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YIELD AND ECONOMICS OF SORGHUM GENOTYPES AS AFFECTED BY FERTILITY LEVELS

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ABSTRACT

A field experiment was undertaken at Instructional Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan) to study the effect of fertility levels on the productivity and economics of sorghum genotypes during kharif season of 2004. Results showed that application of 80: 40 kg N: P ha^{-1} gave significantly higher dry matter accumulation per plant at 60 DAS and at harvest, plant height, weight of 1000 grains, grain and biological yield, gross and net returns over control. The corresponding increases in grain and biological yield, gross and net returns were of the magnitude of 29.3, 11.8, 19.5 and 19.0 %, respectively over control. Among elite sorghum genotypes, SPV 1616 provided significantly higher dry matter accumulation per plant at 60 DAS and harvest, dry fodder yield and biological yield. The CSH 16 recorded maximum test weight, while, SPH 1413 recorded higher gross and net returns and B/C ratio.

Key words: Fertility, elite sorghum genotypes, yield, economics

INTRODUCTION

Sorghum [*Sorghum bicolor* (L.) Moench] is grown as a food, feed, fodder and fuel crop in different parts of the world Therefore, this crop has special significance after wheat and rice. In India, sorghum occupies maximum area (2.03 m ha) among different forage crops (DSR, 2011). Its nutrient removal from the soil is quite high. The forage crops are heavy feeder of plant nutrients and also remove large amount of nutrients from soils. For harvesting good tonnage, forage sorghum requires liberal supplementation of nutrients, addition of external fertilizers to meet the nutritional requirements of the crop. Hence, nutrient management of forage crops is most important. Since the possibility of increasing land under sorghum crop is limited in India, high yielding cultivars coupled with optimum fertilization are the answers for increase the fodder productivity for sustained production. While, the need for adequate fertilizer requirement is desirable, where as identification of suitable genotype with genetic potential is equally important. Thus, suitable cultivars and proper nutrition are very important to get higher yield. Keeping in view the above considerations, the present studies were undertaken to study the effect of fertility levels on elite sorghum genotypes.

MATERIALS AND METHODS

A field investigation was carried out during the *kharif* 2004 at the Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. The soil of experimental site was clay loam in texture having alkaline (pH 7.9) reaction, organic carbon (5.5 g kg^{-1}), medium in available nitrogen (284.9 kg ha^{-1}), available phosphorus (21.8 kg ha^{-1}) and high in available potassium (358.7 kg ha^{-1}). The experiment consisted of three fertility levels (0:0, 40:20 and 80:40 kg N:P ha^{-1} (100% RDF) assigned in main plot and nine elite sorghum genotypes *viz*., SPH 1290, SPH 1410, SPH 1413, SPH1420, SPV1616, CSH 14, CSH 16, SPV462 and CSV 15) in subplot treatments were tested in a split plot design having three replications. Sorghum genotypes were sown on 6th July 2004 at 45 x 12-15 cm row and plant to plant spacing with a seed rate of about 10 kg ha^{-1}. Half dose of nitrogen and full dose of phosphorus was applied as per treatments at sowing time and rest of the nitrogen was top dressed at 30 days after sowing the crop. The crop received 569.6 mm rainfall during crop season. Crop was harvested according to maturity, (genotypes SPH 1290, SPH 1410, SPH 1413, SPH 1420, CSH14 and CSH 16 harvested on October13th, 2004 and SPV

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1616, SPV 462 and CSV15 on 18th October, 2004). Days to 50 % flowering, and maturity, dry matter at 60 DAS and harvest, plant height at harvest, plant population at harvest, test weight, and yields were recorded

RESULTS AND DISCUSSION

Fertility levels: Application of 100 % RDF (80:40 kg N:P ha^{-1}) gave significantly lesser days to 50% flowering and maturity, higher in dry matter accumulation $plant^{-1}$ at 60 DAS and harvest, plant height at harvest, 1000 grains weight, grain and biological yield, HI (%), gross and net returns over that 50% RDF and control (Table 1). The corresponding increases in these parameters were 6.4, 6.4, 2.4, 2.9, 11.2, 4.6 and 8.6 per cent, respectively in dry matter accumulation at 60 DAS and harvest, plant height, test weight, grain yield, HI (%) and gross returns over 50 % RDF. Application of 50 % RDF (40 kg N+ 20 kg P ha^{-1}) also found significantly higher over control in respect to all the above mentioned parameters. 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 alongwith 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. Observed improvement in various yield attributing characters yield and monetary returns due to N and P fertilization is in close conformity with the findings of Dixit *et al* (2005), Singh and Sumeriya (2006), Sumeriya *et al*., (2007), Singh *et al* (2009) and Sumeriya (2010).

Table 1: Effect of fertility levels on growth characters of sorghum genotypes

Treatments	Days to flowering	Days to maturity	Dry matter (g $plant^{-1}$)		Plant height (cm)	Plant population (per plot)	Test weight (g)	Yield (q/ha)			HI (%)	Returns (Rs ha^{-1})		B/C ratio
			60 DAS	Harvest				Grain	Fodder	Biological		Gross	Net	
Fertility ($N:P_2O_5ha^{-1}$)														
0:0	58.70	86.82	102.94	128.21	229.96	166.00	27.68	31.87	126.82	158.72	20.34	31496	24396	3.44
40:20	57.33	86.48	120.72	150.35	233.85	166.37	28.52	37.05	129.76	166.81	22.38	34651	26782	3.40
80:40	56.74	86.52	128.49	160.03	239.56	166.15	29.34	41.22	136.211	177.44	23.40	37657	29018	3.36
CD (P=0.05)	0.867	0.061	8.351	9.544	2.571	NS	0.333	1.470	NS	13.057	0.469	2325.7	2325.7	NS
Genotypes														
SPH 1290	54.11	85.00	105.19	131.01	210.22	167.56	28.40	39.61	117.30	156.91	25.14	34691	26821	3.40
SPH 1410	55.44	84.44	118.54	147.64	212.78	164.89	29.69	39.25	132.23	171.48	22.83	36134	28265	3.59
SPH 1413	58.11	84.33	125.72	156.58	219.78	166.89	25.24	38.19	140.25	178.44	21.38	36432	28563	3.64
SPH 1420	58.22	84.44	107.10	133.39	221.11	166.56	30.49	39.94	119.43	159.37	24.97	35105	27235	3.45
SPV 1616	60.22	90.56	138.50	172.49	288.78	164.56	27.52	30.92	154.53	185.56	16.65	34066	26196	3.33
CSH 14	50.67	84.56	105.75	131.71	217.89	167.44	31.01	39.18	117.92	157.10	24.92	34520	26651	3.40
CSH 16	57.22	85.00	102.17	127.25	230.00	167.22	31.17	39.11	113.92	153.03	25.50	34040	26171	3.33
SPV 462	62.89	90.33	117.81	146.73	247.33	164.67	28.94	30.15	131.40	161.55	18.64	31035	23166	2.95
CSV 15	61.44	90.78	135.67	168.97	262.22	165.78	24.17	34.08	151.37	185.43	18.33	35387	27518	3.50
CD (P=0.05)	0.655	0.705	4.611	5.944	4.700	NS	0.864	1.651	13.580	7.141	0.441	1490.4	1490.4	0.191

Genotypes: Data (Table 1) clearly indicate that minimum days to flowering and maturity, dry matter accumulation at 60 DAS and harvest, plant height at harvest, 1000 grain weight (g), grain, fodder, biological yields, harvest index, gross returns, net returns and B/C ratio, were significantly enhanced by sorghum genotypes. Hybrid CSH 14 and SPH 1420 gave significantly minimum days to flowering and maturity, SPV 1616 and CSV 15 recorded higher in dry matter accumulation at 60 DAS and harvest, plant height, SPV 1616 recorded maximum fodder and biological yield. Genotype SPH 1420 recorded 32.4 and 17.2 percent significantly higher grain yield over SPV 462 and CSV 15, respectively. SPV 1616 recorded 17.6 and 14.8 percent higher dry fodder and biological yield over SPV 462. SPH 1413 recorded 17.3, 23.3 and 23.3 percent higher gross returns, net returns and B/C ratio over SPV 462, respectively. The differential behaviour of these genotypes in respect to yield components and yield could explained solely by the various in their genetic constitution and adaptability of soil and climatic conditions. The higher grain yield and fodder yield registered by SPH 1420 and SPV 1616 over rest of genotypes appears to be a resultant of remarkable improvement in different yield components, which was brought about due to 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 Sumeriya *et al*. (2007), Singh *et al* (2009) and Sumeriya (2010).

Table 2: Interaction effect of fertility levels and genotypes on plant height and grain yield of sorghum

Genotypes	Fertility level N: P_2O_5 (kg ha^{-1})		
	0:0	40:20	80:40
Plant height (cm)			
SPH 1290	201.67	211.67	217.33
SPH 1410	211.67	212.33	214.33
SPH 1413	216.67	216.00	226.67
SPH 1420	218.33	220.00	225.00
SPV 1616	289.67	282.67	294.00
CSH 14	215.00	217.67	221.00
CSH 16	229.00	230.00	231.00
SPV 462	241.00	246.00	255.00
CSV 15	246.67	268.33	271.67
CD (P=0.05)	8.14		
Grain yield (qha^{-1})			
SPH 1290	33.49	39.36	45.99
SPH 1410	33.03	40.13	44.60
SPH 1413	34.60	38.61	41.36
SPH 1420	33.65	40.49	45.68
SPV 1616	25.00	31.95	35.81
CSH 14	35.96	39.63	41.95
CSH 16	34.17	40.34	42.81
SPV 462	26.85	29.79	33.80
CSV 15	30.06	33.15	39.02
CD (P=0.05)	2.86		

Interaction: Significantly maximum plant height (294.00 cm) was noted with genotype SPV 1616 at 80 kg N + 40 kg P_2O_5 ha^{-1} over rest of the varietal and fertility combinations and SPH 1290 at 0 fertility noted minimum (201.67 cm) plant height (Table 2). Genotype SPH 1290 at 80 kg N + 40 kg P_2O_5 ha^{-1} produced significantly maximum grain yield (45.99 q ha^{-1}) and minimum in SPV 1616 under no N and P application.

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