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Design and Development of Vegetable Planting Machine

G. VIGNESH[1], T. PUGAZHENTHI[2], A. SANTHOSHKUMAR[3]
UG Students,
SANJAI KUMAR. S[4]
(ASSISTANT PROFESSOR) KSR Institute for Engineering & Technology, Anna University, Chennai.

ABSTRACT:- India is the second largest producer of vegetable in the world (ranks next to China only). India share 12 percent of world production of vegetable with a productivity of about 15 tons per ha which is quite low as compared to many countries. In India transplanting of vegetable seedling is done manually all over the country, as no machine is yet available commercially for this work. High labour requirement and shortage of labour during peak transplanting season causes delay in transplanting and affects timely operation [1].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 [2].Farm mechanization aims at higher production rate reduction in human drudgery. Many operations in agriculture are now being performed by machines. This reduces the labour requirements which have been the principal motivating force in mechanization. Due to small land holding is not possible to mechanize all the farming operations. Large machines cannot be operated these small farms. Also our farmers cannot afford to buy large costly machine. Vegetable planting machine is a device which helps in planting of vegetable plants in a desired position hence assisting the farmers in saving time and money. The basic objective of planting operation is to plant the vegetable plants in rows at desired depth and plant to plant spacing cover the plants with soil and provide proper compaction over the plant [3].

Keywords— *Seed, Farmer, Planting Machine.*

I. INTRODUCTION

India provides larger quantities of vegetables. During recent years, the production and productivity of vegetable recorded impressive growth. The present vegetable production in India is 113.5 million tons in an area of 7.2 million hectares with an average productivity of 15.7t/ha (Singh,2007). Vegetable play an important role in improving the economic condition of vegetable growing farmers. One of the constraints to increase production and productivity of vegetable crops is low level of mechanization. Mechanization hells in timely compaction of operation. There is lot of scope for increasing yield in most of the vegetables by growing high yielding varieties and adopting improved production technologies. However, in India transplanting of vegetable seedling is done manually (Manes et al., 2008). Manual transplanting is labour & time consuming, costly and more fatigue as transplanting in season causes delay in transplanting which results in poor yield. The transplanting operations represent a significant portion of the transplant seedling cost. Most of the cost is attributable to the labour involved in handling seedling. Maximum vegetable crops like Brinjal, tomato, onion, chilli, cauliflower, cabbage etc. are transplanted manually. Timely transplanting of crops is essential for good yield which may be possible by mechanization. In conventional transplanting practice development of semi-automatic vegetable transplanter is very important. Features of transplanter influenced the performance, plat growth and productivity. Therefore an effort was taken to meet the above requirements and conducted a study of field performance evaluation of semi-automatic vegetable transplanter. A semi-automatic two-row vegetable transplanter was evaluated in the field for brinjal and chillies and compared with the manual transplanting of

bare root seedling [1]. Most of the vegetables like tomato (*Solanum lycopersicum*), and peppers (*Capsicum spp*.) are first sown in nursery beds and later transplanted manually either on ridges or on a well prepared seedbed

Most of Indian farmers have small land holding and have much below living standard. It is very difficult for them to have costly agricultural machinery and equipment. But the development of Indian agriculture sector depends on the development of farm machinery. There is need of cheap and easily available farm machinery to reduce human efforts and the product damage. The available vegetable transplanter are expensive for the small scale farmer, therefore these farmers use traditional methods of vegetable transplanting. In India most of the farmers doing transplanting operation of vegetables with traditional methods, that methods include all operation such as making holes in mulching paper, dugout pits on bed and transplant seedling in each hole are done manually. This method of transplanting is time consuming and need maximum labour input, sometime there is lack of availability of labour. The unavailability of labour, cause delay in transplanting operation which directly affects crop production and economic condition of the farmer.

A human workforce contributes substantially to crop production in Indian agriculture. Approximately 220 million workers provide about eight per cent of all related agricultural activities. Although farm mechanization is increasing rapidly, it is the men whose tasks are predominantly affected. Whereas only hand tools were used in ancient times, there has been a gradual improvement in their design, efficient handling, weight, and cost and worker acceptance in recent times. People today realize that there are still many possibilities to modify these tools for better work efficiency. The development of such equipment is necessary to overcome this problem which is easy to transplant the vegetable and also labour and time saving[4].

The basic function of planting operation is to sow the seed and fertilizer in rows at required depth and to maintain the distance between the seeds and provide proper compaction over the seed. A sowing machine is a device that plants or sows the crops, it digs a furrow places the seed or seeds into the furrow and covers it. Vegetable planting machine ensures uniformity in seed broadcasting and saves time and money [3].

II. DESIGN

The design of manually operated planter for sowing different seed crop is based on the following considerations [5]

- The ease of fabrication of component parts.
- The safety of the operator
- The operation of the machine should be simple for small scale or rural farmers.
- The materials available locally were used in the fabrication of the components.
- Availability and cost of the materials for construction.

Fig 2.1 Developed Vegetable planter machine

Functional requirements of plant metering devices:

- Meter the plant at a predetermined rate/output (e.g.kg/ha or seeds/meter of row length)
- Meter the seed with the required accuracy (spacing) to meet the planting Pattern requirements.
- Cause minimal damage to the seed during the metering process.

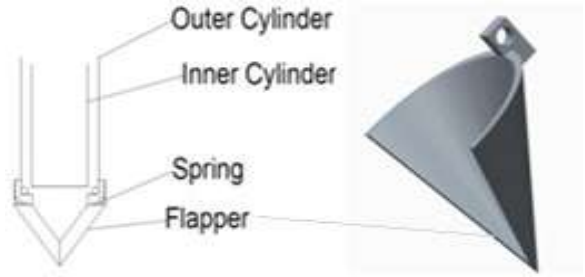


Fig 2.2 Plunger flapper mechanism

III. METHODOLOGY

Fig 3.1 Method of growing plant

The basic objective of planting operation is to put the plant and fertilizer in rows at desired depth and plant to plant spacing, cover the plant with soil and provide proper compaction over the plant. The recommended plant to plant spacing and depth of plant placement vary from crop to crop and for different agro-climate conditions to achieve optimum yields [3].

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.

Table 1 Diameters of different seed

Seed name	Diameter(mm)
Arugula	2.5
Beet	7.5
Broccoli	3.5
Cabbage	3.5
Carrot	3.5
Cauliflower	3.5
Corn	13.5
Cucumber	9
Lettuce	6
Okra	7.5
Onion	6
Pea	10
Radish	4

Table 2 Details for planting seed

Vegetable	Distance between plants(cm)	Planting depth (cm)
Asparagus	30	2.5-4
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
Okra	30	2.5
Onion	5-8	1.5-3
Pepper	60	1.5
Potato	25-30	10
Radish	2.5	1.2
Tomato	90	1.2
Watermelon	30-60	2-3

IV. MECHANISM

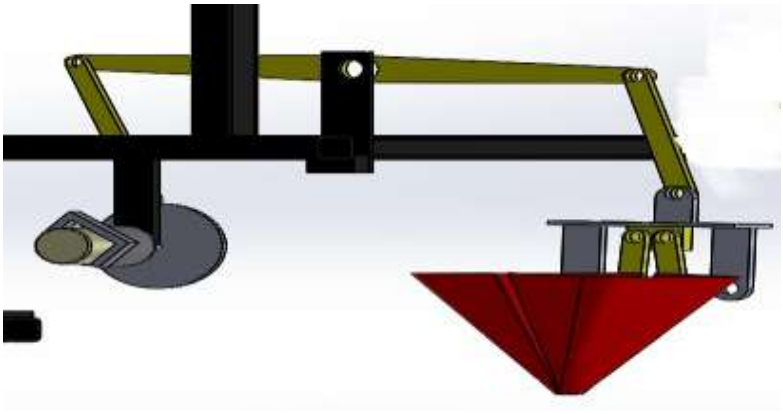
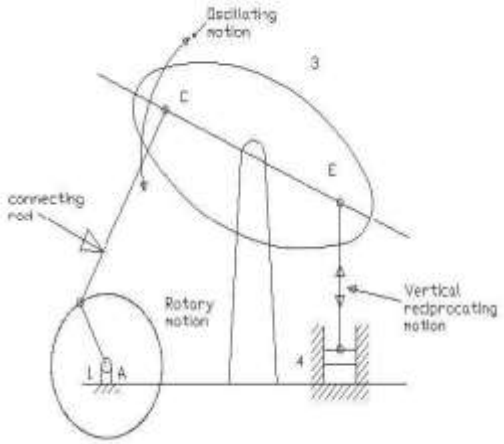


Fig 4.1Mechanism

BEAM ENGINE:

When the crank AB rotates about A, the link CE pivoted at D makes vertical reciprocating motion at end E. This is used to convert rotary motion to reciprocating motion and vice versa. It is also known as Crank and lever mechanism. This mechanism is shown in the figure below.



V. MATERIALS & METHODS

MAIN FRAME:

The main frame is the skeletal structure of the seed planter 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 square tubeof 20 mm x 20 mm and 1mm thickness were used to give the required rigidity [5].

PLANTING MECHANISM:

Metering mechanism is the heart of machine and its function is to distribute plants uniformly at the desired application rates. In planters it also controls plant spacing in a row. A seed planter may be required to drop the seeds at rates varying across wide range. Proper design of the metering device is an essential element for satisfactory performance of the seed planter. The size and number of cells on the seed metering device depends on the size of seed and desired seed spacing. In this design, the seed metering wheel lifts the seeds from the hopper in the cells and drops these into the seed funnel which is conveyed to the open furrow through the

seed tube. For varying the seed rate and sowing different seeds, four separate metering wheels were provided. The number of cells on the seed metering wheel may be obtained from the following expression [5].

VI. SCOPE OF PLANTING MACHINE

- Improvement in planting efficiency.
- Increase in crop yield and cropping reliability.
- Increase in cropping frequency.
- It increases 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 labour also decreased.
- It consume less time for sowing.
- Seed can be placed uniformly in a row with required distance between plants.

VII. CONCLUSIONS

The average plant height, number of branches per plant, plant mortality, yield/m2, seedling missing, and leaf area index was found more by machine transplanting while plant population was found less by machine transplanting. Time saving, labour saving, less cost of operation were achieved in machine transplanting as compare to manual transplanting.

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