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Research Paper :

Feasibility testing of tractor operated seed drill for sowing sorghum

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ABSTRACT

The present study was conducted to evaluate the effect of use of tractor operated seed- cum-fertilizer drill for its field performance in comparison with bullock drawn seed drill (Tifan) for sowing sorghum crop (CSH-9) as per RNAM test codes. The field test was conducted on medium black soil at moisture content of 33.60%. It was found that tractor operated seed-cum-fertilizer drill works better than bullock drawn seed drill in respect of effective field capacity, field efficiency, depth of placement of seed, yield of crop, yield of fodder and cost of sowing per hectare. The mechanized method of sowing has resulted in a 66.70% increase in effective field capacity, 22.36% increase in field efficiency, 20.00% increase in depth of seeding, 16.76% increase in grain yield, 19.14% increase in fodder yield, 66.40% saving in operation of time and 44.70% saving in cost of operation. The overall benefit of Rs.412.12/- per hectare was observed by using mechanized method of sowing.

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Key words : Mechanization, Seed-cum-fertilizer drill, Tifan, Effective field capacity, Field efficiency, Yield, CSH-9

Sorghum [*Sorghum bicolor* (L.) Moench) is one of the major food grain crop of Maharashtra. Besides being a major source of staple food for human, it serves as an important source of cattle feed and fodder. It makes comparatively quick growth and gives not only good yield of grain but also very large quantities of fodder. In India sorghum is grown over an area of 8.47 million hectares with total production of about 7.15 million tonnes. In Maharashtra State it is grown over an area of 5.02 million hectares with total production of about 4.39 million tonnes (Anonymous, 2007).

The sowing of Sorghum seed generally done by broadcasting, dibbling, drilling, hill dropping and check row planting. Sowing of seeds by drilling is modern and most popular method. It is advantageous over other methods in economy and adaptability. The sowing of sorghum is accomplished by using animal drawn seed-drill (Tifan) is tedious, time consuming and expensive. The sowing operation has to be performed within the very short time to take the advantage of monsoon and residual soil moisture. The scarcities of labour and high cost of cultivation, wages have become the important factors affecting the timely sowing of sorghum crop and ultimate its yield. One of the main reason of low productivity is low level of farm mechanization.

Hence, the present study was conducted to evaluate the performance of tractor operated exiting seed-cum-fertilizer drill for sowing sorghum in comparison with the animal drawn seed drill used by the farmers and an impact of mechanization on its economics.

METHODOLOGY

Sorghum seeds (CSH-9) was used for experimental purpose. The tractor operated seed-cum-fertilizer drill was tested in laboratory and field for their performance in comparison with animal drawn seed drill. Before using the seed-cum-fertilizer drill in the field it was calibrated for correct seed and fertilizer rate (Hunt Donnel, 1960). The soil moisture was calculated by taking the samples of soil randomly at three different depths (0-4cm, 4-8cm, 8-12cm) from experimental plot. The field performance tests of mechanized and traditional methods were carried out on each one hectare of area at Central Research Station, Dr. Panjabrao Deshmukh Krishi Vidaypeeth, Akola (M.S.).

Experimental setup:

A tractor operated seed-cum-fertilizer drill with three furrow openers was used for the study as an improved technology over the traditional method of sowing sorghum.

The traditional method in the study area was the bullock drawn seed drill (Tifan) which makes furrows in which sorghum seeds are manually dropped by another man. The box provided on the seed drill was divided in two chambers one for placing of the seed and another for the fertilizer. To control the seed rate fluted roller type metering devices and for the fertilizer application rate gravity type with adjustable orifices and agitators metering devices were provided with external attachment of lever to the metering shaft in seed drill (Rocha and Folle, 1992). The power was transmitted to the seed and fertilizer metering mechanism from ground wheel by chain and sprocket arrangement. The depth of sowing was adjusted with the help of ground wheel. Inverted T- type furrow openers were provided to the seed drill which makes a very narrow slit without disturbing much soil (Khan and Afzal Tabassum, 1990).

Crop spacing:

In traditional method row to row spacing was kept to be 45 cm with 11 cm of plant to plant spacing and in mechanized method the row to row spacing was kept 48 cm and after every three rows one row of 96 cm was kept for the movement of tractor wheels with 9 cm of plant to plant spacing to achieve the required plant population. The spacing between two furrow openers may increase or decrease according to the need of farmers or type of crops.

Observation details:

During the field tests of both the methods following observations were taken *i.e.* plant to plant spacing, row to row spacing, depth of placement of seed, plants population, speed of operation, field capacity, field efficiency, fuel consumption, grain yield and fodder yield by using RNAM test codes (RNAM, 1995).

RESULTS AND DISCUSSION

Detailed observations of seed-cum-fertilizer drill over traditional method of sowing were recorded in Table 1 and 2.

Plant population:

Table 1 shows the differences in plant population between both the methods. It seems from the table that the plant population in mechanized method of sowing was less because of row to row spacing which was greater than recommended *i.e.* 48 cm and after every three rows one row was skipped off for the movement of tractor wheels.

Field performance test:

Table 2 shows the over all comparative performance of tractor operated seed-cum-fertilizer drill and bullock drawn seed drill.

The depth of placement of seed was 20.00% more in mechanized method due to higher draught and weight of tractor operated seed-cum-fertilizer drill as compared to bullock drawn seed drill.

The time required to cover 1 ha. area in mechanized method was 66.40% less with 54.50% of greater traveling speed over the traditional method. The effective field capacity was 66.70% more and field efficiency was 22.36% more in mechanized method due to greater working width and higher speed of operation over the traditional method.

Yield of grain and fodder:

The grain yield in mechanized method was 16.76% more than the traditional method due to greater row to row spacing and one skipped row after every three rows for movement of tractor wheels which permits better atmospheric and biological conditions as compared to traditional method.

The fodder yield was 19.14% more in mechanized method because of healthy crop over the traditional method.

Cost of operation:

The cost of sowing of sorghum crop was Rs.509.68/- and Rs.921.80/- per hectare in mechanized and traditional methods, respectively. The net saving of Rs.412.12/- per hectare was observed by using mechanized method.

Table 1 : Plant population of sorghum crop (CSH-9) in 1 ha area

Sr. No.	Particulars	Mechanized method	Traditional method
1.	Average number of plants observed for 10 m of row length	111	84
2.	Average number of plants observed for 220 m of row length (*i.e.* one row)	2442	1840
3.	Average number of plants for 72 rows in mechanized method and 97 rows in traditional method were observed per unit area (1 ha.)	1,75,824	1,79,256

Table 2 : Comparative field performance of tractor operated seed-cum-fertilizer drill (mechanized method) and bullock drawn seed drill (traditional method)

Sr. No.	Particulars	Mechanized method	Traditional method	Remarks
1.	Row to row spacing (cm)	48	45	6.25% more than traditional method
2.	Plant to plant spacing (cm)	9	11	18.20% less than traditional method
3.	Depth of seeding (cm)	5	4	20.00% more than traditional method
4.	Effective working width (cm)	3×48	3×45	6.25% more than traditional method
5.	Actual area covered (m^2)	10,000	10,000	-
6.	Actual operating time (hr)	1.68	5	66.40% less than traditional method
7.	Time losses for turning and refilling of seeds and fertilizer (sec)	48	25	47.90% more than traditional method
8.	Traveling speed (km/hr)	5.5	2.5	54.50% more than traditional method
9.	Theoretical field capacity (ha/hr)	0.79	0.34	56.96% more than traditional method
10.	Actual field capacity (ha/hr)	0.60	0.20	66.70% more than traditional method
11.	Field efficiency (%)	76	59	22.36% more than traditional method
12.	Tractor wheel slip (%)	9.6	-	-
13.	Fuel consumption (l/ha)	5.04	-	-
14.	Cost of sowing (Rs./ha)	509.68	921.80	44.70% less than traditional method
15.	Yield of grain, (q/ha)	34.05	28.38	16.76 % more than traditional method
16.	Yield of fodder, (q/ha)	74.33	60.10	19.14 % more than traditional method

Conclusion:

It thus seems that mechanized method of sowing save the time of operation and reduces the labour cost required in the sowing operation to nearly half. Thus the mechanized method of sowing was much more efficient than the common method of sowing.

While conducting the evaluation of the machine in the field it has been observed that the following factors may affect the efficiency of the machine are preparation of the field before sowing, moisture content in the soil, physical properties of the soil, speed of the tractor, depth of sowing, topography of land and experience of the operator.

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