Indian J. Agron. **41** (2) : 252–255 (June 1996)

Response of winter-season sorghum (*Sorghum bicolor*) varieties to sowing time and nitrogen

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Received: September 1994

ABSTRACT

An experiment was conducted during the winter season (*rabi*) of 1987–88 to 1989–90 to find out effect of sowing time and nitrogen on sorghum [*Sorghum bicolor* (L.) Moench] varieties. The pooled grain and fodder yields of sorghum varieties were not differed significantly. However, improved variety 'Swati' gave significantly more grain yield than 'M 35-1' during 1988–89. But fodder yield of 'M 35-1' was significantly more than 'Swati' during the same year. The pooled grain yield was significantly the highest in the crop sown in meteorological week 40 and significantly the lowest in the crop sown in meteorological week 38. Application of 50 kg N/ha at seeding significantly increased the grain yield over the control during first 2 years and in pooled data.

In the drought-prone area of Maharashtra, winter-season (*rabi*) sorghum [*Sorghum bicolor* (L.) Moench] is the predominant crop occupying about 60% of the area. The productivity of *rabi* sorghum, however, is very low (400 kg/ha). Out of the several constraints for low productivity of *rabi* sorghum, lack of improved high-yielding cultivars, delayed sowing, very scanty use of fertilizers and poor management techniques are the important. The seeding time had catalystic effect on efficient use of other factors of production. An early seeding shows advantage over late seeding (Umrani and Patil, 1985). The cultivation of *rabi* sorghum is mostly confined to Vertisols of Maharashtra and Karnataka which are universally poor in nitrogen. Therefore the response to nitrogen application on these soils is spectacular. Umrani and Bhoi (1981), Umrani and Patil (1985), Daftardar *et al.* (1987) and Jadhav *et al.* (1991) reported that the application of 50 kg N/ha was the most important key factor for increasing production of *rabi* sorghum. Hence an experiment was conducted to study the response of winter-season sorghum to sowing time and nitrogen.

MATERIALS AND METHODS

The present investigation was conducted at Agricultural Research Station, Jeur, in split-plot design with 3 replications for 3 years from 1987–88 to 1989–90. The combination of 2 varieties, viz. 'M 35-1' and 'Swati', and 3 sowing times, viz. sowing in meteorological weeks (MW) 36, 38 and 40 were tried in main plots and 3 nitrogen levels, viz. 0, 25 and 50 kg/ha in subplots. Nitrogen was applied as per treatments at seeding by placement. The gross plot size was 8.0 m x 5.4 m and net plot size was 7.1 m x 4.5 m.

The experimental soil was Vertisol in nature with uniform in depth up to 75 cm. It was poor in available N (176.23 kg/ha, medium in available P_2O_5 (22.45 kg/ha) and rich in available K_2O (580.0 kg/ha). It was slightly alkaline in reaction (pH 8.1) with electrical conductivity of 0.12 mm hos/cm.

The rainfall of 143.5, 557.7 and 278.2 mm was received up to MW 35 and 300.9, 450.7 and 177.1 mm from 36 to 52 MW, i.e. during crop-growth period in 1987–88, 1988–89 and 1989–90, respectively. The rainfall distribution was good during first 2 years of experimentation resulting in better yields. Saturation of complete profile and better rainfall during September 1988–89 helped for better yield even under delayed sowing in meteorological week 40. However, inadequate and less post-seeding rainfall during 1989–90 resulted in low yields.

RESULTS AND DISCUSSION

Effect of varieties

The grain and fodder yields of varieties were not influenced significantly during 1987–88, 1989–90 and in pooled data (Table 2). However, improved variety 'Swati' gave significantly more grain yield than 'M 35-1' during 1988–89 owing to adequate and well-distributed rainfall and improvement in important yield-contributing characters like weight of ear and weight of grains/ear (Table 1). However, fodder yield of 'M 35-1' was significantly more than 'Swati' during the same year owing to more height and higher dry-matter production (Table 1). These results corroborate the findings of Kulkarni and Choudhary (1984), Umrani and Patil (1985), Daftardar *et al.* (1989) and Jadhav *et al.* (1991).

Effect of sowing time

The sowing of sorghum during MW 40 increased grain yield significantly compared with sowing during MW 38 in 1987–88, 1988–89 and in pooled data (Table 2). The post-seeding rainfall received in MW 46 and 47 (48.4 mm) and MW 50 (61.0 mm) during first year of experimentation correspond to critical growth stages of crop sown in MW

Table 1. Growth and yield attributes of winter sorghum as influenced by different treatments (mean data of 1987–88, 1988–89 and 1989–90)

Treatment	Plant height (cm)	Dry matter/ plant (g)	Ear weight/ (g)	Grain weight/ ear (g)	1,000-grain weight (g)
Varieties					
'M 35-1'	143.2	65.82	35.50	28.38	28.42
'Swati'	129.6	58.60	41.47	34.72	27.51
Sowing time					
MW 36	140.4	63.42	39.63	32.43	27.92
MW 38	136.2	60.51	36.26	29.64	27.61
MW 40	132.6	62.81	39.45	32.53	28.28
N (kg/ha)					
0	127.6	54.36	31.24	24.65	25.82
25	138.2	67.47	43.86	36.23	29.85
50	143.4	64.89	40.42	33.83	28.24

Table 2. Grain and fodder yields of winter sorghum as influenced by different treatments

Treatment	Grain yield (kg/ha)				Fodder yield (kg/ha)			
	1987–88	1988–89	1989–90	Pooled	1987–88	1988–89	1989–90	Pooled
Varieties								
'M 35-1'	1,499	1,363	840	1,234	4,286	3,408	2,327	3,340
'Swati'	1,623	2,331	1,396	1,782	3,354	4,069	2,903	3,442
CD (P = 0.05)		662			488			
Sowing time								
MW 36	1,664	1,725	1,026	1,472	4,318	3,890	2,604	3,604
MW 38	1,200	1,484	970	1,218	3,182	3,220	2,325	2,909
MW 40	1,819	2,331	1,357	1,836	3,960	4,105	2,916	3,660
CD (P = 0.05)	495	810		284	599			520
N (kg/ha)								
0	1,382	1,638	1,043	1,354	3,764	3,573	2,245	3,194
25	1,550	1,819	1,138	1,502	4,114	3,679	2,684	3,492
50	1,750	2,083	1,172	1,668	3,593	3,963	2,916	3,154
CD (P = 0.05)	289	236			391		344	

40, resulting in improvement in growth and yield components (Table 1) and ultimately better grain yield. Similarly, adequate rainfall and better vapsa conditions at seeding of crop sown in MW 40, during second year of experimentation resulted in vigorous crop growth particularly during grand-growth period. The post-seeding rainfall received in MW 44 (12.7 mm) and MW 50 (12.7 mm) also helped in better development of crop sown in MW 40 during later crop-growth stages, resulting in better yields. Umrani and Patil (1985) also reported that the year in which early seeding had no advantage was characterized by late rains in December–January. However, inadequate rainfall during 1987–88 and excess rainfall during 1988–89 at the seeding of crop raised in MW 38 resulted in slow growth during grand-growth period and also in subsequent stages, as indicated by growth and yield-contributing characters (Table 1) resulting low yields. Sorghum sown in MW 36 also showed significant increase in grain yield when the data were pooled compared with MW 38, owing to improvement in growth and yield attributes. The fodder yield of sorghum sown in MW 38 was significantly the lowest during 1987–88 and in pooled data, because of dwarf plants and lower dry-matter production (Table 1).

Effects of nitrogen

Application of 50 kg N/ha significantly increased grain yield over the control during all 3 years and in pooled data except in low-rainfall year of 1989–90 (Table 2), owing to improvement in growth and yield attributes (Table 1). It would be, therefore, beneficial to apply 50 kg N/ha at the time of sowing. Umrani and Bhoi (1981), Umrani and Patil (1985), Daftardar *et al.* (1987) and Jadhav *et al.* (1991) also recommended 50 kg N/ha at sowing for winter (*rabi*) sorghum on deep

Table 3. Grain and fodder yields (kg/ha) of winter sorghum as influenced by varieties x sowing time interaction during 1987–88

Sowing time	Grain yield		Fodder yield	
	'M 35-1'	'Swati'	'M 35-1'	'Swati'
MW 36	1,244	2,083	4,442	4,194
MW 38	1,152	1,248	3,385	2,979
MW 40	2,038	1,538	5,030	2,890
CD (P = 0.05)	699		847	

Vertisols. It was further observed that application of 50 kg N/ha also gave significantly more grain yield than 25 kg N/ha during 1988–89 owing to adequate and well-distributed rainfall during this year. The application of 50 kg N/ha also significantly increased fodder yield over no nitrogen during good-rainfall year of 1988–89 because of taller plants and higher dry-matter production.

Effects of interaction

The variety 'Swati' significantly gave more grain yield than 'M 35-1' under early sowing of MW 36 owing to better post-seeding rainfall, whereas 'M 35-1' significantly increased fodder yield over Swati under late sowing of MW 40 during 1987–88 (Table 3). The grain and fodder yields of 'M 35-1' under delayed sowing of MW 40 was significantly more than earlier sowing in MW 36 and 38 except fodder yield of early-sown crop (MW 36) was on par. However, early sowing of 'Swati' gave significantly more grain and fodder yields than delayed sowing in MW 38 and 40 except grain yield of crop sown in MW 40 was on par.

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