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Short Note

Effect of Fertilizer Levels on Productivity and Economics of Elite Sorghum (*Sorghum bicolor* (L.) Meonch) Genotypes

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A field experiment was undertaken at Instructional Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan) to study the effect of fertilizer levels on the productivity, quality and economics of sorghum genotypes during *kharif* 2006. Results showed that application of recommended dose of fertilizer (80: 40 kg N: P ha^{-1}) gave significantly higher weight of 5 panicle, grain weight of 5 panicle, weight of 1000 grains and grain, dry fodder and biological yields, gross returns, B/ C ratio, NPK uptake over that of 50 % RDF and found at par with 150 % RDF. The corresponding increases in grain, straw and biological yields, gross returns, total NPK uptake were of the order of 7.27, 5.38, 5.82, 6.44, 31.70, 9.72 and 7.33 per cent over 50% recommended dose of fertilizers. Among elite genotypes, SPH 1467 gave significantly higher dry matter accumulation at 60 DAS and at harvest and grain yield and significantly higher NPK uptake. HC 308 recorded higher straw and biological yield, while SPV 1730 recorded higher gross returns, net returns, and B/C ratio. SPH 1467 recorded 9.17 and 167.98 percent higher grain yield over CSV 15 and HC 308.

Key words: Fertility levels, elite sorghum genotypes, nutrient uptake, economics

Sorghum [*Sorghum bicolor* (L.) Moench] is one of the fourth important food grain crop of world. The quick spreading of high yielding genotypes changed the scenario of sorghum production in India. While the need for adequate fertilizer requirement is desirable, identification of suitable genotype with genetic potential is also equally important. Sorghum is a nutrient exhaustive crop and the importance of nitrogen and phosphorus in its nutrition is well documented. Thus, suitable cultivars and proper nutrition are very important to get higher yield. Hence, the present study was undertaken to find out the response of different elite sorghum genotypes to fertilizer levels during *kharif* 2006 at the Instructional Farm, Rajasthan College of Agriculture, Udaipur.

Materials and Methods

A field investigation was carried out during the *kharif* 2006 at Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. The soil of experimental site was clay loam in texture having pH 7.8, organic carbon 0.54 %, medium with respect to available nitrogen 287.9 kg ha^{-1}, available phosphorus 20.8 kg ha^{-1} and high in available potassium 341.50 kg ha ^{1}. The experiment consisted of three fertilizer levels (50 % RDF, 100% RDF (recommended dose of fertilizer,; 80: 40 kg N: P ha^{-1}) and 150 % RDF) and ten elite sorghum genotypes *viz*.,SPV1714, SPV1715, SPV1716, SPV1730, SPH 1467, HC 308, SPV1664, SPV1685, SPV1686 and CSV 15 were tested in a split plot design having fertilizer levels in main plot and genotypes in sub plots with three replications. Sorghum genotypes were sown on 4th July 2006 at 45 x 12-15 cm row and plant to plant spacing with a seed rate of 10 kg ha^{-1}. Half dose of nitrogen and full dose of phosphorus were applied as per treatments at sowing time and rest of the nitrogen was top dressed at 30 days after sowing of the crop. The crop received 350.0 mm rainfall during crop season. Crop was harvested according to maturity, genotypes CSV 15, SPV 1664, SPV 1685, SPV 1686, SPV 1730, SPV 1714 and SPH 1467 harvested on October 15,2006; SPV 1715, SPV 1716 and HC 308 on 23rd October ,2006

Results and Discussion

Fertilizer levels: Application of 100 % RDF (80:40 kg N:P ha^{-1}) gave significantly higher dry matter accumulation plant^{-1} at 60 DAS and at harvest, weight of 5 panicle, grain weight of 5 panicle, weight of 1000 grains, grain, straw and biological yields that 50% RDF (Table 1). Corresponding increases in grain, fodder and biological yields were 7.27, 5.38,
& 5.82 However, it was found statistically at par with 150 % RDF (*viz*. 120:60 kg N:P ha^{-1}) and superior over 50% RDF in enhancing aforesaid parameters. Significantly higher NPK realization by grain, straw and total crop, gross and net returns and B/C ratio observed under 100 % RDF which was found at par with 150 % RDF and significantly higher than 50 %

RDF. It that recorded higher gross return over 50 % RDF by a margin of 6.44 per cent. Further data

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Table 1. Effect of fertilizer levels on growth, yield parameters and yield of sorghum genotypes

Treatment	Plant height (cm)	Days to 50 % flowering	DMA at 60 DAS (g/plant)	DMA at harvest (g/plant)	Weight of 5 panicle(g)	Grain weight of 5 panicle(g)	1000 grain weight (g)	Yield (kg ha^{-1})			Harvest index (%)
								Grain	Straw	Biological	
Fertility levels											
50 % RDF	245.5	72.30	85.99	161.58	467.17	320.23	27.05	3624	12077	15700	23.03
100 % RDF	254.1	71.57	94.09	176.79	484.23	330.17	27.45	3887	12727	16614	23.47
150 % RDF	260.1	71.27	96.16	180.52	487.57	338.00	27.47	3915	12922	16837	23.36
CD (P=0.05)	4.0	0.23	4.16	7.75	5.62	4.57	NS	165	476	641	0.07
Genotypes											
SPV 1714	260.4	70.67	87.53	164.47	509.44	353.00	29.56	3681	13386	17067	21.59
SPV 1715	264.7	77.22	94.09	176.79	467.22	331.67	26.56	3159	12956	16114	19.61
SPV 1716	256.6	78.44	95.31	179.08	367.78	259.44	20.38	3602	11598	15199	23.68
SPV 1730	266.2	70.44	87.31	164.05	538.89	375.00	30.23	4199	13827	18026	23.28
SPH 1467	262.9	65.78	95.54	179.51	539.89	365.00	28.23	4561	11147	15709	29.04
HC308	280.1	77.33	86.95	163.37	341.67	208.89	25.78	1702	14809	16511	10.35
SPV 1664	239.1	71.89	93.51	175.69	500.00	348.33	28.74	4267	11833	16100	26.44
SPV 1685	235.8	70.00	91.62	172.14	482.22	327.22	27.76	4306	12025	16330	26.36
SPV 1686	238.6	66.56	94.17	176.94	568.89	392.22	28.59	4430	11963	16393	27.03
CSV 15	228.2	68.78	94.77	177.56	480.56	333.89	27.39	4178	12210	16388	25.49
CD (P=0.05)	11.7	0.52	3.73	7.06	17.82	11.12	0.63	162	486	638	0.13

RDF = 80 kg N + 40 kg P_2O_5 ha^{-1}

reported that 100 % RDF recorded significantly higher NPK uptake by grain, fodder and total uptake than 50 % RDF and found at par with 150% RDF. The per cent increases were of the order of 43.32, 21.56 & 31.71; 12.61, 8.25 & 9.72; 13.65, 6.75 & 7.33 in NPK uptake by grain, straw and total uptake. It is well emphasized that increasing rates of fertilizer, markedly improved over all growth of the crop in terms of dry matter production per plant by virtue of its impact on morphological and photosynthetic components along with accumulation of nutrients. This suggests greater availability of nutrients and metabolites for growth and development of reproductive structure, which ultimately led to realization of higher productivity of individual plants. One of the other probable reasons could be ascribed to earlier flowering, which might have provided greater duration for reproductive growth. The increased availability of nutrients and photosynthates might have enhanced number of flowers and their fertilization resulting in higher number of grains per panicle. Further, in most of cereals, greater assimilating surface at reproductive development results in better grain formation because adequate production of metabolites and their translocation towards grain as evident from improvement in nutrient concentration and their uptake. This might have resulted in increased weight of individual grain expressed in terms of test weight. Since the grain weight per panicle is dependent on number of grains per panicle and weight of individual grain, the significant improvement in grain weight per panicle under fertility levels could be ascribed to improvement in both these parameters. The results of present investigation are in close conformity with findings of Das *et al* (2000), Dixit *et al* (2005), Singh and Sumeriya (2006) and Sumeriya *et al*., (2007).

Genotypes: Data presented in Table 1 & 2 clearly indicate that minimum days to flowering, dry matter accumulation (g plant $^{-1}$) at 50 DAS and at harvest ,plant height at harvest, weight of 5 panicle, grain weight of 5 panicle, 1000 grain weight (g), grain, fodder, biological yields, harvest index, gross returns (Rs ha^{-1}), net returns (Rs ha^{-1}) and B/C ratio, NPK uptake were significantly enhanced by different sorghum genotypes. Hybrid SPH 1467 recorded significantly minimum days to flowering, higher dry matter accumulation at 60 DAS and at harvest, grain yield, harvest index, total NPK uptake. Genotype SPH 1467 recorded 23.92 and 9.17 percent higher grain yield over SPV 1714 and CSV 15. HC 308 recorded maximum plant height, straw yield and NPK uptake by fodder. Total weight and grain weight of 5 panicles recorded maximum under SPV 1686. Genotype SPV 1730 recorded maximum (30.23 g) test weight which was significantly higher than rest of the genotypes. Maximum biological yield reported by SPV 1714. Genotype SPH 1467 recorded significantly higher test weight, grain yield, harvest index, gross returns, net returns, B/C ratio and Total N and P uptake than check HC 308 and CSV 15. The magnitude of increases were of the order of 46.62 & 11.35 and 14.29 & 5.31, respectively in total N and P uptake by SPH 1467 over HC 308 and CSV

15. Genotype SPV 1730 recorded maximum returns and B/C ratio (Rs 42812, Rs 32425 and 3.13 for gross and net returns and B/C ratio). The differential behaviour of these genotypes in respect to yield components and yield could explained solely by the variation in their genetic constitution and adaptability of soil and climatic conditions. The higher grain yield and fodder yield registered by SPH 1467 and HC308 over rest of genotypes appear to be a resultant of remarkable improvement in different yield components, which was brought about due to

Table 2. Effect of fertility levels on nutrients uptake and economics of sorghum genotypes

Treatment	Nutrient uptake (kg ha^{-1})									Returns (Rs ha^{-1})		B:C ratio
	Nitrogen			Phosphorus			Potassium					
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	Gross	Net	
Fertility levels												
50 % RDF	45.17	51.71	96.88	10.63	20.86	31.49	17.14	185.38	202.52	37139	27695	2.93
100 % RDF	64.74	62.86	127.60	11.97	22.58	34.55	19.48	197.89	217.37	39531	29144	2.81
150 % RDF	66.44	64.33	130.77	12.11	23.01	35.12	19.73	203.43	223.16	39955	28624	2.53
CD (P=0.05)	2.94	2.98	5.91	0.53	0.75	1.28	0.85	8.74	9.55			
Genotypes												
SPV 1714	53.61	58.23	111.84	10.87	23.49	34.36	17.19	200.27	217.46	39236	28849	2.79
SPV 1715	46.24	56.42	102.66	9.43	22.70	32.13	14.74	193.88	208.62	35652	25265	2.45
SPV 1716	56.88	54.71	111.59	11.39	20.58	31.97	18.04	186.60	204.64	36367	25980	2.51
SPV 1730	66.71	65.34	132.06	13.10	24.46	37.56	21.11	222.56	243.67	42812	32425	3.13
SPH 1467	77.63	64.86	142.49	14.46	21.04	35.50	22.92	179.46	202.38	41276	30889	2.99
HC308	26.94	70.24	97.18	5.29	25.76	31.06	8.56	223.49	232.05	29781	19393	1.87
SPV 1664	63.19	51.55	114.74	12.69	20.75	33.45	21.57	183.23	204.80	40508	30121	2.90
SPV 1685	67.82	52.26	120.09	12.85	21.02	33.88	21.60	185.75	207.35	40990	30603	2.96
SPV 1686	64.07	59.50	123.57	13.10	20.51	33.60	21.46	187.74	209.20	41624	31236	3.02
CSV 15	64.73	63.25	127.97	12.51	21.20	33.71	20.64	192.69	213.33	40250	29862	2.88
CD (P=0.05)	3.01	2.96	5.80	0.57	1.02	1.53	0.94	8.93	9.58			

adoption of genotypes. It was further confirmed by the fact that seed yield was found strongly correlated with different yield components. The results are in close conformity with the findings of Rana *et.al* (2000), Sumeriya *et al*. (2005), Singh *et al* (2009) and Sumeriya (2010)

Conclusion

Application of 100% recommended dose of fertilizers ((80:40 kg N:P ha^{-1}) gave 3887, 12727 and 16614 kg ha^{-1} of grain, straw and biological yield and net realization of Rs. 29144 ha^{-1}. Among genotypes, SPH 1467 recorded higher grain yield (4561 kg ha^{-1}) and HC 308 recorded higher straw yield (14809 kg ha^{-1})

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