Indian Journal of Agronomy **50** (2) : 140–142 (June 2005)

Effect of row spacing, nitrogen and weed control on growth, yield and nutrient uptake of sorghum (*Sorghum bicolor*)

M.K. KAUSHIK AND M.S. SHAKTAWAT

Department of Agronomy, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur 313 001

Received: January 2004

ABSTRACT

A field experiment was conducted during the rainy seasons of 1998 and 1999, at Rajasthan College of Agriculture, Udaipur, to study the effect of row spacing, nitrogen and chemical / cultural weed - control practice on sorghum [*Sorghum bicolor* (L.) Moench] production. Row spacing had no significant influence on growth parameters and nutrient uptake. The maximum grain yield was obtained with 60 cm row spacing (23.48 q/ha). There was no significant difference in yield due to 60 and 80 cm row spacing. Application of 80 kg N/ha significantly increased grain yield and total N uptake by crop and weeds; however total P uptake was significantly increased up to 120 kg N/ha. Atrazine @ 0.5 kg a.i./ha +1 hoeing at 35 days significantly increased yields, N and P uptake over atrazine alone.

Key words : Sorghum, Row spacing, Nitrogen, Atrazine, Hoeing, Weed, Nutrient uptake

Sorghum is the third important cereal crop in India but its area declined from 17.98 million ha to 13.24 million ha within a span of 3 decades. Sorghum growers have shifted to other crops because of its low yields. There may be many reasons for this, but mainly it is the high cost of labour involved from sowing to harvesting, specially in interculture operation. Under wider row spacing, all agronomic cultural operations can be possible with tractor-drawn implements and for maintaining plant population at wider row spacing, it is essential to reduce plant-to-plant spacing. Sorghum is a heavy feeder of nutrient, and nitrogen nutrition plays a vital role in maximizing the grain and fodder yields. Further, working out chemical weed control and interculture operations are equally important to avoid weed–crop competition during early stage of sorghum growth which ultimately affects yield (Shelke *et al.*, 1986). Since information pertaining to the effect of row spacing, nitrogen and weed-control practice on the yield and nutrient uptake of sorghum is meagre, especially in Rajasthan, an experiment was carried out on these aspects.

MATERIALS AND METHODS

A field experiment was conducted during the rainy season of 1998 and 1999 at the research farm, Rajasthan College of Agriculture, Udaipur. The soil of the experimental site was clay loam, medium in available N and P and high in available K, with pH 7.8. The experiment was laid out in randomized block design with 24 treatment combinations of 3 row spacings (40, 60 and 80 cm), 4 nitrogen levels (0,40,80 and 120 kg/ha) and 2 weed-control practices [atrazine @ 0.5 kg a.i./ha alone and in combination with 1 manual hoeing at 35 days after sowing (DAS)]. Sorghum cultivar 'CSV 10' was used with seed rate of 12 kg/ha. Nitrogen and phosphorus uptake was estimated in grain and stover at harvest of the crop.

RESULTS AND DISCUSSION

Row spacing

Row spacing had significant effect on grain and stover yields of sorghum (Table 1). On mean basis, row spacing of 60 cm significantly increased grain yield by 11.2 % over 40 cm, whereas significantly higher stover yield was obtained at 40 cm row spacing over 60 cm row spacing. There was no significant difference in grain yield due to 60 and 80 cm row spacing. These results are in agreement with findings of Salimath *et al.* (1991). Total uptake of N and P was also not influenced significantly due to row spacing treatment. Dry matter of weed was significantly higher at 80 cm row spacing over 60 and 40 cm row spacing during both the years, resulting in higher N uptake by weeds also.

Nitrogen

Grain weight/panicle and test weight increased significantly with N application up to 80 kg/ha. Maximum grain yield obtained with 120 kg N/ha was 2.4, 14.6 and 51.0 %

Table 1. Effect of row spacing, nitrogen and weed control on growth, yield attributes and yield of sorghum

Treatment	Plant height (cm)		Dry matter (g/plant)		Grain weight/ panicle (g)		Test weight (g)		Grain yield (q/ha)		Stover yield (q/ha)		Harvest index (%)	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Row spacing (cm)														
40	184.0	180.3	53.9	52.1	17.8	17.5	21.69	21.26	21.78	20.45	60.03	57.91	26.8	26.2
60	175.7	177.5	51.3	49.4	18.3	17.8	22.25	21.70	24.32	22.64	53.47	54.72	31.1	29.2
80	180.3	172.2	52.0	48.4	18.0	17.6	21.88	21.41	23.68	21.90	56.72	51.44	29.2	29.7
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	1.83	1.76	5.12	4.24	1.1	0.9
Nitrogen (kg/ha)														
0	154.9	150.9	38.8	39.0	13.2	12.7	20.49	19.98	16.87	16.91	43.73	44.53	27.7	27.4
40	178.6	173.8	50.7	47.6	17.5	17.1	21.84	21.36	23.39	21.28	54.23	51.73	30.2	29.1
80	189.7	188.3	58.9	55.6	21.3	20.9	22.58	22.11	26.07	23.91	63.20	60.70	29.2	28.3
120	196.7	193.7	61.4	57.6	20.6	19.9	22.85	22.38	26.70	24.53	65.80	61.80	28.9	28.5
CD (P=0.05)	10.7	13.6	4.4	3.7	1.4	1.3	1.42	1.52	2.11	2.03	5.91	4.89	1.3	1.1
Weed control														
Atrazine alone	171.4	167.2	47.4	46.6	16.3	15.9	21.74	21.16	20.92	19.97	52.74	52.19	28.3	27.6
Atrazine + hoeing	188.7	186.1	57.5	53.3	19.8	19.5	22.14	21.76	25.59	23.34	60.74	57.19	29.8	29.1
CD (P=0.05)	7.6	9.6	3.1	2.6	1.0	0.9	NS	NS	1.49	1.43	4.18	3.46	0.9	0.8

Table 2. Effect of row spacing, nitrogen and weed-control practice on N and P uptake (pooled data) by sorghum, weed dry matter and N uptake by weeds

Treatment	N uptake (kg/ha)			P uptake (kg/ha)			Weed dry matter (g/m²)		N% in weed		N uptake by weed (kg/ha)	
	Grain	Stover	Total	Grain	Stover	Total	1998	1999	1998	1999	1998	1999
Row spacing (cm)												
40	30.2	21.5	51.7	6.2	7.9	14.0	68.9	57.9	1.45	1.44	9.9	8.3
60	33.9	19.2	53.1	6.8	7.2	14.1	74.0	67.6	1.46	1.43	10.7	9.7
80	32.5	19.0	51.6	6.7	7.3	14.0	99.4	93.1	1.44	1.42	14.3	13.1
CD (P=0.05)	2.8	1.9	NS	0.6	NS	NS	10.0	9.2	NS	NS	1.6	1.5
Nitrogen (kg/ha)												
0	20.1	12.8	32.9	4.1	5.1	9.2	75.3	67.4	1.36	1.35	10.1	9.0
40	31.6	18.4	50.1	6.0	6.8	12.8	80.2	70.9	1.41	1.39	11.3	9.7
80	37.3	23.7	61.0	7.8	8.6	16.4	81.3	72.2	1.47	1.45	11.9	10.4
120	39.8	24.7	64.6	8.4	9.4	17.8	86.4	81.0	1.56	1.53	13.4	12.3
CD (P=0.05)	3.5	2.4	5.2	0.6	0.8	1.3	NS	10.7	0.04	0.04	1.9	1.5
Weed control												
Atrazine alone	29.1	18.4	47.5	5.9	6.9	12.9	134.4	117.0	1.44	1.41	19.4	16.5
Atrazine + hoeing	35.3	21.5	56.8	7.2	8.0	15.2	27.2	28.7	1.46	1.44	4.0	4.2
CD (P=0.05)	2.5	1.6	3.7	0.5	0.5	0.6	8.2	8.6	NS	NS	1.3	1.1

higher over 80, 40 and 0 kg N/ha respectively. The difference between grain yields obtained with 80 and 120 kg N/ha was non significant. This confirms the findings of Singh *et al.* (1993). Total N uptake was significantly higher at 80 kg N/ha over 40 kg and the control. However, increasing levels of N from 0 to 120 kg/ha significantly increased total P uptake by crop (Table 2). The increased uptake of nutrients with increased N levels seems to be the resultant of higher grain and stover yields of sorghum (Table 1). Application of N up to 120 kg/ha significantly increased weed dry matter, resulting in significantly higher N uptake by weed over the control. The results confirm the findings of Balyan and Singh (1987).

Weed control

Atrazine + hoeing signifiicantly increased plant height, dry matter/plant and grain weight/panicle over atrazine alone. Similarly, atrazine+hoeing significantly increased grain and stover yields over atrazine alone, indicating the importance of hoeing.

The increase in yield by atrazine + hoeing was owing to manual hoeing at 35 days after sowing that keeps the crop free from weeds for longer time and results in better soil aeration and ultimately resulted in better growth and yield, apart from this, cultivation also increased the effectiveness of atrazine (Wicks and Burnsinde, 1997). Atrazine + hoeing significantly increased N and P uptake by grain and stover (Table 2). This was mainly owing to higher grain and stover yields. Jay Kumar *et al.* (1987) also reported similar results. Further, atrazine + hoeing significantly reduced weed dry matter over atrazine alone which led to reduced N uptake by weeds.

REFERENCES

Balyan, J.S. and Singh, S.P. 1985. Effect of plant rectangularity and nitrogen on sorghum under dry land conditions. *Indian Journal of Agronomy* **30** (3) : 391–392.

Jay Kumar, R., Siddewaran, K., Kempuchetty, N. and Subramainan, S. 1987. Studies on nitrogen and weed management in relation to nutrient uptake and yield of sorghum. *Madras Agriculture Journal* **74** (1) : 21–25.

Salimath, V.N., Patil, V.S., Hiremath, S.M. and Malligawad, L.H. 1991. Response of *rabi* sorghum genotype to row spacing in transitional tract of Karnataka. *Karnataka Journal of Agriculture Science* **4** (3–4) : 177–178.

Shelke, D.K., Bhosle, R.H., Jadhav, N.S. and Nankar, J.T. 1986. Studies on crop–weed compitition in *kharif* sorghum. *(In) Abstracts of Annual Conference of Indian Society of Weed Science,* pp. 59, held at Agricultural Research Station, Durgapura, Jaipur, Rajasthan.

Singh, I., Chouhan, G.S. and Choudhary, L.S. 1993. Response of sorghum (*Sorghum bicolor* L.) to nitrogen and phosphate under western Rajasthan condition. *Indian Journal of Agronomy* **38** (2) : 305–306.

Wicks, G. A. and Burnside, O.C. 1972. Pre-planting atrazine application on sorghum. *Weed Science* **20** (1) : 49–52.