

Original Research Article

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## Sorghum [*Sorghum bicolor* (L.) Moench] Productivity as Affected by Tillage and Integrated Nutrient Management

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### ABSTRACT

A field experiment was conducted at the farm of Sorghum Research Unit Dr. P.D.K.V., Akola to study the effect of tillage and integrated nutrient management on sorghum productivity. The experiment was carried out during the kharif season of 2009 to 2011 in Split plot design in three replications. The treatments were as main plot -tillage practices(3) T1: Conventional tillage (1 summer ploughing before monsoon) + 2 harrowing + atrazine as pre-em + 1 hoeing + 1 hand weeding), T2: Reduced tillage (2 harrowing + atrazine as pre-em + 1 hand weeding) and T3: Minimum tillage (1 harrowing + atrazine as pre-em + 1 hand weeding) and each main plot sub divided into four Nutrient management practices-F<sub>1</sub>-100% RDF through inorganic, F<sub>2</sub>-75% RDF through inorganic + 5t FYM/ha, F<sub>3</sub>-50% RDF through inorganic + 5t FYM/ha + Azotobactor + PSB and F<sub>4</sub>-Control (Native fertility). From the three years data it is concluded that conventional tillage practice produced significantly highest plant height grain, fodder yield which was at par with reduced tillage practice. Application of 100% RDF through inorganic sources produced significantly highest grain, fodder yield which was at par with the application of 75% RDF through inorganic + 5 t FYM/ha.

#### Keywords

INM,  
Sorghum,  
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### Introduction

Sorghum is the crop par excellence for dry regions and areas with uncertain and scanty rainfall. Sorghum is important food and fodder crop in kharif season in the states of Maharashtra, Karnataka, Rajasthan and Andhra Pradesh. Tillage practices can greatly affect soil water content both at planting and during the growing season. For maximum sorghum production and profit, planned crop rotations and tillage practices are critical for enhancing soil water contents and ensuring successful sorghum production. Tillage techniques are used in order to provide a good seedbed, root development, weed control, and

manage crop residues, leveling the surface for uniform irrigation and incorporation of fertilizers (Srivastava *et al.*, 2006). Different tillage practices may influence the growth and yield of grain sorghum. Tillage practices are critical components of soil management systems (Mosaddeghi *et al.*, 2009). Inappropriate tillage practices could inhibit crop growth and yield. The selection of an appropriate tillage practice for the production of crops is very important for optimum growth and yield. Chemical fertilizer, herbicide and pesticide used in agriculture for increasing yield and controlling weeds and

pests can contaminate the water, air and food, decrease soil fertility, inhibit growth of soil microorganisms and hazard human health (Erisman *et al.*, 2001). In addition, chemicals may destroy many species of plants, insects, fishes and soil microorganisms. The integrated nutrient management helps to restore and sustain fertility and crop productivity. It may also help to check the emerging deficiency of nutrients other than N, P and K. Further, it brings economy and efficiency in fertilizers. The integrated nutrient management favorably affects the physical, chemical and biological environment of soils. Thus integrated use of chemical fertilizers along with other organic sources of nutrients and biofertilizers can help in maintaining yield levels in most of the crops under different agro-ecological regions.

### **Materials and Methods**

A field experiment was conducted at Sorghum Research Unit Dr.Panjabrao Deshmukh Kruhi Vidhyapeeth, Akola, Maharashtra, during the rainy (kharif) on clayey soil, having pH 7.60 and electrical conductivity 0.28 dS/m. It was medium in organic carbon (0.55 %), low in available nitrogen (260 kg/ha), low in available phosphorus (22.10 kg/ha) and very high in available potassium (436 kg/ha).

The experiment was laid out in split plot design and The treatments were as main plot - tillage practices(3) T1: Conventional tillage (1 summer ploughing before monsoon) + 2 harrowing + atrazine as pre-em + 1 hoeing + 1 hand weeding), T2: Reduced tillage (2 harrowing + atrazine as pre-em + 1 hand weeding) and T3: Minimum tillage (1 harrowing + atrazine as pre-em + 1 hand weeding) and each main plot sub divided into four Nutrient management practices-F1-100% RDF through inorganic, F 2-75% RDF through inorganic + 5t FYM/ha, F 3-50%

RDF through inorganic + 5t FYM/ha + Azotobactor + PSB and F4-Control (Native fertility) resulting in 12 treatment combinations were replicated three times. The tillage treatments were imposed by tractor drawn harrow during the field preparation in summer. Required plant population was maintained by thinning at 20 days after sowing (DAS).

Hoeing and weeding were carried out as per agronomic recommendation and treatments. The Nitrogen was applied in 2 splits, half at sowing along with entire quantity of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O and remaining N was applied 30 days after sowing.

Nitrogen, phosphorus and potassium were applied through urea, single superphosphate and muriate of potash, respectively. The FYM was applied as per treatments and biofertilizers used in the form of seed inoculation were Azotobactor and phosphate-solubilizing bacteria.

Sorghum (CSH-16) was sown using seed rates of 7.5-10 kg ha<sup>-1</sup> with a spacing of 45 cm x 15 cm. Sowing was done in second fortnight of July and harvested during 1st week of November. The data height, grain and fodder yield of sorghum were recorded. Representative plant and grain samples were also drawn after harvest. The data was analyzed statistically as per Panse and Sukhatme (1967)

### **Results and Discussion**

In tillage practices the plant height was significantly maximum with the conventional tillage practice and was at par with reduced tillage practice during individual years of experiment and in pooled data (205cm).

**Table.1** Plant height (cm), Grain yield (q ha<sup>-1</sup>) and Fodder yield (q ha<sup>-1</sup>) as influenced by different treatments

Treatments	Plant height (cm)				Grain yield (q ha <sup>-1</sup> )				Fodder yield (q ha <sup>-1</sup> )			
	2009-10	2010-11	2011-12	Pooled Mean	2009-10	2010-11	2011-12	Pooled Mean	2009-10	2010-11	2011-12	Pooled Mean
<b>Main plot:-Tillage practices</b>												
<b>Conventional tillage:-</b> (1 summer ploughing before monsoon + 2 harrowing + atrazine as pre-em+ 1 hoeing + 1 hand weeding)	207	210	200	205	32.01	33.43	36.77	34.07	110.50	118.01	119.79	116.10
<b>Reduced tillage:-</b> (2 harrowing + atrazine as pre-em + 1 hand weeding)	201	204	197	201	29.01	30.80	28.14	29.32	103.13	112.04	111.90	109.01
<b>Minimum tillage:-</b> (1 harrowing + atrazine as pre-em + 1 hand weeding)	196	194	196	195	25.9	22.09	19.42	22.47	98.07	99.11	98.63	98.57
SE(m) ±	4.97	5.01	4.72	1.66	1.72	1.25	1.29	1.91	2.01	3.77	3.86	1.55
CD(P=0.05)	13	14.23	13.07	4.59	4.45	3.18	3.57	5.29	5.17	9.46	10.69	4.29
<b>Sub plot:- Nutrient management practices</b>												
100% RDF through inorganic	214	214	216	215	33.4	33.06	33.06	33.17	115.91	124.02	125.46	121.80
75% RDF through inorganic + 5t FYM/ha	207	211	212	210	32.23	32.11	32.26	32.20	111.60	122.12	122.07	118.60
50% RDF through inorganic + 5t FYM/ha + Azotobactor + PSB	206	206	198	203	29.08	28.03	27.74	28.28	101.60	109.00	109.50	106.70
Control (Native fertility)	179	181	166	175	21.29	20.01	19.37	20.22	86.42	84.00	83.41	84.61
SE(m) ±	3.03	3.09	5.41	5.41	0.68	1.44	1.44	0.69	2.15	4.32	4.32	1.93
CD(P=0.05)	7.35	7.78	11.36	11.36	2.24	4.79	3.02	1.44	5.36	10.76	9.07	4.02
<b>Interaction</b>												
SE(m) ±	1.51	8.32	13.08	11.23	5.34	4.67	4.89	6.23	6.45	8.67	7.65	4.32
CD(P=0.05)	3.88	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

The conventional tillage practices recorded significantly maximum grain yield (32.01 q/ha) but it was at par with reduced tillage practices during first and second year of experiment and in pooled mean. The conventional tillage practice recorded significantly maximum fodder yield during the three year of experiment as well as pooled data (116.1 q/ha). The grain and dry fodder yields were significantly higher under conventional tillage followed by reduced tillage and both were superior over minimum tillage (Table 1). This was mainly because of better crop growth, increased dry matter production and yield attributes. Higher uptake of nutrient and improved yield components were also observed, mainly owing to favourable physical condition with greater moisture provided to the crop with this tillage practice (Khurshid *et al.*, 2006). Laddha and Totawat (1997) also recorded that deep tillage operations were superior to shallow tillage treatments.

The treatment 100% RDF through inorganic sources recorded significantly maximum plant height. However, it was at par with 75% RDF through inorganic + 5 t FYM/ha during the three year of experiment as well as in pooled mean. The treatment 100% RDF through inorganic sources recorded significantly maximum grain yield (33.17 q/ha) and it was at par with 75% RDF through inorganic + 5 t FYM/ha during the three year of experiment and in pooled data. It was due to improved dry matter production with fertilizer application. Similar results were also obtained by Das *et al.*, (2000) and Mali *et al.*, (2000).

The treatments 75% RDF+5 t FYM/ha and 50% RDF+2.5 t FYM/ ha+Azotobacter+PSB were at par. The higher economic yield in treatments having FYM+Azotobacter+PSB was mainly as a result of increased water holding capacity and nutrient supply, which helped the crop to receive optimum level of

soil moisture and nutrients besides fixation of atmospheric nitrogen and solubilization of phosphorus into utilizable form with application of Azotobacter and PSB. 100% RDF through inorganic recorded significantly maximum fodder yield(121.8 q/ha) and it was at par with 75% RDF through inorganic + 5 t FYM/ha (118.60 q/ha)during the three year of experiment as well as in pooled data and both the treatments were superior to other treatments.

From the three years data it is concluded that conventional tillage practice produced significantly highest grain, fodder yield of Kharif sorghum followed by reduced tillage and application of 100% RDF through inorganic sources produced significantly highest grain, fodder yield and input output ratio which was at par with the application of 75% RDF through inorganic + 5 t FYM/ha.

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