# Design and Fabrication of Advanced Seed Sowing Machine

**Avesh Khan[1] Harsh Shah[2]**
[1]Assistant Professor [2]UG Student
[1,2]Department of Mechanical Engineering
[1,2]ITM Universe, India

*Abstract*— India is an agricultural country cultivating more number of ground nuts, corns, etc., in the village sides of the country. Manual method of seed planting, ends up in low seed placement, spacing efficiencies and heavy back ache for the farmer which limits the dimensions of field that may be planted. This project work focused on the design and fabrication of a manually operated sowing for various crop seed that is cheap, easily affordable by the agricultural farmers, easy to maintain and less laborious to use. In this project an attempt has been made for the design and fabrication of maintenance free multipurpose sowing machine exclusively for small farmers at lowest cost.

***Keywords:*** Seed Sowing, Seed Sowing Techniques, Planting Seed, Farmer

## I. INTRODUCTION

Agricultural sector is changing the socio-economic environment of the population because of liberalization and globalization. About 75% people live within the geographical area and are still keen about agriculture. About 43% of geographic region is employed 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 additionally increasing, this needs efficient and high-capacity machines. So mechanization in agricultural industry plays a vital role in Indian economy.

Fig. 1: Manual Seed Sowing

The basic function of sowing operation is to sow the seed and fertilizer in rows at required depth and to keep up the space between the seeds and supply proper compaction over the seed.

### *A. Sowing Methods*

*1) Broadcasting-*

Broadcasting is the method of random scattering of seeds on the surface of seedbed. It can be done manually or mechanically. When broadcasting is done manually, uniformity of seed placement depends upon the skill of the man scattering the seeds. Soon after broadcasting the seeds are covered by planking or some other devices. Usually higher seed rate is obtained in this system. Mechanical broadcasters are used for large-scale sowing. The device scatters the seeds on the surface of the seedbed at controlled rates.

Fig. 2: Broadcasting

*2) Dibbling*

Dibbling is the process of placing seeds in holes made in the seedbed and closing the seed with soil. In this method, seeds are placed in holes made at definite depth at fixed spacing. The equipment used for dibbling is called *dibbler*. It is a conical shape instrument used to make proper holes in the field. Small hand dibblers are made with several conical projections made in a frame. This is very time consuming process, so it is not suitable for small seeds. Mostly vegetables are sown in this way.

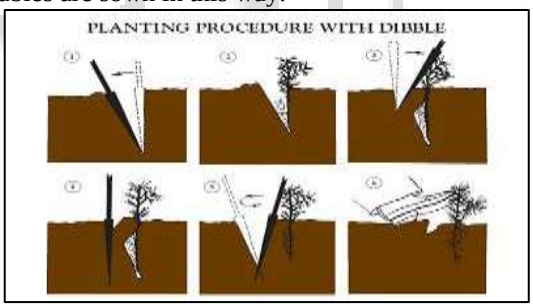


Fig. 3: Dibbling

*3) Drilling*

Drilling consists of dropping the seeds in furrow lines in a continuous stream and covering them with soil. The spacing between the seeds is not uniform. Seed metering may be done either manually or mechanically. The number of rows planted may be one or more. This method is very helpful in achieving proper depth of sowing, proper spacing between seeds and proper seed rate. Drilling can be done by using seed drills of tractor drawn and animal drawn types.

 

Fig. 4: Drilling

*4) Seed Dropping Behind the Plough*

It is a very common method of sowing followed by farmers in villages. This method is used for seeds like maize, gram, peas, wheat and barley. A woman/ man walks behind a plough ploughing the land and drop the seeds in the furrows made by the plough. Sowing behind the plough can be done by a device known as malobansa. It consists of a bamboo tube provided with a funnel shaped mouth. It is fitted to the handle of the plough. One man drops the seeds through the funnel and other man handles the plough and the bullocks. This method is a slow and laborious method.

Fig. 5: Seed dropping behind the plough

*5) Transplanting*

Transplanting consists of rising the seedlings in a nursery bed and then planting the seedlings in another field (main field). It is commonly done for paddy, vegetable and flowers. It is a time consuming operation. Equipment used for planting the seedlings in the main field is called trans planter.

Fig. 6: Transplanting

*6) Hill Dropping*

In this method, few seeds are dropped as a hill at a fixed place and not in a continuous stream. The spacing between hill to hill in a row is constant the equipment are called planters.


Fig. 7: Hill dropping

*7) Check Row Planting*

It is a method of planting, in which row-to-row and plant-to-plant distance is uniform. In this method, seeds are planted precisely along straight parallel furrows. The rows are always in two perpendicular directions. A machine used for check row planting is called check row planter.

Fig. 8: Check row planting

## II. LIMITATIONS OF SEED SOWING

- In manual seeding, it's unfeasible to achieve uniformity in distribution of seeds.
- A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is probably going to be uneven resulting in bunching and gaps in field.
- Poor control over depth of seed placement.
- It is necessary sow seed at high rates and bring the plant population to a desired level by thinning.
- Labor requirement is high because two persons are required for dropping seed and fertilizer.
- The effect of accuracies in seed placement on plant stand is bigger just in case of crops sown under rain fed conditions.
- The above limitations also mention the problem identification regarding seed sowing process.

## III. MECHANICAL FACTORS WHICH AFFECT THE SEEDS

- Seed damage during metering.
- Uniformity of depth of placement of seed.
- Uniformity of distribution of seed along rows.
- Transverse displacement of the seed from the row.

- Prevention of loose soil getting under the seed.
- Degree of soil compaction above the seed.
- Uniformity of soil cover over the seed.
- Mixing of fertilizer with seed during placement in the furrow.

| Vegetable | Distance between plants(cm) | Planting depth |
|---|---|---|
| (cm) | | |
| Beet | 3-5 | 1.5 |
| Broccoli | 45-60 | 0.5-1.5 |
| Cabbage | 45 | 0.5-1.5 |
| Carrot | 3-5 | 1.5 |
| Cauliflower | 45-60 | 0.5-1.5 |
| Corn | 15-25 | 2.5 |
| Onion | 5-8 | 1.5-3 |

Table I: Details for Planting Seed

## IV. OBJECTIVES

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.

## V. SELECTION OF COMPONENTS

### *A. Main Frame*

The main frame is the skeletal structure of the seed sowing machine on which all other components are mounted. The two design factors considered in the determination of the material required for the frame are the weight and strength. In this work, mild steel angle bar was used to give the required rigidity.

### *B. Handles*

The adjustable handles consist of two mild steel flat bar welded to the frame at two ends of the flat bar. One pipe of 20 mm external diameter attached at the end of mild steel flat bar.

### *C. Seed hopper*

The seed hopper was made of mild steel having a frustration cross-section of a pyramid of square at the bottom, square at the top and 300mm height. The capacity is based on the volume of seeds required to plant a hectare of field.

### *D. Plough Rod*

The design of plough rod of seed planters varies to suit the soil conditions of particular region. Most seed planters are provided with pointed tool to form a narrow slit in the soil for seed deposition. The adjustable furrow opener permits planting at each variety's ideal ground depth. The type used for this work is the pointed bar type. These types of furrow openers are used for forming narrow slit under heavy soils for placement of seeds at medium depths. The Furrow opener is a thin mild steel (angle bar). The angle bar iron was fabricated to shoe type like structure to facilitate an easy cut through the soil. Nut and both were used to fasten the device to the frame through a hole drilled on the frame for adjusting sowing depth according to crop.

### *E. Transport wheels*

Two transport wheels are made of mild steel. The front wheels have many numbers of lugs on its periphery which increase traction and reduction slip. These are located at both ends of the frame. Spokes are used to support the Centre bushing or hub. The spokes are arranged in such a way that it braced the wheel's circular circumference and also gives it necessary radial support.

### *F. Seed tube*

The seed tube is made of rubber hose pipe 30mm diameter and 300 mm long. Seeds picked from the hoppers pass through the upper hole at the slide of the castellated metering mechanism to the lower hole. Into the discharge tube which deposits the seeds at desired uniform spacing into the opened furrow.

### *G. Bearing Selection*

Bearings are selected based on their load carrying capacity, life expectancy and reliability. Ball bearings are fixed in the bushing provided at the two ends of the frame in other to support the eccentric shaft on which the wheels are attached. They allow the carrying of an impressive load without wear and tear and with reduced friction. This device ensures the smooth operation of the wheels. The material for the bearing is high speed steel.

### *H. Seed metering wheel house*

The seed metering house was constructed from mild steel made at the upper and lower portions on the metering housing. Seeds from the hoppers pass through the lower slot to the castellated metering mechanism to the lower hole, into the discharge tube.

### *I. Chain and sprocket*

Power transmission is done by the gear sprocket and pintle chain. When push the planter front wheel rotate then small sprocket of front wheel rotate and transfer the power to seed metering wheel shaft sprocket with the help of chain, in such a way seed metering wheel rotate, seed was singulated into the cell and dropped into the planting shoe/ground opener with the help of seed discharge tube that deposits the seed in the soil.

## VI. DESIGN IN SOLID-EDGE SOFTWARE

The Design of Seed Sowing machine was made in solid edge software. The orthographic views and 3D Views which can be seen in below figures.

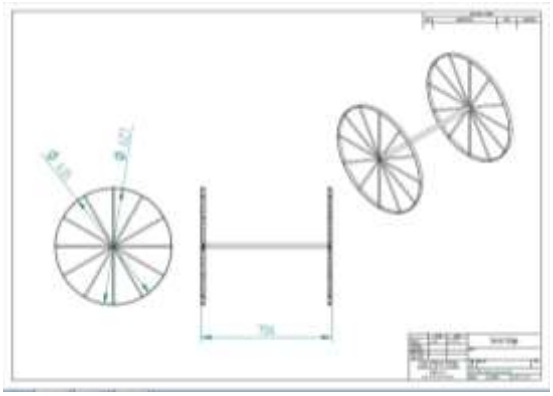

Fig. 9: Wheel Assembly Design

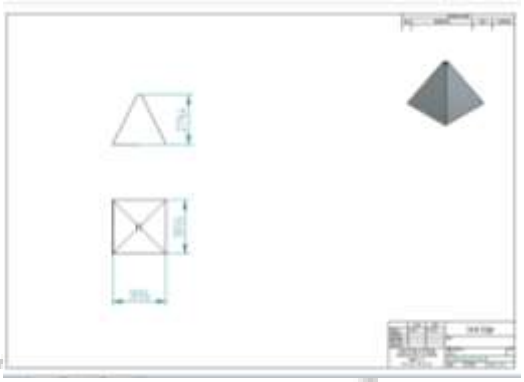

Fig. 10: Hooper Design

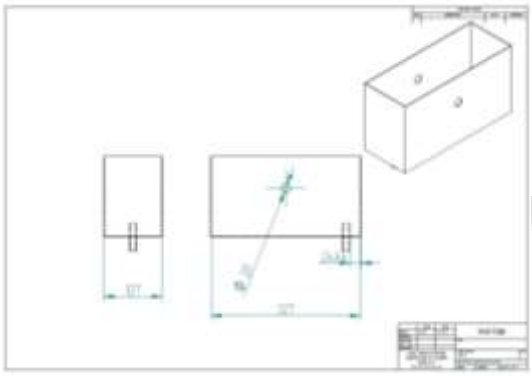

Fig. 11: Spade Drill Tank Design

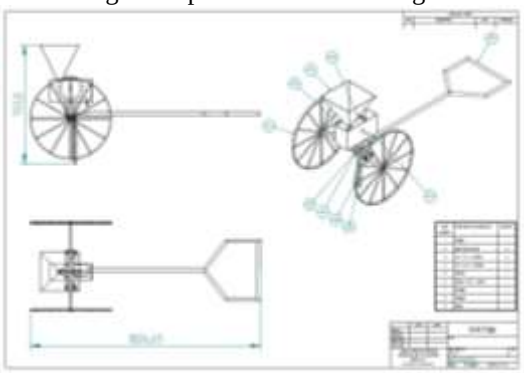

Fig. 12: Orthographic and Isometric view of Seed Sowing Machine

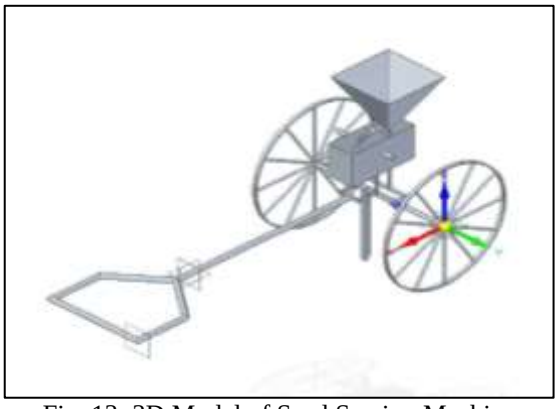

Fig. 13: 3D Model of Seed Sowing Machine

## VII. COMPONENT MATERIAL AND DESCRIPTION

Preferable Materials for the Parts:

1) Shaft: The shaft main rod can be made of Alloy steel/cast iron and our model is of a length of 1807mm.The shaft carries all the main of the mechanical plough cum seed like the wheels, pull rod, basins and the plough rods. The design of this shaft is done in a way that it should have the strength and the stress is developed at all the joins equally.
2) Wheels: The wheels can be made up of carbon alloys that they should be of minimum weight that they move with ease in the mud of the farm. Here to they are designed that it had spokes that the stress distribution is equal.
3) Pull-rod: The pull-rod is the main thing of the mechanical machine to work with this. The pull rod is joined to the bearing of the shaft and is designed in a rectangular way that the farmer can pull this. The principle for this pulling is easier than pushing.
4) Hopper: These are designed in a way that they are cylindrical in structure or joining of two conic sections that the seeds are moved to the Centre to seed them with ease and they don't get stuck at any places as they are forced to move to the centre and at the join, it is given small join hole of millimeter in diameter that only one seed can pass through that which can be done by micromachining process while fabricating the basin and it is made with sheets of mild steel that they are of less weight.
5) Plough rods: These are clamped to the bearings of the shaft and are designed in as C-clamps that they have been made of cast iron. These are at an angle and are placed somewhat back to the seeding position that after seeding this plough will be levelling the ground and then ploughs the field.

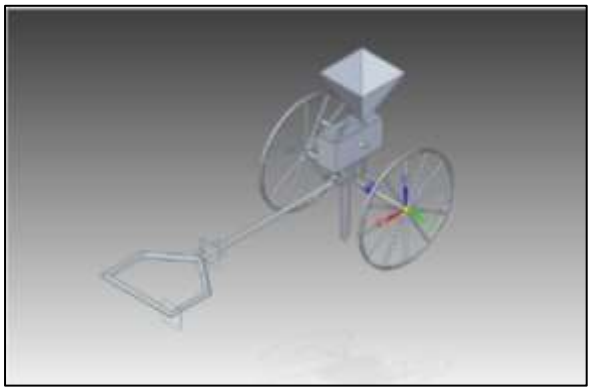

Fig. 14: 3D Model of Seed Sowing Machine

As shown in Fig.14, all the parts of the seed sowing machine were fabricated from mild steel material, the seed funnel which was made from rubber material, and the seed tube which was also made from rubber material. The rubber material will go a long way in minimizing seed bouncing, thereby protecting the seeds from damage due to impact. The hopper was fabricated using 2mm thick mild steel metal sheet.

## VIII. FABRICATION PROCESS FOR FINAL MODEL

The basic fabrication process can be seen in below mentioned flow chart.

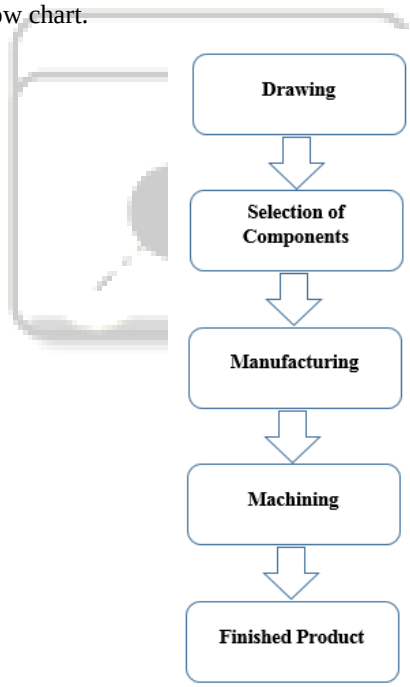


Fig. 15: Flow chart of basic fabrication processes

Formally the Fabrication process starts with the concept design and idea implementation in form of finalizing project components. The secondary process is to decide tools and machinery for smooth conversion of raw materials to finished product. Therefore, Fabrication is a process of making components by cutting, bending and assembling. Fabrication is the extended phase in our project. The method of manufacturing includes many steps.

Fabrication includes primary steps as follows:

- Marking and measurement
- Sawing
- Welding
- Inspection and Quality control

This may also include some of the secondary operations like:

- Grinding
- Chamfering
- Facing

These parts are then welded to the main shaft one by one. There are also many welding processes to weld these parts. Generally, the type of welding process we do use for these types of parts to connect them to a shaft by arc welding process as these need strong attachment between them. Finally the assembling of fabricated components is to be done.

The detailed fabrication process as an overview can be seen in below mentioned flow chart.

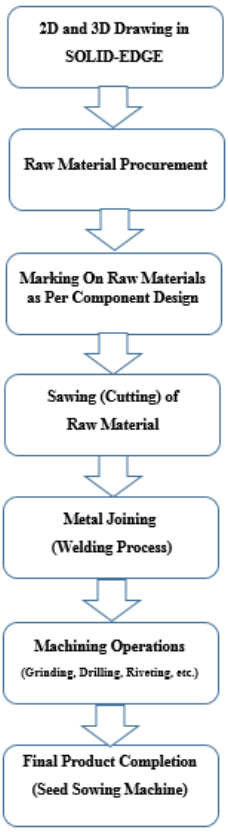


Fig. 16: Flow chart of detailed fabrication processes

Finally, the finished product after completion of all the required manufacturing processes resulted in the below successful project- seed sowing machine

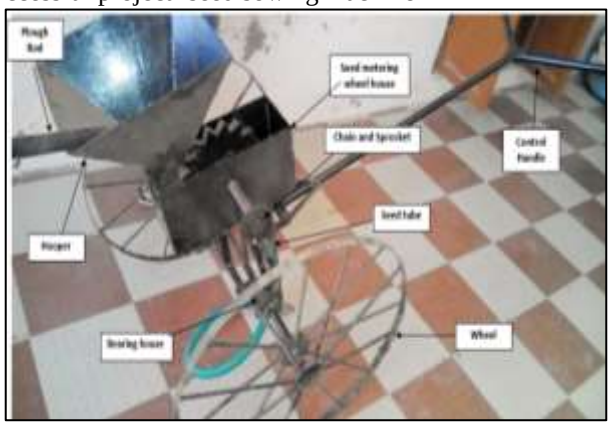

 

Fig. 17: components of seed sowing machine

Fig. 18: Front view of seed sowing machine

## IX. CONCLUSION

The need of a poor and small land farmer has fulfilled by the manual operated seed planter and they can easily and effectively plant their seed in the field by these planters. But due to different crops have different requirement for the seed planting in the field. So the usefulness of the single crop planter is limited. Hence the requirement of the manually operated multi-crop planter is very high. This work focused on the design and fabrication of a manually operated single-row multi-crop planter that is cheap, easily affordable, easy to maintain and less laborious to use. The planter will go a long way in making farming more attractive and increasing agricultural output. All parts of the planter were fabricated from mild steel material, except for the metering mechanism which was made from good quality nylon and the seed funnel and tube, which were made from rubber material. The seed metering type with cells on its periphery. For this design, the drive shaft directly controls the seed metering mechanism which eliminates completely attachments power transmission system thereby eliminating complexities which increase cost, and increasing efficiency at a highly reduced cost.

## X. FUTURE SCOPE

Top priority is given only for safety operation lost reduction; the seed sowing machine is fabricated with safety operation and reduced cost. Since, top priority is given only for cost reduction and safety operation it is noted that we should improve the strength of the machine members such as seed metering mechanism. No priority is given for strength and rigidity at the time of initial design. After installation and establishing successful working of the machine, it is proposed to concentrate on value engineering to increase the future value of the machine in all aspects. Presently, full focus is given only to Fabrication of machine for the benefit of the small farmers. At present, seed metering mechanism is used for sowing different types of seeds with single metering mechanism. We can use separate metering mechanism for every seeds. Thus, we can increase the value of the machine in future.

## REFERENCES

[1] Dransfield P S, Willatt T and Willis a H (1965), "Soil to Implement Reaction Experienced with Simple Tines at Various Angle Attack", Journal of Agriculture Engineering Research, Vol. 9, No. 3, pp. 220-224.
[2] Gupta V K, Vig A C and Ranjodh Singh (1970), "Influence of Spacing, Time of Sowing and Nitrogen Fertilization on the Yield of Wheat", Indian Journal of Agronomy, Vol. 15, pp. 251-253.
[3] Iqbal N, Akbar N, Ali M, Sattar M and Ali L (2005), "Effect of Seed Rate and Row Spacing on Yield and Yield Components of Wheat", Journal of Agricultural Research, Vol. 48, No. 2.
[4] Malik A U, Ahmad Alias M, Bukhsh H A and Hussain I (2009), "Effect of Seed Rates Sown on Different Dates on Wheat Under Agro-Ecological Conditions of Dera Ghazi Khan", The Journal of Animal & Plant Sciences, Vol. 19, No. 3, pp. 126-129.
[5] Sankaranarayanan M, "Development of A Push Type Seed Drill for Sowing Maize in Rwanda". Institut Supérieur d'Agriculture et d' Elevage, ISAE, Busogo, Post Box No. 210, Musanze, Rwanda.
[6] Rolando P, "Development of a manually operated disc-type corn seeder".
[7] Ed Dager, "Proper Equipment for Small Farms" Kaitlin D'Agostino, Economics, SAS '13, Rabin, 12/03/09.

 