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Design development of tractor operated raised bed planter cum sprayer with covering device

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Abstract

The present study was performed to utilize all mechanical aids for development and management of field production, weed control and water control. Mechanization can help in increasing the production by timely farm operation, reducing losses, reducing the cost of operations. The machine was developed using different components such as frame, tynes, furrow openers, transport wheels, ground wheel, ridger, hitching unit, seed cum fertilizer box, seed tube, drives for metering device, weedicide sprayer unit and seed covering blade. The developed machine can be used for preparing the raised beds and simultaneously planting the seeds at designed row to row and plant to plant spacing. The working width of planter was 190 cm with 5 nos of tyne at a depth of 8 cm. The trapezoidal hopper was designed have length 127 cm, height 24 cm and bottom width of 38 cm. The tyne of furrow has height 45 cm and thickness 20 cm. The furrow opener size used was 4.5 cm. The ground wheel was designed for planter has diameter 28 cm with 12 nos of pegs. A covering device was connected behind furrow openers to cover the seeds with soil to protect seeds from birds and helps to germinate the seeds immediately. The developed sprayer was found to be cost efficient and can be exploited in the market.

Keywords: BBF planter cum sprayer, dry spell, rainfed, soybean planter

1. Introduction

Mechanization of different farm operations can increase the agricultural productivity by more work in less time, efficient use of inputs, by producing quality product, improving the safety of the farmers, reducing the loss of produce and drudgery of farmers thus, and improving comforts of farmers. It is also to reduce the manpower as in today's scenario labors are very hard to find as well as it reduces the working time. The agriculture sector is under increasing pressure to sustainable produce higher yields with less input, due to declining land and water productivity potential, increasing cost of production, variable market conditions and increasing world population (Gupta *et al.*, 1994) ^[6]. The planting operation is one of the most important cultural practices associated with crop production. Increases in crop yield, cropping reliability, cropping frequency and crop returns all depend on the uniform and timely establishment of optimum plant populations. Raised bed (RB) farming systems combine most of the elements of conservation agriculture and have produced encouraging production results under various environmental conditions. RBs offer the opportunity of reducing field compaction and restoring physically degraded soil structure, as well as, the potential to reduce irrigation water and increase crop yield while reducing the risk of water logging (Pandey, 1997) ^[7]. Presently farmers are using different types of implements for different farm operations as Seed bed preparation, sowing, inter-culturing and spraying etc. It is costly and difficult for small and marginal farmers to maintain number of implements. Therefore, it is decided to design develop a Tractor operated raised bed planter cum sprayer with covering device.

2. Methodology

The strength, durability workability and economy of any farm machinery or implement depends largely upon selection and quality of material used in its fabrication. In the construction of an implement, it is advisable to eliminate as many castings as possible and to use pressed, stamped and tabular steel.

This results in reduction of weight and cost of an implement in addition to retaining the required strength, durability and case in case of repairs. The choice of the material was on the basis of following factors.

1. Cost of material and easy availability.
2. Easy handling and processing.
3. Suitability of material to satisfy the need.
4. Reliability while it is in operation.

This machine consists of the following functional components.

1. Main frame

2. Tynes
3. Furrow openers
4. Transport wheels
5. Ground wheel
6. Ridger
7. Hitching unit
8. Seed cum fertilizer box
9. Seed tube
10. Drives for metering device
11. Weedicide Sprayer unit
12. Seed Covering Blade
13. Inter-cultivators

Table 1: Specification of Planter

Sr. No	Particulars	Specification
1	Frame size	2290mm×605mm×480mm.
2	Type	Tractor operated,5 row
3	Power source	45 hp Tractor & Above
4	Man power required	One person
5	Total weight of planter kg	290
7	Tyne to Tyne distance, cm	6-48
8	Seed to Seed distance, cm	1-52
9	Seed metering device	Inclined plate metering mechanism
10	Fertilizer metering mechanism	Fluted feed roller
11	Seed type	All type of Seed
12	Furrow opener	Shovel type
13	Seed dispenser pipe	Breaded type
14	Power transmission planter	From ground wheel of through sprocket & chain arrangement
15	Power transmission sprayer	Tractor PTO
16	Hopper dimensions, cm	380x240x1270 mm

2.1 Size of planter

In order to select the size of the planter we use the following formula

$$Z = \frac{D}{d}$$

Z= no. of openers in the planter
 D= draft in, kgf
 d= draft at each row, kgf

2.2 Working width of machine

$$W = Z \times a$$

W= working width, cm

Z = no. of openers in planter
 a = row to row distance, cm

2.3 Mechanism

The power from ground wheel is transmitted to the metering device by means of chain and sprocket arrangement. It consists of following parts:

1. Sprockets: Six sprockets of 17 teeth
2. Chain: Three chains of 1m, 1.5 m length
3. Transmission shafts: Two transmission shaft
4. Bevel gears: Five pairs of 1:1 power transmission ratio

For spraying HDP pump is powered by Tractor PTO by using Belt-pully mechanism.

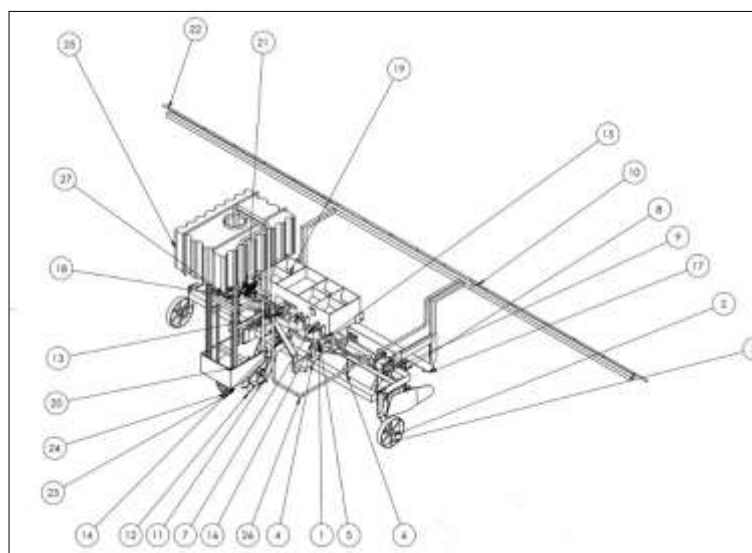


Fig 1: Schematic view of planter cum sprayer

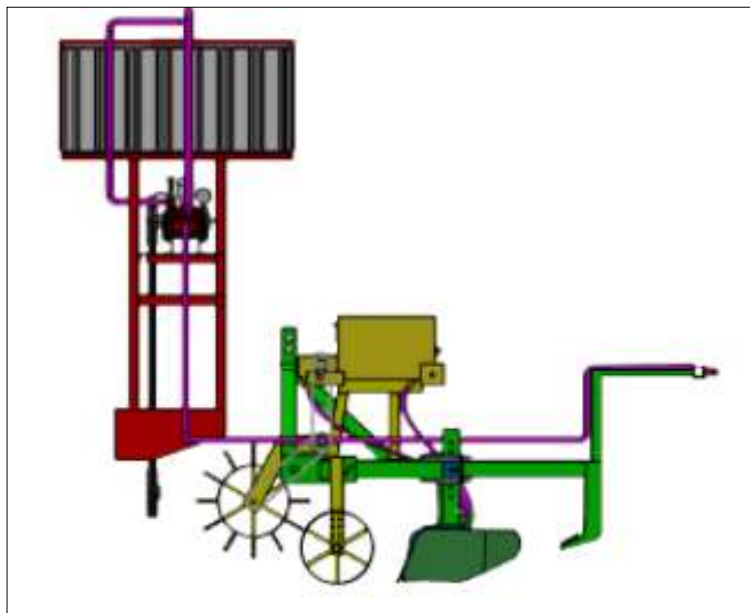


Fig 2: Solid view of developed BBF planter cum sprayer with covering device.

2.4 Advantages of BBF planter cum sprayer with covering device

2.4.1 Planting has several advantages over drilling.

1. Seed rate is reduced thereby saving the valuable seed.
2. Inter cultivation is facilitated.
3. This method works well in both conditions in dry spell as well as in wet spell.
4. Human skill for planting is not required.
5. Seed can be sown at required spacing i.e. plant to plant and row to row distance can maintain.
6. There is arrangement for fertilizer application, the fertilizer can be applied at required points economically.
7. Improves aeration and reduces insect pest attack on crop by results of sunlight.
8. Because of proper placement of seed, the germination percent can increase.
9. By spraying weedicide as preemergence we can keep our field free from weed.

3. Results

The developed Tractor Operated Raised Bed Planter Cum Sprayer with Covering Device and Weeder was tested at UAE, VNMKV, Parbhani field. Trial of Tractor Operated Raised Bed Planter Cum Sprayer with Covering Device and Weeder was taken at UAE, Center Farm, Soyabean Research, VNMKV, Parbhani different parameter such as operating speed, draft, working depth, working width, Field efficiency were noted.

4. Conclusions

4.1 Based on the results obtained, the following conclusions are drawn

1. The machine can be used for preparing the raised beds simultaneously plants the seed on bed at required row to row and plant to plant spacing.
2. The performance of inclined plate seed metering device is satisfactory.
3. Average speed of implement was 2.46 Km/hr.
4. Only one person is required to operate the machine and it can cover 0.49 ha/hr for Soybean crop.
5. The average discharge from each nozzle 750 ml/min.
6. Total boom discharge is 10.5 lit/min
7. Total Draft required is 609.4 kg

8. Total power output is 5.55 hp

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