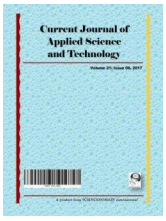

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Comparative Study on Manually Operated Onion Bulblet Planter over a Traditional Method of Planting

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted that the comparison between the planting of onion by manually operated onion bulblet planter over a hand planting method (Traditional method of planting) in the college of Agricultural Engineering JNKVV Jabalpur. A manually operated onion bulblet planter was developed with an inclined plate metering device. The performance evaluation of developed planter in term of field efficiency and missing hill percentage. And it also compares the cost and time of operation of developed planter over a hand planting. The results showed that the field efficiency was 83.33% with chisel type furrow opener and the missing index percentage was 2.22%. It observed that the cost of planting by manually operated onion bulblet planter was Rs. 1790.81 per hectare of land as compared to the hand planting method for one hectare of land was required 65 man days and cost of Rs. 9300.

Keywords: Onion planter; field efficiency; chisel type furrow opener.

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1. INTRODUCTION

Most of the farmer use traditional methods for sowing/ planting such as broadcasting and seed dropping behind the plough, which effects germination due to the non-uniform placement of seeds at the proper depth. All methods of onion planting depend heavily on manual labour. In daily life onion are an important vegetable, it is unfortunate that not much development has been made in mechanising cultivation practices in onion production. Mechanisation will lead to a reduction of labour demand, uniform rate of production and high yield that occurs a relatively short period in each growing season.

The performance of manually operated garlic planter at Jabalpur. They compared the cost economics and labour requirement of the planter with the traditional method. The result shows that the capacity of the manual planter for the sowing of garlic crop was 0.019 ha/h with including 2 people [7].

The performance parameters measured during field test included, i.e. seeding depth, miss index, multiple indexes and seed damage. The results indicated the seeding depth and spacing was 12.3 and 22.7 cm respectively. Also, miss index, multiple indexes and seed damage were measured as 12.23, 2.43 and 1.41% respectively [4].

In this study the performance of animal-drawn planter on establishment and productivity of groundnut in the north of Sudan. The results showed that there were highly significant differences between the animal-drawn planter and manual for parameters such as time for sowing, sowing depth, plant population, uniformity of seedling, in groundnut cultivation, weeding efficiency, seed and hay yield (kg/ha). The animal-drawn planter saves sowing time by 86.6% compared to manual sowing. It also gave better crop establishment, distribution and uniformity of plant population which resulted in higher yield (1583.9 kg/ha) than that of manual treatment (998 kg/ha) [2].

The need for mechanisation, the planter was developed to improve planting efficiency and reduce drudgery involved in manual planting method. The aim of the study was to a comparison between the planting of onion by manually operated onion bulblet planter over a hand planting method (Traditional method of planting).

2. MATERIALS AND METHODS

The study was conducted in the year 2016-17 at the college of agricultural engineering, JNKVV, Jabalpur Madhya Pradesh. After completion of the fabrication, the machine was tested both the laboratory and field for onion bulbs. The field was prepared before evaluation. Instruments like measuring metallic and steel tape, stopwatch, the weighing balance were used to evaluate the planter. There was a comparison of operational cost with manually operated onion bulblet planter and traditional method of planting.

2.1 Procedure for Field Testing

The onion bulblet planter was testes in well-prepared land and following data were obtained. The field test was conducted on the farm field College of Agricultural Engineering JNKVV Jabalpur Madhya Pradesh on an area of 30 m^2. The type of soil was black cotton soil (Vertisol). Clean and fresh onion bulbs were selected (35 mm in diameter) for testing. There are some parameter used for planter testing:-

2.2 Theoretical Field Capacity

It depends upon theoretical speed and width of the implement. The theoretical field capacity was calculated as:

$$\text{Theoretical field capacity(ha/h)} = \frac{S \times W}{10}$$

Where, S speed of travel km/h
W = theoretical width of implement, m

2.3 Effective Field Capacity

For calculating effective field capacity, the time is taken for actual work and that lost for other activities such as turning, cleaning, refilling of a seedbox, adjustment of machine and time spent for machine trouble were taken into consideration. By calculating the area covered per hour, the actual field capacity was calculated.

2.4 Field Efficiency

Field efficiency is the ratio of the effective field capacity and theoretical field capacity and expressed in percentage. Field efficiency was calculated as:

$$\text{Field efficiency} = \frac{Effective field capacity}{Theoretical field capacity} \times 100$$

2.5 Missing Hill Percentage

Missing hill percentage is useful to know the precision of the metering unit of the planter. The missing hill percentage was calculated by using the formula:

Missing hill percentage = $\frac{nt-na}{nt}\ X\ 100$

Where,

n_t= number of hills present in a row for given row length, theoretically
n_a= Actual number of hills observed in a row for the same length.

2.6 Cost of Operation

2.6.1 Fixed costs

2.6.1.1 Depreciation

This cost reflects the reduction in value of a machine with use (wear) and time (obsolescence). While actual depreciation would depend on the sale price of the machine after its use, on the basis of different computational methods depreciation can be estimated by a straight-line method as given below:

(D) = $\frac{P-S}{L\times H}$

Where
D = average depreciation cost (Rs. /year)
P = purchase price of the machine (Rs.)
S = residual value of the machine (Rs.)
L = useful life of the machine (years)
H= working hours per year

The depreciation cost per hour can be estimated by dividing "D" by the number of hours the machine is expected to be utilised in a year. The residual value of the machines may be taken as 10 per cent of the purchase price.

2.6.1.2 Interest

An annual charge of interest was calculated by taking 10 per cent of the purchase price of the machine. Interest was calculated by using the formula given below

$$\mathbf{I = \frac{P+S}{2} \times \frac{i}{H}}$$

Where

I = Interest on capital Rs./h,
P = purchase price of the machine, and
S = residual value of the machine.
i = interest rate in fraction
H= working hours per year, hours

2.6.1.3 Insurance, taxes and shelter

Insurance and taxes were estimated taking as 2 per cent of average purchase price of the machine.

2.6.2 Variable cost

2.6.2.1 Repair and maintenance

The cost of repair and maintenance was assumed to be 10 per cent of purchase price.

2.6.2.2 Wages and Labour charges

The cost of labour was estimated taking the prevailing rate of Rs. 150 /day.

3. RESULTS AND DISCUSSION

3.1 Field Efficiency

As Fig. 1 shows that chisel type furrow opener is more suitable as it provided higher efficiency, i.e. 83.3% as compared to shovel and shoe type furrow opener for the moisture content 17.2% at the speed of 1.8 km/h.

3.2 Missing Hill Percentage

The observation of a number of hills was taken in randomly selected 3 rows in the field. The missing hill percentage was calculated. The missing hills were calculated for those bulbs which fall on the row and distance between two adjacent bulb more than 1.5 times than the recommended theoretical distance. There were 180 bulbs in three rows, and missing hills was 2.22% the number of miss was only 4.

Missing hill percentage:= (4/180) x 100 =2.22%

As shown in Fig. 2 the average missing hill percentage by onion bulblet planter was 2.22% while manually 6.01%.

3.3 Cost Economics

The cost of operation of the machine per hour as well as per hectare is presented in Table 1 and Fig. 4. The machine cost is taken which may be used in other farm operation also. The annual use of the machine taken in to account is only 200 h/year.

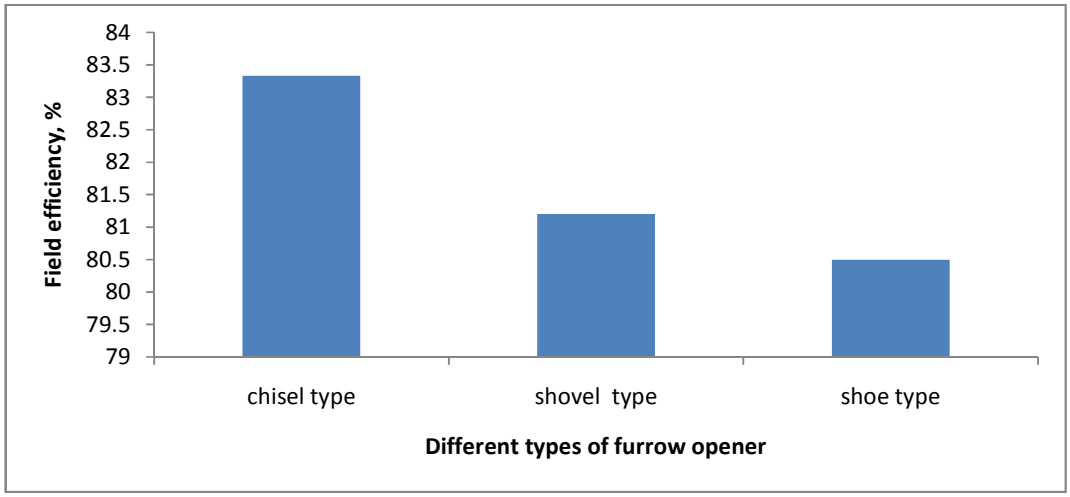

Fig. 1. Effect of different shapes of furrow opener on field efficiency at 17.2 % moisture content and 1.8 km /h

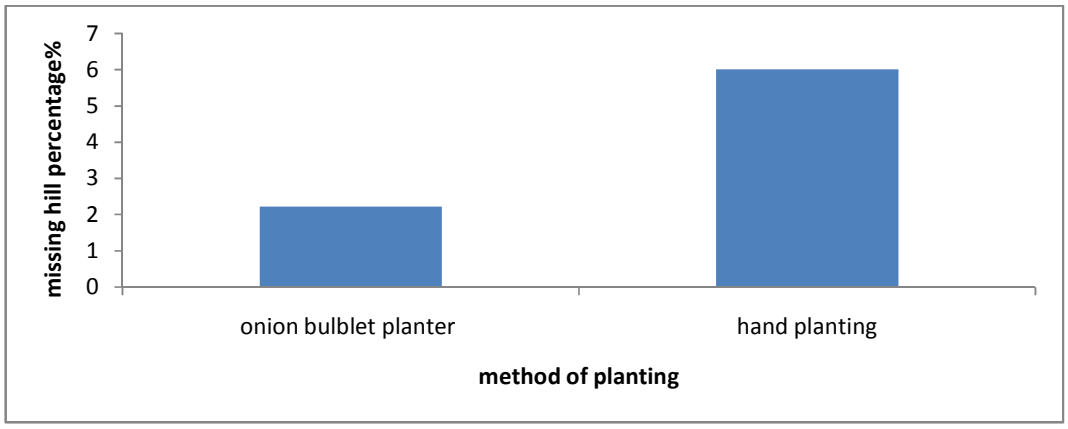

Fig. 2. Comparison of different planting method

Table 1. Cost of calculation per hour and per ha by manually operated onion bulblet planter

S No	Particulars	Amount
1	Cost of machine , Rs	5000
2	Life of machine (y)	10
3	Annual use (h)	200
4	Depreciation, Rs	450
5	Interest, Rs	275
6	Housing, Rs	50
Sum of (1 to 6)	Fixed cost (Rs./year)	775
A	Fixed cost (Rs./h)	3.87
B	Operational cost	
1	Repair and maintenance, Rs	37.5
2	Wages of 2 operator (Rs 150/day*), Rs.	2.5
Total of B	Operational cost (Rs/h)	40
Total of (A+B)	Machinery cost, (Rs./h)	43.87
	Cost of operation, Rs./ha	1790.80

Assumptions: 1 day i.e. 8 hours of work, Life of machine = 10 yr, Annual use = 200 h

Fig. 3. Given field testing

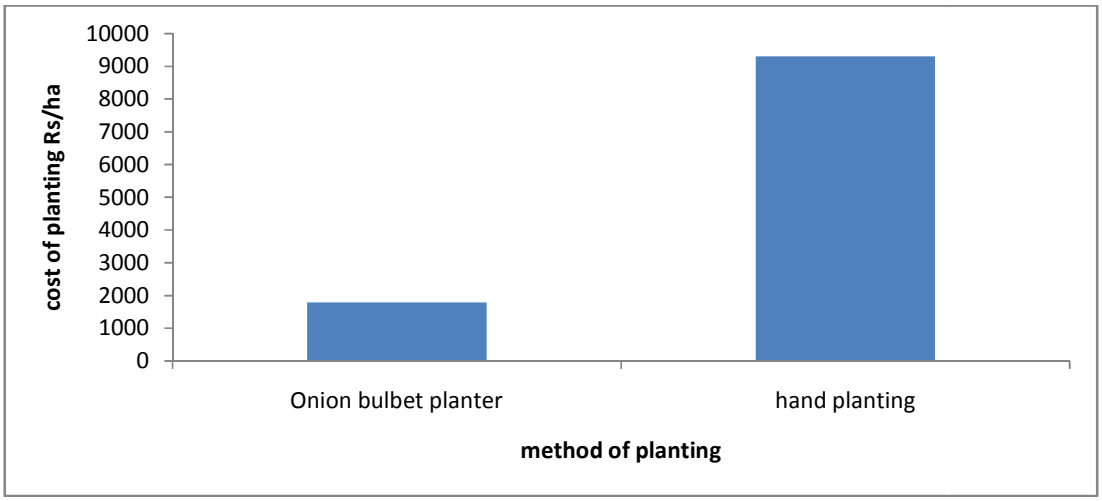

Fig. 4. Comparison of Cost of planting for a different method for onion bulblet planting

It was found that the cost of the machine mainly depends upon its annual use. The cost of planting by manually operated onion bulblet planter was Rs. 1790.81 per hectare of land as compared to the hand planting method for one hectare of land was required 65 man days and cost of Rs. 9300.

3.4 Timeliness of Operation

It was calculated that the manually operated onion bulblet planter required 42.4 hours to complete 1 hectare of land. Fig. 5 shows the comparison of the onion bulblet planter consumes less time for planting than the hand planting method.

The difference of about 25 hrs for the planting of onion bulbs results into saving of cost labour and provides timeliness of planting. The maintenance of planting time ultimately results into increased productivity, as we know every day delay in planting result into 2% of reduced yield.

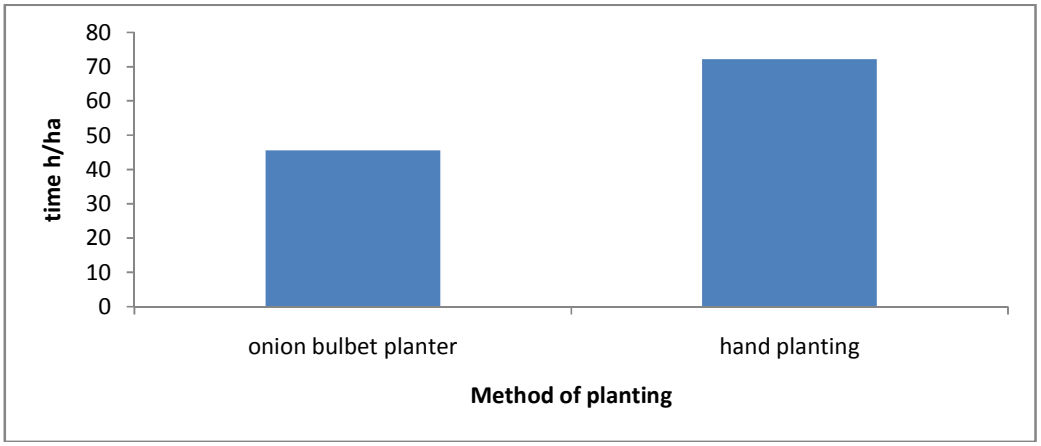

Fig. 5. Comparison of the different method of planting in time

4. CONCLUSION

The study concluded that the missing hill percentage was less when compared to hand plating (Traditional method of planting). The cost of operation for planting one hectare of land the manual onion bulblet planter required Rs 1790.8 /ha. Which is much less as compared to traditional method of planting which required 65 man days and required the additional cost of Rs. 9300. Time and labour can be saved with the planter compared to the traditional method of planting. the planter is useful for small and marginal farmers who cannot afford large machinery and for fields where large machinery is not suitable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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