of Chain Drive

As per std. Table on reference,

Service factor (K_s) = 1.2

As per std. Table on reference, (17 teeth)

$K_2 = 1.0$

Single strand

$K_1 = 1.0$

The Rating Power for the chain 08B is 1.70 kW at 300 rpm

We know that,

Power to be transmitted = $\frac{(\text{kW rating of the chain}) * K_1 K_2}{K_s}$

$= \frac{1.70*1*1}{1.2}$

kW = 1.416 kW

Step 2: Tension in Chain

As per table for 08B chain

Pitch (p) = 12.79 mm

Then velocity

$$V = \frac{z1pn1}{60\times10^3}$$

$$= \frac{17\times12.70\times300}{60\times10^3}$$

Chain Tension is given by,

$$P_1 = \frac{1000 \text{ kW}}{V}$$

$$= \frac{1000 \times (1.4166)}{1.079}$$

P_1 = 1312.88 N

Step 3: Factor of Safety

Breaking load for the chain 08B is 17800 N. Thus

$$f_s = \frac{178000}{1312.88}$$

f_s = 13.55

9. Merits

- It is simple in operation.
- It can Equidistant sugarcane plantation and seed sowing process.
- Maintenance cost is low.
- No damage of sugarcane eye as well as No seed loss in terms of remaining in the hopper.
- Low plantation cost.

- It is more suitable for small farmers.
- Reduced size and complexity when compared to existing machine.
- Simple mechanism.

10. Conclusion

The sugarcane plantation with inner seed sowing machine is already proven to be beneficial, inter cultural operation in the field is very important and it should be performed effectively. The tractor operated sugarcane plantation with inner seed sowing machine inter row cultivator is effective and superior to the traditional method of inter culture. The field capacity of the machine was 4-6 ha/day. The field efficiency was 80.0 percent at effective working with a forward speed of 2 km/hr(2nd Low gear). It will save labour, time and cost which will improve overall profitability of farmers. The cost of operation per ha in case of this equipment will be in the range of Rs. 2000 as compared to Rs. 7000 manually. Thus, this kind of equipment reduces the cost of operation, impart consistency, better utilization of resources, quality work performance resulting in better production and productivity.

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