

# International Journal OF Engineering Sciences & Management Research HANDHELD PLANT TRANSPLANTER.

Mr. Lokhande P.V.\*<sup>1</sup>, Mr.Kokane P. D.<sup>2</sup>, Mr. PhapaleN.S..<sup>3</sup>& Mr.Tikekar B.R.<sup>4</sup>

\*<sup>1</sup>Dipoma Student, Mechanical engineering, Jaihind Polytechnic, Kuran, Pune, India.

<sup>2</sup>Dipoma Student, Mechanical engineering, Jaihind Polytechnic, Kuran, Pune, India.

<sup>3</sup>Dipoma Student, Mechanical engineering, Jaihind Polytechnic, Kuran, Pune, India.

<sup>4</sup>Dipoma Student, Mechanical engineering, Jaihind Polytechnic, Kuran, Pune, India.

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# ABSTRACT

The hand held vegetable transplanted consists of different component like handle, lever, hollow pipe, jaw and jaw operating wire. The implement penetrates into soil by its self weight hold with handle, seedling is dropped into hollow pipe then the jaw opened with lever. This work is focused on design, development and testing of hand held vegetable transplanted capable to transplant seedling precisely in a straight line with uniform depth in mulch bed. The work demonstrates the application of engineering techniques to reduce the labour efforts and time required for transplanting. The result obtained from the trial tests concluded that transplanter functioned properly as there is no miss planting compared with automatic vegetable transplanter, also the rate of tilted planting is negligible. The cost of operation is comparatively less than traditional method of transplanting. From visual observation we have seen that there is no damage to the seedling during operation. The transplanting capacity observed from trail is 0.02 ha/hr, theoretical field capacity is 0.0243 ha/hr, field efficiency is 82.30%.

# **INTRODUCTION**

India is the second largest producer of vegetables. About 175 types of vegetables are grown in India including 82 field vegetables and 41 root (tuber and bulb) crops in India produces 14 % (146.55 million tons) of world's vegetables on 15 % (8.5 million hectares) of world area under vegetables. Productivity of vegetables in India (17.3t/ha) is less than the world average productivity (18.8t/ha) in 2012-2013. 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.

Nasik is leading tomato producer in Asia; pimpalgaon has been creating production record in the tomato market. This September, Pimpalgaon exported tomatoes worth Rs.90 crore to Pakistan and other neighboring countries. Now a day's most of farmer uses mulching bed for tomato transplanting in Nasik. But they use traditional method of transplanting with hand, which is labour and time consuming.

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.

# MATERIAL AND METHOD

The prototype was design for vegetable transplanting such as tomato, capsicum, etc. **Factors influencing the design are considered in details** 

#### Dimension of seedling

The dimension of seedling is important to decide the diameter of hollow pipe, height of jaw and apex angle. Canopy of seedling is considered to decide the diameter of hollow pipe, the average size of canopy is required to avoid clogging in hollow pipe, also stage of seedling decide the height of jaw. The height of seedling should not be more than 20cm



# International Journal OF Engineering Sciences & Management Research

### Dimension of coco peat

The height and diameter of seedling pot is important consideration in hand held vegetable transplanter, the dimension of seedling pot is 5cm in width and height.

#### Preparation of mulch bed

The height of the mulch bed is important to decide the height of the implement for human comfort. The dimension of mulch bed is 20cm in height and 60cm to 90cm in width is considered.

#### Hand grip

The diameter of handle is decided according to the average hand grip of human and also to maintain the distance between handle and lever which should not exceed 4cm.

#### Apex angle

The apex angle  $2\Theta$  is inclined angle formed between the two edges, according to singh (1998). It ranges between  $36^{\circ}$  to  $60^{\circ}$  for proper penetration of implement into the soil; therefore apex angle of jaw is taken as  $47.26^{\circ}$ .

#### Working principle of the developed hand held vegetable transplanter

The main working principle of hand held vegetable transplanter is lever operated. This prototype has simple mechanism; the jaw is operated with lever which is connected by gauge wire. The prototype in held position with handle as the jaw penetrate into soil bed, pick up one seedling and drop into hollow pipe, then pull the lever upside. The action of lever open the jaw inside the soil, at that condition seedling is drop into the pit. Now pick up the implement in same position (jaw in open position), the outermost soil from jaw is come towards the root zone of seedling. The main parts of implement are hollow pipe, handle, lever, jaw operating wire and jaw.

#### Adjustment

- 1. Position of handle
- 2. Distance between handle and lever
- 3. Length of jaw operating wire
- 4. Diameter of hollow pipe



#### **RESULTS AND DISCUSSION**

The hand held vegetable transplanter consists of different component such as handle, lever, hollow pipe, jaw, jaw operating wire. The total weight of implement is 270 g, which is easy to hold and operate. The diameter of the hole punched is 70 mm and depth of operation achieved is 100 mm. This implement is beneficial to small land holders and to those where lack of availability of labour. It is light weight, so there is no difficulty in handling. It require skill operator for proper transplanting operation. The price of the implement is Rs.500/-which is economical to farmer. The maintenance is not essential, so it is one time investment. It is design to transplant vegetable crops only i.e. tomatoes, chilli, capsicum etc, but the canopy of seedling must be below 100 mm. The equipment is simple in design and cheap in price.



International Journal OF Engineering S	Sciences & Management Research
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Sr. no.	Length, m	Width, m	Area, m2	Time	Speed,	TFC,	EFC,
				required,	km/hr	ha/hr	ha/hr
				min			
1	10m	5m	50 m2	15	0.261	0.02349	0.02
2	10m	5m	50 m2	15.5	0.255	0.02297	0.01935
3	10m	5m	50 m2	16	0.25	0.0225	0.01875
4	10m	5m	50 m2	17	0.247	0.02223	0.01765
5	10m	5m	50 m2	17.5	0.245	0.022	0.0172
Mean 16.5		0.2516		0.02263	0.0185	59	

# CONCLUSIONS

During the project of design, development and testing of hand held vegetable transplanter we get following results:

- 1. The field capacity of hand held vegetable transplanter is more than traditional method of transplanting.
- 2. The time required for operation is 20 hr for 2 labours by hand held vegetable transplanter and 46 hr for 2 labours by traditional method
- 3. Cost of operation is much less than traditional method.

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