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Influence of Fertilizer Application on the Yield and Nutrient Uptake in Sorghum

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Field experiments were conducted in red and black soils to study the effect of mode of application of nitrogen on yield and uptake of major nutrients in sorghum Co 20 under rainfed condition. Application of 45 kg N and 22.5 kg each of P and K was found to be advantageous. Application of 60 kg N and 30 kg P recorded higher N uptake in red soil. Nutrient requirement to produce one quintal of grain was higher in red soil than in black soil.

The cultivation of crops in more than 75 per cent of the arable area depends on rainfall today and also in future the dependence will be nearly 50 per cent. Fertilizer application and method of application play an important role in the uptake of nutrients and yield of sorghum. Mariakulandai and Morachan (1966)reported the increased yield of Sorghum with increased nitrogen application. Khuspe and Patil (1970) found that foliar application increased the grain and straw yield and also increased the uptake of major nutrients. Muthuswamy (1972) reported increased uptake of major nutrients with fertilizer application to the rainfed sorghum. The present investigation was taken up to study the influence of nitrogen, phosphorus and potassium and different methods of nitrogen application on the uptake of major nutrients and the yield of sorghum grain and straw in red and black soils under rainfed conditions.

MATERIALS AND METHODS

Field experiments in 20 sq.m. plots with ten treatments (Table I) and three replications were conducted in red and black soils of Coimbatore. Split and foliar applications were carried out at tillering stage. For foliar application one per cent urea solution was utilised. Farm yard manure at the rate of 5 tons/acre was applied to all the treatments as basal dose. The rainfall received during the stand of the crop in the field was 621.6 mm. The grain and straw yield were recorded. The grain and straw were analysed for N, P and K content. Total uptake of these nutrients was calculated, and the data were statistically scrutinised.

RESULTS AND DISCUSSION

The yield of grain and straw per hectare is presented in Table I. In

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TABLE I. Yield of sorghum grain and straw in kg/ha

	Treatment				Mean Yield			
					Red Soil		Black soil	
					Grain	Straw	Grain	Straw
T_1	Control				370.50	2386.02	1679.00	8941.40
	N	P	K					
T_2	45	22.5	0	Basal	1679.60	15906.10	1926.60	11806.60
T_3	45	22.5	22.5	Basal	1827.80	17650.62	1778.40	12747.20
T_4	60	30	0	Basal	2346.50	21849.62	1976.00	11658.40
T_5	45	22.5	0	1/2 basal + 1/2 split application at tillering stage.	676.78	8407.80	1778.40	11658.40
T_6	45	22.5	22.5	1/2 basal + 1/2 split application at tillering stage.	2104.44	21340.80	2272.40	12893.40
T_7	60	30	0	1/2 basal + 1/2 split application at tillering stage.	1279.46	13466.44	1877.20	12809.42
T_8	45	22.5	0	1/2 basal + 1/2 foliar application at tillering stage.	859.56	11791.78	1976.00	11658.40
T_9	45	22.5	22.5	1/2 basal + 1/2 foliar application at tillering stage.	1946.36	18653.44	1827.80	12350.00
T_{10}	60	30	0	1/2 basal + 1/2 foliar application at tillering stage.	2193.36	23746.58	1976.00	11841.18
				C. D. (P=0.05)	493.9	3681.60	N. S.	N. S.

N. S. — Not significant

general, the yield of sorghum grain and straw was higher in red soil than in black soil. It may be due to the better physical nature of the soil. Statistically significant higher grain yields were obtained at increased nitrogen application both in complete basal and half basal + 1/2 foliar application treatments. Higher straw yields were also obtained in the above treatments in red soil. Although T_{10}, T_4 and T_6 treatments were on par, T_6 was observed to be advantageously good with regard to ease of application and balanced nature. The yield differences among the treatments were not significant in black soil. It may be attributed to the high fertility status of the black soil which is reflected by obtaining high yield in control plots. Increased phosphorus fertilizer application increased the yield of grain and straw in red soil only. Potassium application has not increased the yield of either grain or straw. Bathkal *et al.* (1971) also reported that the application of phosphorus and potassium did not significantly increase the sorghum grain yield in black soil. Bodade (1964) reported that foliar spray of 3% urea increased the yield. Khuspe and Patil (1970) also observed that foliar appli- of nitrogen increased yield of sorghum.

The nutrients required (in kg) for production of one quintal of sorghum grain under rainfed conditions were calculated and presented. No significant difference was noted between treatments for all the three major nutrients in both red and black soils. It is also interesting to note that the nutrient requirements are more in the case of red soil than in black soil.

TABLE II. Uptake of Nutrients kg/ha (Mean value)

Treatments	Red Soil			Black Soil		
	N	P	K	N	P	K
T_1	9.02	5.83	10.52	24.77	8.25	39.03
T_2	48.17	32.06	64.57	30.92	10.87	37.69
T_3	60.75	37.74	46.49	33.20	12.20	40.06
T_4	69.85	44.66	61.65	29.69	11.10	39.47
T_5	30.13	15.17	30.43	27.76	9.59	40.01
T_6	61.01	38.88	44.81	33.44	12.65	43.82
T_7	39.82	23.86	52.12	27.37	8.89	40.51
T_8	28.41	15.31	31.52	31.32	11.21	35.17
T_9	62.05	36.75	50.73	30.28	10.13	37.54
T_{10}	72.47	46.39	92.33	23.32	8.65	35.27
C. D.	11.36	N. S.	11.36	N. S.	N. S.	N. S.

N. S. – Not significant

Uptake of major nutrients : In red soil nitrogen and potassium uptake was statistically higher at increased level of N application, especially in foliar treatment (Table II). Total P uptake was also higher in the above treatment although the difference did not attain the level of statistical significance Potassium application had also no influence in the uptake of nutrients. In black soil, though higher nitrogen and potassium uptake were noted in the treatment which received N, P, K 60-30 -0 (1/2 basal + 1/2 split application) the difference did not attain the level of statistical significance. It is seen that increased nitrogen and phosphorus application increased the yield of grain and straw and uptake of nutrients only in red soil.

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