Design and Manufacturing of Seed Sowing Machine for Agricultural Field

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Abstract— In the farming process, the often-used conventional seeding procedure takes plenty of time and more labor. The seed feed rate is added further as the time required for the total operation and the total cost is increased due to labor. To meet the future food demands, the farmers should implement the new techniques which will not affect the soil texture but will increase the overall crop production. The seed sowing methods used in India and fertilizer placement is being studied. A machine to perform the above-mentioned operations is proposed in this project work. The comparison between the traditional sowing method and the new proposed machine which can perform numerous simultaneous operations like ploughing using a shank, sowing, and spraying of water and pesticide is highlighted in this piece of work. The day by day labor availability becomes a great concern for the farmers as the labor cost is more. This proposed seed sowing machine reduces the efforts and overall cost of sowing the seeds. 

Key words: Seed Feed Rate, Ploughing, Shank

I. INTRODUCTION

Agricultural sector results in alterations in the socio-economic environment of the population due to liberalisation and globalization. Around 75% people reside in the rural areas and are still dependent on agriculture. Around 43% of geographical area is consumed for agricultural activity. Agriculture has been the backbone of the Indian economy since ages with men and women equally involved in the field. As the Indian population is growing at pace, continuously, the demand for producing crop per hectar is also increasing; this requires highly efficient and high-capacity machines. Hence, mechanization in agricultural industry plays an important role in the Indian economy.

The basic objective of sowing operation comprises of placing the seeds and fertilizer in rows at a desired depth and at a specific seed to seed spacing, to cover them with soil and to provide a proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and depends upon different climatic conditions to achieve optimum yield. Under intensive cropping, the timeliness of operations is one of the most important factors which can only be achieved through appropriate use of agricultural machines. 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 points are to be optimized by proper design and selection of the components required on the machine to suit the needs of crops.

A sowing machine is a device that plants or sows the crops; it digs a furrow to place the seed and covers it. Seed sowing machine ensures uniformity in seed broadcasting henceforth saving time and money. The row spacing for soybean seed is 15 to 18 inch and seed spacing as 2 to 3 inch. For corn seed the row and seed spacing is 15 inch and 6 inch respectively. For groundnut, which having around 7.2mm in diameter has row spacing from 6 to 12 inch.

II. OBJECTIVES

In most of the farms, the different methods used for ploughing, sowing & spraying, used to be carried out sequentially and required plenty of time. The labour work required was more resulting in higher cost. Small seeds often got sowed too thickly and needed to be thinned. The equipment used for Sowing being costly was not affordable by small landholders. The recommended seed to seed spacing and the depth of seed placement vary from crop to crop which wasn’t possible accurately when done manually. Thus, there is a need of a machine which is capable to do these operations simultaneously. The factors which affect the germination and emergence of seeds are:

a) Consistency of depth of placement of seed.
b) Consistency of distribution of seed along rows.
c) Transverse displacement of seed from the row.
d) Prevention of loose soil getting under the seed.
e) Consistency of soil covers over the seed.
f) Mixing of fertilizer with seed during placement in the furrow.

With appropriate planting equipment, seeds may be distributed as per any of the following procedures:

a) “Broadcasting” meaning random scattering of seeds over the surface of the field
b) “Drill seeding” meaning random dropping and covering of seeds in furrows to give definite rows
c) “Precision planting” meaning accurate placing of single seeds at about equal intervals in rows
d) “Hill dropping” meaning placing groups of seeds at about equal intervals in rows

Solid planting is generally done by using any one of the first two procedures, whereas row-crop planting may involve any of the procedure except for broadcasting. Except for broadcasters, a seed planter is required to perform all the following agricultural functions:

a) To meter the seed.
b) To deposit the seed in an acceptable pattern.
c) To cover the seed and compact the soil around the seed to prevent rapid loss of moisture from the soil around the seed.
d) It should neither damage the seed nor affect germination, that is, the seed should be placed in the...
soil in such a manner that all the factors affecting germination and emergence will be as favourable as possible.

e) Since timeliness is of extreme importance in most planting operations, it is desirable that a planter can perform these functions accurately at high rates of speed

f) To ensure uniform soil penetration.

g) To reduce time required to seed sowing.

h) To reduce man power.

III. METHODOLOGY

![Methodology of Seed Sowing Machine](image)

IV. WORKING

A. Drilling

When the machine is pushed manually, its first task is to dig the soil by setting the depth of drill. When the machine gets moved, the wheels start rotating and shank also moves with respect to the machine. By this the drilling process gets completed.

B. Seed Sowing

Wheels are connected to the circular plates that are situated below the hoppers. Both the wheels and plates are connected to each other by shaft and gear. The seeds are filled into the hoppers to be sowed into the soil. When wheel starts rotating, the plate also gets rotated as they are connected to each other. The hole on the plates coincides with the hopper hole, and the seed gets dropped through this hole to be get sowed into the soil.

C. Spreading of Fertilizer

This process is similar to the seed dropping process. The Fertilizer is filled into the hopper to spread into the soil. When wheel starts rotating, the plate also gets rotated as they are connected to each other. The hole on the plates coincides with the hopper hole, and the fertilizer gets dropped through this hole and gets spread into the soil. The fertilizer is usually mixed with the seeds.

D. Covering of Soil

The backward part of the machine consists of an angle shaped part which is used to fill up the soil which covers up the seeds with soil.

V. DESIGN

![Concept model of Seed Sowing Machine](image)

### A. Design of Chain and Sprocket

**Speed of Shaft 1 (N₁):**

\[
N_1 = \frac{60 \times 10^3 \times V}{\pi \times D_p} = \frac{60 \times 10^3 \times 0.33}{\pi \times 100} \\
\therefore N_1 = 64 \text{ rpm}
\]

### B. Shaft Design

**Torque**

\[
T_d = \frac{60 \times P_d}{2 \pi \times N_2}
\]

### C. Length of Chain in Pitches

\[
L_p = \frac{t_1 + t_2}{2} + \frac{2C}{P} + \frac{P(t_1 + t_2)^2}{40C}
\]

### D. Bevel Gear Design

1) **Acute Angle Gear**

\[
\tan \gamma_p = \frac{t_{g_p}}{t_{p}} = \frac{\sin \theta}{\cos \theta}
\]

2) **Pitch Line Velocity**

\[
V_p = \frac{\pi \times D_p \times N_p}{60 \times 10^3}
\]

VI. CONCLUSION

Hence, the seed sowing cum fertilizer drilling machine concludes the task of soil drilling, seed sowing, fertilizer spreading and soil marinating, hence proving itself for a multipurpose usage. The machine comes with its biggest advantage that it is a non-electrical, manual or mechanically operated machine. It is also a comparatively less time-consuming machine with decreased labor than the previous methods used for farming and crops cultivation.

REFERENCES


