



DESIGN AND DEVELOPMENT OF GROUNDNUT SEED SOWING ATTACHMENT FOR SMALL SCALE LAND HOLDERS

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ABSTRACT

Seed plantation is an important part in the farming activity. In the present condition maximum farmers are sowing the groundnut seeds manually and machinery usage is very less. The new seed sowing product designed is considered with various parameters of customer needs like size, seed sowing for a specific distance, type of mechanism, ergonomics consideration and spare parts availability in the local areas are the important parameters. The purpose of this research is to study about groundnut cultivation and its economic analysis. The concept is generated and created in 3D virtual model and the final concepts are selected using PUGH matrix method. The wheel base and engine with gear box with handles can be attached for multipurpose cultivation. The concept of seed sowing attachment designed for groundnut is very simple, easy to assemble and disassemble and with low cost. The main parts are fly wheel to pick the groundnut from the drum and dispersing in specific distance, and then pass through the pipe by means of gravity. From the ethnography study, it is found that about 63% of the farmers are using traditional method of groundnut seed plantation and 37% farmers are dependent on machineries. The conventional method of seed sowing involves manual method, which disperses 2 to 3 seeds in the same place causing high labour cost and time consumption. This problem can be overcome by using developed new concept. This product being economical fulfils the medium and small farmers needs and also reduces the human effort.

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INTRODUCTION

In India, there are about 70% of people who depend upon on agriculture. Most of the farmers are following traditional method for various operations. Seed sowing is an important operation in farming activity, where conventional seeding operation consumes more time in addition to man power. The seed feed rate, time required for the total operation is more and the total cost is increased due to labour shortage and hiring of equipment. The conventional seed sowing machine is having many challenges and it is less efficient, time consuming.

To meet the future food demands, farmers have to implement the new techniques which will not affect the soil quality but will increase the overall crop production. In the farming process, often used conventional seeding operation takes more time and labour. The machine reduces the efforts and total cost of sowing the seeds and fertilizer placement.

Due to industrialization, there is challenge in getting man power in agriculture industry. The main aim of automated machines in the seed sowing is to improve productivity in the agriculture, integration of the automatic mechanisms will help in increase the efficiency for Seed sowing. Automation saves a lot of tedious manual work and speeds up the production

processes. So, it is the time to automate the sector to overcome this problem.

In the present scenario most of the countries do not have sufficient skilled man power in agricultural sector and that affects the growth of developing countries. Therefore farmers have to use upgraded technology for cultivation activity like digging, seed sowing, fertilizing, spraying etc.

LITERATURE REVIEW

The major occupation of the Indian rural people is agriculture, where both men and women are equally involved in the process. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time.

In olden days planting was done manually. The seeds would be thrown, or broadcast. This system made it more difficult to weed and harvest the crop. The idea for dropping the seeds through a tube first appeared in Mesopotamia in 1500 B. C. In 1701AD Jethro Tull invented the first seed drill. The implement would cut small channels into the soil and the seed would be dropped into the channel. Before this, seeds were usually planted by a method known as broadcasting. Broadcasting is simply throwing seeds onto the ground (Roshan V- 2013). Push type machine where wheel is operated using power and the power is transmitted through plunger

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chain mechanism and cam is mounted on the sprocket. The plunger is penetrating through the soil and flapper is opened and the seed get inserted in dig (Kyada A. R-2014). Seed metering plates are used to drop the seed in specified distance from the seed box. Even remote controlled and battery operated multipurpose farming equipment like seed plantation, fertilizer distributing, spreading and water sprinkler. This machine reduces the man power and works without using petrol and diesel (K.Mahalle-2020). Later develop the walking tiller assembly with low cost farming machine, one row iron plough is used to loosening the soil. Seed sowing machine attached to main machine and designed two rows sowing at a time (Sheikh Mohd-2017). Engine specification of 7.5 BHP and displacement of engine is 97.20cc were used and maximum speed of 60Mph.

Three rows seed dispensing machine were developed to drop the seeds using sensors logic pulse (Aniket Kumbhar-2018). This is controlled by micro controller. The rotor will rotate once after receiving of one pulse and one seed is dropped and repeating process.

Later develop microcontroller DC motors and LCD with automated seed dropping machine consists of solenoid valve, relay and its driver were used. With the help of drilling mechanism, the soil is drilled while the robot is moving in forward direction (Abdulrahman -2017) through solenoid valve seeds are dispensed, and same process is continued till the end.

The seed sowing process is automated to reduce the human effort and increase the yield. The distance between the two seeds are controlled and varied using mechanized systems. It is also possible to cultivate various kinds of seeds with varying distance.

Ethnography study



Figure 1 Seed dispersing equipment

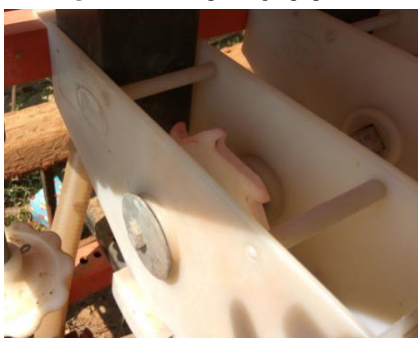


Figure 2 Groundnut dispersing method

Figure 1 and 2 shows that seed dropping equipment for specified distance. In this method, if the seeds are dropped in six rows then it is required to assemble six parts to the tractor attachment system.

Groundnut Seed plantation

While planting the groundnut seeds, important factors to be considered are, depth, rows and distance between the plants should be uniform which helps in transverse distribution of seeds and loosen the soil and covers soil over the seed uniformly. To improve the performance above factors should be optimized, so that the desired efficacy from the system is economical.

Sample data from 300 farmers were collected in central dry zone of Karnataka. In this region it was observed that the majority of farmers belong to category of marginal and small land holders.

From the ethnography study it was found that about 63% of the farmers use traditional method of groundnut seed plantation and 37% of the farmers are dependent on machineries. When the groundnut is planted manually seeds are not dropped uniformly, sometimes 2 -3 seeds will be dropped at a time in the same place. If plants are overlapping, then the yield would be reduced.



Figure 3 Groundnut seed dropping method

Figure 3 shows traditional seed dropping method. In this process, more number of labours and money are required for seed plantation. During cultivation season, it was observed that there is a huge labor scarcity and not availability of machineries for small land owners. For economical cultivation, the cost should be minimum and process should be faster. To achieve so, it was observed that automation is the only solution to overcome this issue.

In small villages, only one or two tractors are available for farming activity. Medium, small and marginal farmers are facing huge scarcity of tractors during the cultivation season.

Based on the survey, it is required to design an new seed sowing equipment, which helps in sowing of seeds in the desired position by assisting the farmers to save the time and also it should lead to low cost and decrease the operational cost. In the same time it should support for increase the productivity. The proposed product should be able to operate in the small farming land (1 to 3 acre).

MATERIAL AND METHODS

Study Area

The data was collected from Chitradurga and Tumkur districts of India, which is located in the central dryzone of Karnataka. This is located between 760 34'49.86"E to 760 51' 32.13"E and 140 14'13.63"N to 140 30'28.30" The temperature in

these areas varies from 17⁰C to 43⁰C depending on the seasons. The rain fall ranges between 453.5 and 717.7 mm and found to be maximum during Kharif season. The soil is sandy loam and red in major areas and remaining areas are deep black. The main crops grown in these areas are Groundnut, Ragi, Jowar and vegetables.

RESULTS AND DISCUSSION

Base product concept

Based on the results obtained from survey, the concepts are generated to disperse the groundnut seeds in an efficient manner. Firstly, the waling tiller main base product with gear box, engine, wheels and handles were developed and are shown in figure 4. For this main base product, various attachments required for i.e., seeds plantation, chemical spraying, harvesting and other operations are planned to develop.

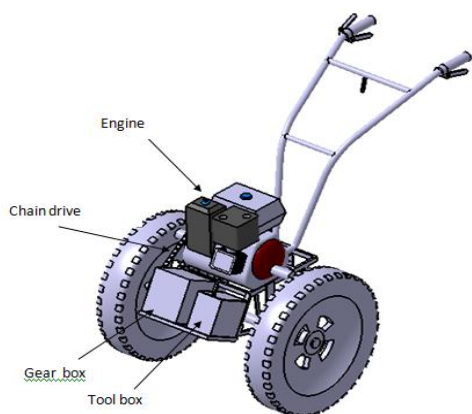


Figure 4 Main base walking tiller

Concept-1 Seed plantation attachment

In the present method, the groundnut seeds are sown manually or by using some attachment using bullock while ploughing. Another method is the attachment is fitted to tractor. In the proposed work, attachment is connected to the walking tiller. The hopper is designed to store the seeds, and seeds pass through circular pipe to centre shaft. Circular type drum is connected to shaft. In the drum, holes are provided to drop the seeds at specified distance and the seeds flow through drum to pipe while ploughing where the land is digged by 4-5 inches. And the roller is designed to fill the soil above the seeds. Chain drive mechanism is used to connect to the engine and to the seed attachment. Once the base product starts moving, three rows are planted at a time. In this way 3 to 4 acre of land can be covered in a day. This reduces the time consumption when compared to manual method. The developed concept-1 along with the seed plantation attachment is shown in figure 5.

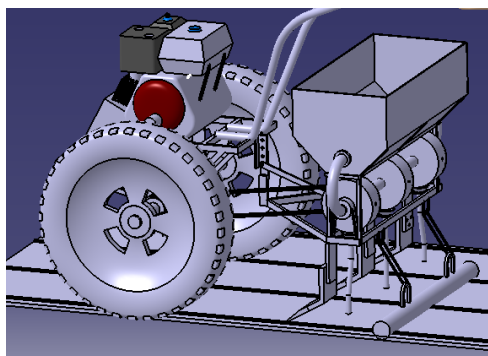


Figure 5 Concept-1 Seed plantation attachment

Concepts-2 Seed Plantation attachment

The seed planting method in concept 2 is different from the concept-1 as shown in figure 6. In this design, the new attachment is connected to the walking tiller.

The hopper is designed to store the seeds, circular type flying wheel is connected to shaft. Semi circular elliptical bucket is connected to circular flywheel to collect the seeds. This will collect single seed at a time and drop them to the discharging drum. From discharging drum the seeds pass through the hose pipe to ground. While ploughing, the land is digged by 4-5 inches after that seeds are dropped and the roller is designed to fill the soil above the seeds. Chain drive is connected to the engine and seed attachment. Once the machine starts moving three rows are planted at a time. In this way 3 to 4 acre of land can be ploughed in a day. This reduces the time consumption and the seeds are dropped in specified distance and increase the production rate when compared to manual method.

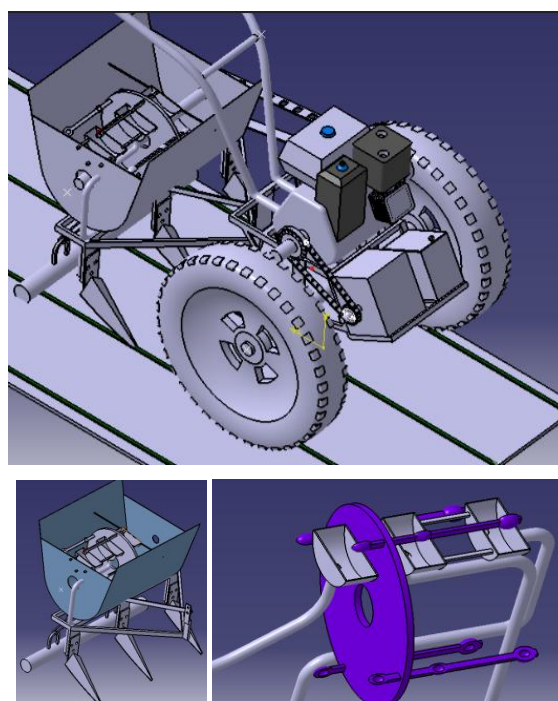


Figure 6 Concept-2 Seed plantation attachment

Concept-3 Seed plantation attachment

The seed planting method in concept 3 is different from the concept-1 and concept-2 and is shown figure 7. In this design, the new attachment is connected to the walking tiller. The hopper is designed to store the seeds, two shafts are connected inside the hopper, and timer belt is connected in between the shafts. For timing belt, semi circular bucket is connected according to specified distance, the bucket is used to collect the seeds. This will collect one seed at a time and drop them to the discharging drum as shown in figure-7.

From discharging drum, the seeds pass through the hose pipe to ground. While ploughing, the land is digged by 4-5 inches. There are three timer belts connected so that seeds are dropped at three rows at a time. And the roller is designed to fill the soil above the seeds. Chain drive is connected to the engine and seed attachment. Once the machine starts moving three rows are planted at a time. In this way 3 to 4 acre of land can be sowed in a day.

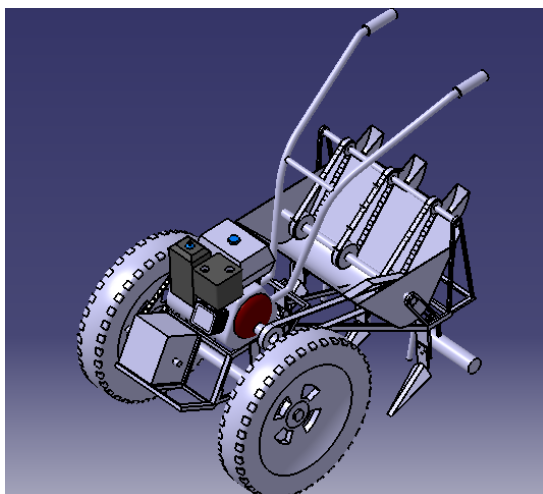






Figure 7 Concept-3 Seed plantation attachment

Final Concept selection

Concept selection is one of the major challenge for designers. PUGH matrix is used to rank scoring method to select the final concept. Concepts are analyzed by various parameters of each model against datum model. Its pluses and minuses or same like datum product (+ or -) in terms of its user design simplicity, cost involved, efficiency, size, shape, aesthetics and fabrication are the important factors.

Table 1 Concept selected using PUGH Matrix method

		Concept-1	Concept-2	Concept-3
Criteria	Datum 			
Compact	0	+1	+1	+1
Less maintenance	0	+1	+1	+1
Easy assembly and disassembly	0	0	+1	0
Cost of Product	0	+1	+1	+1
Seed pickup and drop	0	0	0	0
Easy of use	0	+1	+1	+1
Availability of spare parts	0	+1	+1	0
Reduce the man power	0	0	0	0
Total Score		5	6	4
Rank		II	I	III

From the table 1 it was observed that concept 2 is selected for final concept got highest scoring compared to other concepts shown in figure 8.

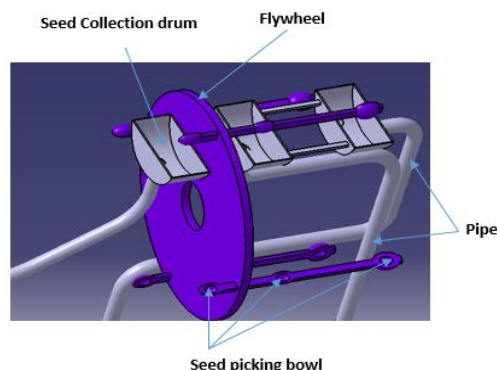
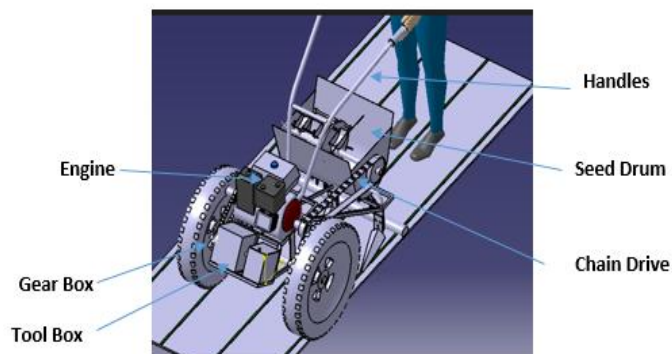


Figure 8 Final Concept seed plantation with attachment

From the ethnography study it is found that in central dry zone of Karnataka seed plantation distance between rows is 8 inch and width is 11 inch.

Seeding plantation distance calculation

Dia of cylinder- 259
 $r = 129.5, D = 259\text{mm}$
 $C = 2 \pi r$
 $= 2 \times \pi \times 129.5 = 813.26$
 Circumference : 813.26mm
 1. $813.26 / 4 = 203.31 \text{ mm (8 inch)}$
 2. $813.26 / 3 = 271.08\text{mm}$

So that our design is 4 bucket in a wheel

CONCLUSION

Seed plantation is an important part in the farming activity. In the present condition maximum farmers are sowing the groundnut seeds manually and machinery usage is very less. To meet the future food demands, farmers have to implement the new techniques which will not affect the soil quality but will increase the overall crop production. While planting the groundnut seeds, important factors to be considered are, depth, rows and distance between the plants should be uniform which helps in transverse distribution of seeds and loosen the soil and covers soil over the seed uniformly. In this context, five concepts were developed and the final product was selected based on PUGH matrix and the selected concept was developed to suite to small and medium scale farmers. The new method of seed plantation helps in reducing the wastage of seeds, time and labour cost when compared to manual method. This product is found to be very efficient and beneficial to medium and small scale farmers.

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