DESIGN AND DEVELOPMENT OF MANUALLY OPERATED SEED PLANTER MACHINE

Kyada, A. R¹, Patel, D. B.²

¹Lecturer, LDRP Institute of Technology and Research, Gandhinagar, 382481, ani_kyadaauto@yahoo.co.in
²Assistant Professor, Gandhinagar Institute of Technology, Gandhinagar, 382721, dhaval.patel@git.org.in

Abstract

The basic requirements for small scale cropping machines are, they should be suitable for small farms, simple in design and technology and versatile for use in different farm operations. A manually operated template row planter was designed and developed to improve planting efficiency and reduce drudgery involved in manual planting method. Seed planting is also possible for different size of seed at variable depth and space between two seed. Also it increased seed planting, seed/fertilizer placement accuracies and it was made of durable and cheap material affordable for the small scale peasant farmers. The operating, adjusting and maintaining principles were made simple for effective handling by unskilled operators (farmers).

Keyword: Seed, Sawing, Planting

1. Introduction

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 seed planting, results in low 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 seed 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.

Hand-pushed and Transnational Journal of Science and Technology August 2012 edition volume2, No.728 tractor mounted row seeders(usually single and multiple row).Normally requires a well prepared seed-bed which may be ridged or flat bed. In the past, various types of design have been developed with different design approaches which have their advantages and disadvantages and also operation a limitation.Adisa and Braid(2012) [1] designed and constructed a manually operated flute planter/fertilizer distributor which was found to be 94% efficient in seed spacing but could not be used on the ridged seed bed and requires quite some effort and time to change seed drill size and seed spacing. Also Braide and Njidda (1989) [2]developed a combined jab planter which
was found to be 73.4% efficient and was three times faster than manual planting with hoes and cutlass. Abubakar (1987) [3] made use of the principle of jab planter in applying fertilizers. Adekoya and Buchele (1987) [4] developed a cam activated precision punch planter which was capable of planting an unttled soil. Braide and Ahmadu (1990) [5] developed a transplanter for some selected crops in Guinea Savannah of Nigeria which has 0.19ha/h field capacity and 20% field efficiency. All of the above designs were reported to have got quite promising results.

2. **Purpose of seed planter machine.**

The basic objective of sowing 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. The recommended seed to seed spacing and depth of seed placement vary from crop to crop and for different agro-climate conditions to achieve optimum yields.

3. **Factors affecting seed emergence**

Mechanical factors, which affect seed germination and emergence, are:

- Uniformity of depth of placement of seed.
- Uniformity of distribution of seed along rows.
- Transverse displacement of seed from the row.
- Prevention of loose soil getting under the seed.
- Uniformity of soil cover over the seed.
- Mixing of fertilizer with seed during placement in the furrow.

To achieve the best performance from a seed drill or planter, the above factors are to be optimized by proper design and selection of the components required on the machine to suit the needs of the crops. The seed drill or planter can play an important role in manipulating the physical environment. The metering system selected for the seed should not damage the seed while in operation.

**Table 1** Diameters of different seed

<table>
<thead>
<tr>
<th>Seed name</th>
<th>Diameter(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arugula</td>
<td>2.5</td>
</tr>
<tr>
<td>Beet</td>
<td>7.5</td>
</tr>
<tr>
<td>Broccoli</td>
<td>3.5</td>
</tr>
<tr>
<td>Cabbage</td>
<td>3.5</td>
</tr>
<tr>
<td>Carrot</td>
<td>3.5</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>3.5</td>
</tr>
<tr>
<td>Corn</td>
<td>13.5</td>
</tr>
<tr>
<td>Cucumber</td>
<td>9</td>
</tr>
<tr>
<td>Lettuce</td>
<td>6</td>
</tr>
<tr>
<td>Okra</td>
<td>7.5</td>
</tr>
<tr>
<td>Onion</td>
<td>6</td>
</tr>
<tr>
<td>Pea</td>
<td>10</td>
</tr>
<tr>
<td>Radish</td>
<td>4</td>
</tr>
<tr>
<td>Sunflower</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**Table 2** Details for planting seed

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Distance between plants(cm)</th>
<th>Planting depth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>30</td>
<td>2.5-4</td>
</tr>
<tr>
<td>Beet</td>
<td>3-5</td>
<td>1.5</td>
</tr>
<tr>
<td>Broccoli</td>
<td>45-60</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Cabbage</td>
<td>45</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Carrot</td>
<td>3-5</td>
<td>1.5</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>45-60</td>
<td>0.5-1.5</td>
</tr>
<tr>
<td>Corn</td>
<td>15-25</td>
<td>2.5</td>
</tr>
<tr>
<td>Okra</td>
<td>30</td>
<td>2.5</td>
</tr>
<tr>
<td>Onion</td>
<td>5-8</td>
<td>1.5-3</td>
</tr>
<tr>
<td>Pepper</td>
<td>60</td>
<td>1.5</td>
</tr>
<tr>
<td>Potato</td>
<td>25-30</td>
<td>10</td>
</tr>
<tr>
<td>Radish</td>
<td>2.5</td>
<td>1.2</td>
</tr>
</tbody>
</table>
4. Development of Seed planter machine

By using this machine as shown in Figure 1, seed to seed spacing and depth of seed placement vary from crop to crop for different agro-climate conditions.

As machine is pushed, power wheel is rotating which transmit power to plunger through chain and sprocket mechanism. Now cam is mounted on sprocket shaft which push plunger towards downward direction. Once plunger is penetrate in soil and during backward stroke flapper is opened so seed get separated from plunger and inserted in dig.

5. Purpose to use mechanism

Main four types of mechanism is set in machine to sowing as per requirement of varying seed to seed spacing and depth of seed placement from crop to crop.

5.1 Seed meter mechanism

Seed metering devices are those devices that meter the seed from the seed box and deposit it into the delivery system (plunger) that conveys the seed for placement.

Functional requirements of seed metering devices:
1. Meter the seed at a predetermined rate/output (e.g. kg/ha or seeds/meter of row length).
2. Meter the seed with the required accuracy (spacing) to meet the plantingPattern requirements.
3. Cause minimal damage to the seed during the metering process.

All function can be fulfill by using one plate as shown in figure 3. Cover plate is used to cover remaining hole on seed metering plate because at a
time for one revolution of shaft only one seed is required to deposit.

![Figure 3 Seed metering plate and cover plate](image)

5.2 Plunger mechanism

Plunger mechanism as shown in figure 4 is used for digging and seeding. Plunger itself is used as digging tool and spring mechanism for predefined timing seeding. Plunger is pushed by the cam which is synchronized with lever fulcrum mechanism. Plunger has a flapper for opening into the cavity for seeding.

![Figure 4 Plunger flapper mechanism](image)

5.3 Lever-fulcrum mechanism

Function of slotted lever mechanism is to give downward motion of the plunger as shown in figure 5

![Figure 5 Lever-fulcrum mechanism](image)
Use of slotted lever mechanism instead of lever fulcrum mechanism to get better functioning of cylinder motion in downward direction.

Main purpose of use the lever fulcrum mechanism is to get downward displacement motion of plunger as per varying depth of crop. By using screw nut mechanism length of lever can be very so according to that downward displacement is varying as per required. This mechanism is set to vary up to 50 mm depth which sufficient for sawing.

5.4 Cam shaft transmission

Cam shaft mechanism is used to push and pull plunger which is linked with the lever fulcrum mechanism as shown in figure 6.

Here two types of cam, primary cam and secondary cam is used to create the appropriate force and displacement with the help of adjusting lever. Primary cam is used to push plunger and secondary cam is used to pull plunger during forward and return stroke.

5.5 Power transmission mechanism

Power transmission is done by the gear sprocket transmission system as shown in figure 7.

Here total seven sprockets is used to transmit the motion to plunger and speed variation to get variable distance between the two seed. Total eight types of variable distance like 5 cm, 8 cm, 10 cm, 15 cm, 20 cm, 30 cm, 45 cm, 60 cm are achieved by changing speed of sprocket. Speed of sprocket is changed by shifting chain from one sprocket to another sprocket through mechanism which is available in geared bicycle.

Main power of machine is available from power wheel. Once person push machine, power wheel rotates according to speed of machine. So sprocket which is mounted on shaft of power wheel transmit power through power transmission mechanism.

5.6 Pulling mechanism

Pulling mechanism is used to keep plunger stationary while it inserted in soil and bring it to original position while plunger come out from soil as shown in figure 8.
Here sliding mechanism and spring is used for pulling plunger. Plunger having sliding joint with body so it can freely slide. Once plunger is inserted in to soil at that time the machine is continuously running so to prevent plunger from drawing it in to soil, the plunger should be slide backward side. The slider join is allowed plunger to move backside until it come out from soil. So plunger remains stationary in to soil and only one hole is produced while digging.

Once plunger come out from soil during returning stroke, spring is pull plunger to its original position and the process is repeated continuously.

5.7 Advantages of machine

Following are the advantages of manual seed planter machine are

- Improvement in planting efficiency.
- Increase in crop yield and cropping reliability.
- Increase in cropping frequency.
- It increased seed planting.
- Seed/fertilizer placement accuracies.
- It was made of durable and cheap material affordable for the small scale peasant farmers.
- Lesser maintenance cost.
- The seed can be placed at any required depth.
- The plant germination can be improved.
- Requirement of labor also decreased.
- It consume less time for sowing.
- Seed can be placed uniformly in a row with required distance between plants.
- Provide proper compaction over the seed.

Conclusions

This manual seed planter machine has considerable potential to greatly increase productivity. Other countries of the world where the two wheel tractor is the main traction unit in farming. The main task now is to promote this technology and have available to farmers at an affordable price. The manual Seed Planter machine can be readily made from local components in workshops. The only specialized items required are the seed meters plunger which can be sourced at an inexpensive price from local promoter and plunger is easily manufactured. By using of this machine, achievement of flexibility of distance and depth variation for different seed plantation is possible.

Reference
