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RESEARCH ARTICLE :

Evaluation of tractor drawn seed drill for sesame

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SUMMARY : The study was conducted to assess the performance of tractor operated seed drill for sowing sesame seeds. The field tests were conducted on red sandy loam soil. The seed rate of the seed drill was less compared to traditional method of sowing. The seed rate obtained was 1.8 kg/ha. The field capacity and effective field efficiency was found to be 0.35 ha/h and 63%, respectively. The fuel consumption was found to be 4 lph with the work rate of 2.87 h/ha. The cost of sowing was less with the planter when compared to traditional methods of sowing. Seed, time and labour can be saved with the seed drill compared to manual methods of sowing. The technology assessed better performance over farmers practice. Due to more fatigue, it was suggested that power operated equipment was better than traditional method for sowing.

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KEY WORDS :
Drilling, Seed drill, Field efficiency, Field capacity

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BACKGROUND AND OBJECTIVES

Sesame (*Sesamum indicum* L.) belongs to the family of Pedaliaceae, and is one of the most ancient crops and oilseeds known and used by mankind. It is also known as benniseed, gingelly, simsim, ajonjoli, sesamo and til. It was a major oilseed crop in the ancient world due to its easiness of extraction, great stability. This is an important oil yielding crop with oil content of 50-60 per cent and 19-25 per cent protein. The crop can be grown at elevations upto 1200 meters. This crop cannot stand frost, continued heavy rains, prolonged drought. The optimum soil pH ranges from 5.5 to 8.2. The sesame crop can be grown as summer crop, *Kharif* crop and also as semi-*Rabi* crop.

Because of small size of the seeds, broadcast seeding is common in India and worldwide. In line sowing crop plants come up uniformly. The lack of mechanization in cultural practices exists in the areas of broadcast seeding. Line sowing permits easy intercultural operations and weed control. The machine sowing gives proper space for branching and in turn yield can be effectively enhanced. Broadcasting produces higher weed covercompared to machine sowing. This could be due to the difficulty associated with weeding in the plot with broadcast crop compared with drilled plots where weeding waseasier and more effective. This result agrees with the findings of Weiss (1971) who showed the superiority of row planting over broadcasting in controlling weeds, and Van Rheenen (1973) observed that the practice of seed broadcasting resulted in over

population and posed difficulties in weeding operations. Best weed suppression and highest yield was obtained from drilling method (Imoloame *et al.*, 2007).

The intra and inter-plant competition athigher seed rate for space, soil moisture, nu-trients, light and assimilates in simple nutrient forms like sulphates, phosphates and nitrates. These assimilates undergo metabolic transformation to organic plant constituents which could have been made available for absorption to the plants. Plants under broadcasting method had the advantage of lesser population of plants and lesser competition for the assimilation, thus benefiting more than plants under drilling method.

The area under sesame exists in Northern Telangana Zone, most of the turmeric fallows take sesameand broadcasting is the practice in farmers.In those areas of broadcast seeding,seed rate is not well adjusted and the maintenance is not pursued by mechanization. This negatively affects the yield and cost of production. Therefore, increasing the yield and expanding the usage of mechanization in planting areas is a necessity. Keeping this in view, the study was conducted to evaluate the performance of seed drill for sesame.

RESOURCES AND METHODS

The experimental work was carried out during 2016-17 Rabiat Regional Agricultural Research Station, Polasa, Jagtial to evaluate the performance of seed drill for sowing sesame. *Swetha* variety of sesame seed was selected for the study. The tractor mounted seed drill was tested in laboratory before taking to actual field conditions. The seeds were passed through the grooves of circular plate to check the regularity of flow and damage. The line to line spacing of seed drill was adjusted at 40 cm. The machine was calibrated for seed per hectare for normal conditions. The calibration for fertilizer per hectare was also done.The seed-drill was placed on a level ground and jacked upto facilitate the rotation of ground drive wheel freely. Laboratory test was carried for ten revolution of ground drive wheel. Standard procedure was followed for calibration of seed-cum fertilizer drill (Sahay, 2008).

Experimental site and cultural practices :

Land preparation was carried out with a MB plough followed by cultivator and then with rotavator for fine tilth which is very important for sesame sowing. Seedbeing small mixed with fine sand at 1: 3 Vol/Volratio and sown at shallow depth of 30-50 mm. Sesame popular variety *Swetha* was sown at optimum sowing date 15th February 2017.

Table A : Experimental site details		
Season	:	Rabi 2016-17
Variety	:	Swetha
Plot size	:	1800 (60 x 30) m^2
Design	:	Observatory trial
Data analysis	:	Sampling method
Date of sowing	:	15/2/2017
Date of harvesting	:	22/5/2017
Planting method	:	seed drill
Row to row spacing	:	40 cm

Interculture:

First hoeing, weeding and thinning were done at 15 days stage. Thinning operation was carried out to keep the plants about 7 cm apart. Further weeding was carried out with wheel hoe.

Irrigation:

Immediate post-sowing application of irrigation was done. Subsequent irrigations were given at intervals of 10-12 days. At the time of the critical stages *i.e.*, 4-5 leaf stage, flowering and pod formation regular irrigation with short durations were given.

Fertilizer use:

Sesame is an exhaustive crop and responds to fertilizer. Recommended fertilizer dosage of 30-20-20 kg N-P_2O_5-K_2O/ha was applied to the crop. Recommended dosage of P_2O_5 and half of N was applied as basal dosage and the remaining nitrogen and K_2O was applied at first hoeing and weeding.

Harvesting:

The crop was harvested when the plants started yellowing and drying of capsules commenced. Delayed harvesting may cause loss in yield due to bursting and shattering of capsules. After harvesting the plants were stacked for 3 to 4 days to allow the seeds in the upper capsules to ripe. The plants were dried by keeping the plant tip towards the sun so that seeds do not drop from capsules. Threshing was done after 3-4 days of drying.

Performance assessment of technology with performance indicators

Tractor working speed:

The average tractor working speed with 4 furrow openers spaced 40 cm apart was determined using a stopwatch and allowing the tractor to travel along the field of 55 m ten times. The turning time at headlands was determined also.

Field capacity:

The theoretical field capacity, field efficiency and effective field capacity were calculated.The calculations were made according to the following formulae (Roth *et al.*, 1982).

$$C_T = \frac{S \times W}{10}$$

where:

C_T = Theoretical field capacity (ha/hr).

S = Average speed of machine (km/hr).

W = Rated width of machine (m).

$$10 = \text{Constant} = \frac{(10000\ m^2/ha)}{(1000\ m/km)}$$

Field efficiency (E_f) as decimal was determined by the following formula:

$$E_f = \frac{\text{Actual working time}}{\text{Total time (Actual working time)} + \text{Turning time at head lands)}}$$

The effective field capacity in ha/hr was determined by multiplying the theoretical field capacity by the field efficiency (E_f).

$$C_E = \frac{S \times W \times E_f}{10}$$

Work rate:

From the effective field capacity, the time taken for sowing of 1 ha was determined as:

$$\text{Work rate} = \frac{1}{C_E} \text{ in h/ha}$$

Population of established plant in unit area:

Five random readings per subplot were taken for determining crop emergence/ 25 m^2, while plant population in 10 m row length was determined at maturity by the same method. Seed weight was determined by taking randomly a subsample from each harvested grain per subplot.

OBSERVATIONS AND ANALYSIS

Sesame seed was mixed with fine sand at 1: 3 Vol/Volratio to ensure even distribution and reduced very close spacing of sesame seed.This makes distribution of the seed evenly, thus reducing the number of seedlings lost during thinning. Seed rate obtained while sowing with tractor operated seed drill was 1.8 kg/ha.Seed rate was reduced comparatively with conventional broadcasting methods where seed rate ranges from 5-6 kg/ha. It was found that sesame seed was germinated uniformly without any gap using the seed drill. Following table gives the specifications of tractor operated the seed drill and germination rate.

Table 1 : Specification of the tractor operated seed drill

Type	Specification
Machine	Tractor drawn seed drill.
Metering mechanism	Cell feed mechanism (Cups in 7 sizes)
Cup size suitable for sesame	4
Seed rate	1.8 kg/ha
Operating speed	3.48kmph (2^{nd} gear)
Depth of operation	30-50 mm
Row to row adjusted for	400 mm
Fuel consumption	4 *l*/hr
Germination rate	95% (no gap filling done)

The tractor was operated at speed of 3.48 kmph at second gear and with an effective field capacity of 0.35 ha/h and working with an efficiency of 63%. The time taken to cover an area of hectare for sowing is 2.87 hours which is less comparatively conventional methods and reduces the man hours *i.e.*, working time at sowing. The following table gives the result of field capacity and work rate of the seed drill.

Table 2 : Theoretical field capacity (TFC), actual field capacity (AFC) and work rate

Speed, km/h	3.48
Effective width, m	1.60
Theoretical field capacity, ha/h	0.56
Effective field efficiency, %	63
Affective field capacity, ha/h	0.35
Work rate, h/ha	2.87

The plant to plant spacing was observed to be 2cm. Thinning operation was carried out to maintain a plan to plant spacing of 7-10 cm. The following table gives the plant to plant spacing obtained in the field.

The average yield obtained per hectare was observed to be 1032 kg/ha which was comparatively more

Table 3 : Plant to plant spacing

Sample	1	2	3	4	5	6	Mean	S.D.%	S.E.±	CV %
Spacing plant to plant, cm	2	1.5	3	1.8	2.2	1.4	1.98	0.58	0.24	29.3

than conventional broad casting method. The following table gives the longitudinal scattering, plant population per unit area and yield per unit area. Drilling produced higher grain yield than broadcasting. The reason for thiscould be the inter plant competition for moisture and nutrients which could be more severe under broadcast crop compared to the drilled crop during the dry spell before harvesting. Also, the higher weed infestation under the broadcast crop as evident from the higher weed cover and total dry weed weight must have further reduced the amount of nutrients and water available to the broadcast crop. Olowe and Busari (1994) who reported that plants inwide rows were exposed to less intra specific competition and tended to be most vigorous and productive. This could be due to intra plant competition for growth resources and space under drilling method compared with broadcast method. This agrees with the findings of Weiss (1971) and Stonebridge (1963) who reported the superiority of row planting over broadcasting to control weeds, and that this factor alone resulted in considerable yield increases.These worker so bserved that as the intra and inter-row spacing decreases,plants compete for above ground resource (light).

Table 4 : Longitudinal scattering, plant population per unit area and yield per unit area

Sample	No. of plants/10 m	No. of plants/ 5m^2 area	Yield/ 5 m^2 in g
1	612	1012	618
2	658	890	550
3	566	876	480
Mean	612.00	926.00	549.33
S.D.%	46.00	74.81	69.00
S.E.±	26.56	43.19	39.84
C.V.%	7.52	8.08	12.56

The taller plants produced by drilling method of sowing the seeds compared with the broadcasting method due to greater intra and inter plant competitionfor nutrients and moisture in broadcast plots while the taller plants produced under broadcast method in 2002 could be due to the change in soil texture to sandyclay loam which retained more water for the plants.Mazzani and Cobo (1956); Donald (1965); Weiss (1983); Van Rheenen (1973); Delgado and Yermanos (1975) and Ndarubu *et al.* (1996), reported increase in plant heightwith decreased intra and inter-row spacing.

In sowing plants with seed drill, one of the major factors in obtaining high yield is the sound cultural practice. This provides the opportunity for the cultural processes to be carried out more effectively and healthily, and therefore increases the yield.

Conclusion :

Sowing of sesame using tractor operated seed drill was found to be more economical for the farmers as it reduced the cost of production and gave higher yield compared to conventional method of sowing sesame.

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