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Performance evaluation of tractor drawn 2-row raised bed turmeric semi-automatic planter

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Abstract

Turmeric is an important commercial spice crop grown in India since ancient times and named as “Indian saffron”. In India turmeric was grown in an area of 2, 96,181 ha with a production of 11,78,750 tonnes during the year 2019-20. Telangana state ranks first in area and production of turmeric. In Telangana turmeric crop was grown in an area of 55,444 ha with a production of 3,86,596 tonnes during the year 2019-20 (www.indianspices.com). In Telangana state, the farmers are following conventional method of sowing for the turmeric crop which is tidy, time consuming and laborious process. The performance of tractor drawn 2-row raised bed turmeric semi-automatic planter was done to alleviate these problems and provide required technical information to the farmers. During the field evaluation, it was observed that the field capacity of 2-row raised bed turmeric semi-automatic planter (wheel based) as 0.083 ha h⁻¹ at an average speed of 1.004 kmph with the field efficiency of 79.305 percent. The seed rate was observed as 1239 kg ha⁻¹ for 2-row raised bed turmeric semi-automatic planter. The fuel consumption was recorded as 5 l/h. As per the results the operating cost was obtained for 2-row raised bed turmeric semi-automatic planter with Rs. 98,692.92 per hectare. 2-row raised bed turmeric semi-automatic planter has shown satisfactory results for sowing of turmeric.

Keywords: Semi-automatic raised bed planter, field capacity, field efficiency, metering mechanism

Introduction

Turmeric is an important commercial spice crop grown in India since ancient times and named as “Indian saffron”. It is known as the “golden spice” as well as the “spice of life.” Turmeric is now grown in countries like India, China, Pakistan, Bangladesh, Vietnam, Thailand, Philippines, Japan, Korea, Sri Lanka, Nepal, South Pacific Islands, East and West Africa, Malaysia, Caribbean Islands and Central America (Naresh babu *et al.*, 2015) [5]. India accounts for about 80% of world turmeric production and 60% of world exports (Vaijanath Bomble, 2020) [3] and (Dhanalakshmi *et al.*, 2018) [1]. India produces 75 percent of world’s turmeric and is the largest exporter in trade (Ajaib Singh and Sumanjit Kaur, 2015) [2].

In India turmeric was grown in an area of 2, 96,181 ha with a production of 11,78,750 tonnes during the year 2019-20 (www.indianspices.com). Major turmeric producing states in India are Telangana, Maharashtra, Andhra Pradesh, Orissa, Karnataka, Tamil Nadu, West Bengal, Assam, Mizoram and Gujarat. In India, Telangana state ranks first in area and production of turmeric. In Telangana turmeric crop was grown in an area of 55,444 ha with a production of 3,86,596 tonnes during the year 2019-20 (www.indianspices.com).

In Telangana state, the farmers are following conventional method of sowing for the turmeric crop by indigenous plough with a pair of bullocks for making furrows and keep the turmeric rhizome seeds in the furrows which is tidy, time consuming and laborious process. In this method recommended seed rate may not be achieved and affects the yield. Considering all these constraints, performance evaluation of tractor drawn 2-row raised bed turmeric semi-automatic planters was carried out to alleviate these problems and to provide required technical information to the farmers.

Material and Methods

The turmeric sowing equipment namely tractor drawn 2-row raised bed turmeric semi-automatic planters was selected to study their field performance to provide required technical information to the farmers. The tractor drawn 2-row raised bed turmeric semi-automatic planter consists of wheel type metering mechanism, seed hopper, furrow openers, raised bed making arrangement, seat arrangement and ground wheel.

Two persons are required to place the turmeric rhizome seeds in the metering mechanism during operation. The metering mechanism contains 10 numbers of compartments and rotated by ground wheel through gear drive mechanism. The seeds drop due to gravity in the furrow openers. The experiment was conducted at College of Food Science and Technology, Regional Sugarcane and Rice Research Station and Krishi Vigyan Kendra, Rudrur during Kharif 2020 in the extent of an area about 1050 m² (21mx50m).

The technical specifications of selected turmeric sowing equipment is given in Table 1 and the views are shown in Fig.1 and Fig. 2 respectively.

Table 1: The technical specifications of tractor drawn 2-row raised bed turmeric semi-automatic planter

S. No	Machine parameters	2-row raised bed turmeric semi-automatic planter
1	Cost of machine, Rs/-	95,000/-
2	No. of furrow openers	2
3	No. of ridge formers	-
4	No. of bed formers	2
5	Row Spacing, m	0.30
6	Effective operating width, m	1.05
7	Type of metering mechanism	Horizontal plate with 10 no. of slots
8	Power source	40 hp and above



Fig 1: View of 2-row raised bed turmeric semi-automatic planter.

Field performance of 2-row raised bed turmeric semi-automatic planter

The field was prepared by ploughing with MB plough and cultivator, followed by soil pulverized with rotovator to brought a fine tilth to easily formation of raised beds for 2-row raised bed turmeric semi-automatic planter during sowing operation. The “Erra Duggirala” variety seed rhizomes were selected and cut into single node pieces before sowing operation. During the experiment the parameters like speed of operation, effective field capacity, theoretical field capacity, field efficiency, seed rate and yield were observed by using the following procedure.

Operating time for each operation

To determine operating time, time was noted at starting and ending point of sowing operation by using stop watch, so that actual time required for sowing with 2-row raised bed turmeric semi-automatic planter was computed in terms of

h/ha. The time required for one turn of the machine and time consumed for adjustments were also noted to compute time loss in operation.

Speed of operation

To determine the speed of operation, marked the length of 25 m and 2-row raised bed turmeric semi-automatic planter was operated in the marked run length. A stop watch was used to record the time for sowing to traverse the marked run so that the speed of travel was computed in m s⁻¹.

Effective field capacity

Effective field capacity was measured by the actual area covered by the implement, based on its total time consumed and its width. Effective field capacity was determined by the following relationship.

$$\text{Effective field capacity, ha h}^{-1} = \frac{\text{Total area covered, ha}}{\text{Total time taken, h}} \times 100$$

Theoretical field capacity

Theoretical field capacity is the rate of field coverage of the machine, based on 100 percent of time at the rated speed and covering 100 percent of its rated width. The theoretical field capacity was determined using the following relationship

$$\text{Theoretical field capacity, ha h}^{-1} = \frac{\text{width (m)} \times \text{Speed (kmph)}}{10}$$

Field efficiency

Field efficiency is the ratio of effective field capacity to theoretical field capacity. It was determined by the following formula

$$\text{Field efficiency, \%} = \frac{\text{Effective field capacity, } \left(\frac{\text{ha}}{\text{h}}\right)}{\text{theoretical field capacity } \left(\frac{\text{ha}}{\text{h}}\right)} \times 100$$

Seed rate

The seed rate was determined by taking the weight of seed before and after sowing operation. Then subtracted the final weight of seed from initial weight of seed so that the seed rate was obtained and the results were expressed in terms of kg ha⁻¹.

Yield

Turmeric yield was determined from one m² area. Five random observations were taken from the field and thoroughly removed the soil from the rhizomes. After completion of cleaning, the weight of turmeric rhizomes were recorded and the converted to kg ha⁻¹.

Results and Discussion

The field performance of tractor drawn 2-row raised bed turmeric semi-automatic planters was done at College of Food Science & Technology, Regional sugarcane and Rice Research station and Krishi vigyan Kendra, PJTSAU, Rudrur, Nizamabad to provide required technical information to the farmers.

During the field evaluation, it was observed that the field capacity of the 2-row raised bed turmeric semi-automatic planter (wheel based) as 0.083 ha h⁻¹ at an average speed of 1.004kmph with the field efficiency of 79.305 percent. The seed rate was observed as 1239 kg ha⁻¹ for 2-row raised bed turmeric semi-automatic planter. The fuel consumption was recorded as 5 l/h for sowing machine. The good yield (dry rhizomes) was recorded as 1.11 kg m⁻² for 2-row raised bed

turmeric semi-automatic Planter because the raised bed method produced heavier rhizomes with mean single rhizome weight of 365.55 g. Tractor drawn turmeric planter put the rhizome at suitable depth and spacing and it increases the crop yield (Vaijanath Bomble, 2020) [3]. The length and diameter for turmeric rhizomes sown with semi-automatic planter were

highest because the rhizomes were grown on ridges and had additional space area for its superior growth (Ajaib singh and Sumanjit kaur, 2015) [2]. The results and field performance of 2-row raised bed turmeric semi-automatic Planter is given in Table 2 and field operation of machine is shown in Fig. 3.



Fig 2: Sowing operation of 2-row raised bed turmeric semi-automatic planter



Fig 3: Crop view after sowing with 2-row turmeric semi-automatic planter

Table 2: Field performance of tractor drawn 2-row raised bed turmeric semi-automatic Planter

S. No	Machine parameters	2-row raised bed turmeric semi-automatic planter
1	Plot dimensions (L x W), m	50 x 21
2	Area, Sq. m.	1050
3	Date of sowing	6/7/2020
4	Depth of planting, cm	10-12
5	Row to row distance, cm	30
6	No. of rows	2
7	Trapezoidal Bed dimensions (Top width x Bottom width X Height), cm	60 x 90 x 25
8	Bed to Bed distance	1.05
9	Plant to plant distance, cm	20
10	Width of operation, m	1.05
11	Speed, kmph	1.004
12	Theoretical Field capacity, ha/h	0.105
13	Effective Field Capacity, ha/h	0.083
14	Field Efficiency, %	79.305
15	Fuel consumption, l/h	5
16	Seed rate, kg/ha	1239
17	Number of labour required	3
18	Fresh Yield, kg/m ²	5.3889
19	Fresh Yield, kg/ha	53889
20	Dry yield, kg/m ²	1.113
21	Dry yield, kg/ha	11130

Conclusions

The following conclusions were drawn from the study

- It was observed that the field capacity of 2-row raised bed turmeric semi-automatic planter (wheel based) 0.083 ha h⁻¹ at an average speed 1.004 kmph with the field efficiency of 79.305 percent.
- The seed rate observed as 1239 kg ha⁻¹ for 2-row raised bed turmeric semi-automatic planter.
- The fuel consumption recorded as 5 l/h for sowing machine.
- The good yield was obtained for 2-row raised bed turmeric semi-automatic planter.
- The performance of 2-row raised bed turmeric semi-automatic planter has shown satisfactory results for sowing of turmeric.

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