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DIRECT AND RESIDUAL EFFECTS OF NITROGEN SOURCES DRYLAND ON SORGHUM IN BLACK SOIL

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Clays with expanding lattice type have the ability to fix ammonium in non-exchangeable form. Sen (1954) observed that the ammonium fixing capacity of the soils increased with the increasing clay content, cation-exchange capacity and the water holding capacity. However, results obtained from upland crops showed no significant difference between the ammonium and nitrate containing nitrogenous fertilizers in terms of their efficiencies whereas, for rice, ammonical fertilizers were reported to be superior to nitrate containing sources (Rajendra Prasad *et al.*, 1980). This paper highlights the results of the studies conducted with different sources of nitrogen for their efficiencies, both direct and residual, to rainfed sorghum in medium black soil. The soils of the experimental site had the following characteristics: Soil depth 85 cm, pH 8.2 and organic carbon 0.51 per cent. Coarse sand, fine sand, silt and clay constituted 39.04, 4.30. 10.70 and 45. 96 per cent, respectively. During kharif 1980-81, sorghum (CSH-6) was grown with 60 kg N and 40 kg P_2O_5 per hectare along with a control (no nitrogen) in three replications. Nitrogen and phosphorus were given through - 1) urea + single super phosphate (SSP), -) calcium ammonium nitrate + SSP, and 3) diammonium phosphate + urea which constituted the main plots alongwith a control plot receiving only 40 kg P_2O_5/ha through SSP. During kharif 1981-82, CSH-6 sorghum was grown in the main plots with 0, 15, 30, 45 and 60 kg N/ha in strip plot design. A basal dose of P_2O_5 @ 40 kg/ha was also applied to all the plots. After the harvest of the first crop, soil samples were collected upto a depth of 45 cm and were analysed for nitrate nitrogen after Jackson, (1967).

Results of the first crop of sorghum taken during 1980-81 showed that different sources of nitrogen did not produce significant difference in grain yield (Table 1). Evidently the efficiencies of urea and calcium ammonium nitrate were found to be the same for sorghum. A combination of urea and DAP as nitrogen source also produced similar effect. However, sorghum grain yield was significantly low (18.0 q/ha) when the crop was not fertilized with nitrogen. Direct effect of different sources of nitrogen was thus not discernible in this study indicating that loss of available N (from ammonical sources, viz., DAP and partly CAN) through fixation in black soil was not

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significant for sorghum. As the single super phosphate and diammonium phosphate contain all water soluble phosphate, no separate effect of these two sources was expected in this study.

Table 1. Effect of sources of nitrogen (60 kg/ha) on the grain yield of sorghum (1980-81)

Sources of N and P	Grain yield (q/ha)
Control (no fertilizer N)	18.0
Urea + SSP	33.7
Urea + DAP	32.8
CAN + SSP	29.0

Nitrate nitrogen content in soils, estimated after the harvest of the first crop, revealed a decreasing trend in contents with increase in soil depth upto 45 cm (Table 2). Nitrate nitrogen content of the soils was found to be higher in the surface layer (0-15 cm) of the plots which received nitrogen during 1980-81. Similar effect was not discernible in the sub-surface soil. The plots which received all nitrogen through urea seemed to contain more nitrate nitrogen in the surface soil (70 kg/ha). Rainfall being low during 1980-81 and the heavy textured soil perhaps prevented movement of nitrate in the soil profile and higher accumulation was thus observed in the surface soil layer.

Residual fertility, evaluated by growing sorghum as the test crop during 1981-82 with graded levels of nitrogen, was found to be un-affected by different sources of nitrogen. The data presented in table 3 suggest that urea (20.3 q/ha), urea+DAP (16.8 p/ha) and CAN (17.6 q/ha) are similar as far as their residual effects are concerned. However, it was observed that the grain yield of sorghum tended to increase at zero nitrogen level in the plots which received fertilizer nitrogen during 1980-81 irrespective of the sources. This effect may be ascribed to the higher nitrate nitrogen content in the surface soil of the N-fertilized plots (Table 2). Response to applied nitrogen was obtained upto the level of 30 kg/ha.

Table 2. Nitrate nitrogen content in soil at different depths after the harvest of sorghum during 1980-81

Sources of N and P	Nitrate N (kg/ha) Soil depth (cm) 0-15	15-30	30-45
Control	33.1	29.5	6.5
Urea + SSP	70.0	19.3	6.1
Urea + DAP	53.7	23.1	5.8
CAN + SSP	56.5	22.9	4.8

Table 3. Residual effect of sources of nitrogen (applied to sorghum during 1980-81) and response of sorghum to N levels applied during 1981-82

Levels of N (kg/ha)	Grain yield (q/ha) Sources of N (1980-81)				Mean
	Control	Urea + SSP	Urea+DAP	CAN + SSP	
0	13.4	20.3	16.8	17.6	17.0
15	13.2	19.5	18.9	20.2	17.9
30	27.2	31.6	25.6	26.9	27.8
45	31.0	25.9	27.8	24.1	27.2
60	26.9	26.0	26.3	31.3	27.6
Mean	22.3	24.7	23.1	24.0	

CD 5 % N Levels 6.25, Sources of N Not significant

Among different sources of nitrogen, CAN, Urea and DAP+Urea were found to be equally effective for the rainfed sorghum. No deleterious effect of ammonium fixation was observed in black soil containing 46 per cent clay, when a part of the was nitrogen supplied in ammonium form.

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PERFORMANCE OF SEWAN *(LASIURUS SINDICUS* HENR STRAINS IN WESTERN RAJASTHAN

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Maintenance of optimum levels of forage production from rangelands is important in the arid western Rajasthan. Forage yield can be increased four to six times if the existing rangelands are improved by reseeding with high yielding and perennial grasses e.g., *Lasiurus sindicus, Cenchrus ciliaris* and *C. setigerus* (Gupta *et. al.*, 1970, Chakaravarty, *et al.*, 1966 and Dass, 1977). The Sewan grass is recommended for the rehabilitation of rangelands on sandy soils with low precipitation. With a view to identify strains of high production potential, studies were carried out for six years (1975-1980) at the Central Arid Zone Research Institute, Regional station Jaisalmer (26°-54N latitude and 70°-55E longitude). The terrain is a sandy burried pediment with varying levels of sand deposition. The climate is dry with annual precipitation ranging from 107 mm in 1980 to 406.2 mm in 1975. The natural grass cover is *Lasiurus sindicus-Eleusine compressa* type. The vegetation is exposed to high diurnal temperatures maximum reaching to 49°c in May-June and minimum to -3°c during winter. Wind, velocity during the summer is very high and droughts are frequent.

Five strains of Sewan. viz., CAZRI :17, 318, 319, 353 and 565 were sown in 4 x 4 m plots in a Randomised Block Design with five replications in August, 1975. Observations on growth characteristics, i.e., plant height, number of tillers and basal area of six randomly selected plants were recorded from each plot, from 1976 to 1980. The forage was harvested in mid October.

The annual precipitation in 1975, 1976, 1977, 1978, 1979, and 1980 was 406.2, 377.2, 141.2, 328.3, 224.1 and 107 mm respectively. The total rainfall-during 1975 was above normal which favoured establishment of the grass strains. Onset of the monsoon in 1976 was early and the precipitation was distributed fairly upto September. The precipitation in 1977 was below normal and it extended from June to September. The rainfall in 1978 was above normal and 80 % of it occurred in July. The two years 1979 and 1980, had sub-normal precipitation.

The forage production over five years was significantly ($P < .01$) higher in strain No CAZRI 353 compared to other the strains except CAZRI 565. However, high forage production potential of these two strains is not reflected in the yield attributes viz., plant height, basal area and tiller number, probably because of the tiller woodiness observed in these strains.

Table 1. Yield attributes of *Lasiurus sindicus* strains and environmental effect

	Plant height (cm)	Basal area of clump (cm^2)	Tillers (no)	Forage yield (q/ha)
		YIELD ATTRIBUTES		
L. sindicus 317	86.2	119.1	32.7	9.9
L. sindicus 318	98.9	158.4	88.7	10.6
L. sindicus 319	91.2	100.1	49.0	9.9
L. sindicus 353	88.1	142.6	56.3	15.5
L. sindicus 565	65.1	96.2	35.7	13.6
CD 5%	13.5	30.8	10.3	2.2
CD 1%	18.8	42.7	14.4	2.9
		ENVIRONMENTAL EFFECT		
YEAR				
1976	61.3	34.8	5.8	-
1977	87.3	184.5	99.4	9.0
1978	109.1	150.0	52.2	19.7
1979	-	-	-	12.7
1980	-	-	-	6.1
CD 5%	10.5	23.8	8.0	1.9
CD 1%	14.6	33.1	11.1	2.6

The environmental effect on the forage production of *L. sindicus* strains was also significant ($P < .01$). The maximum forage yield (19.7 q/ha) was recorded in 1978 which was significantly higher than the yields in all other years. This could be attributed to better clump formation in *L. sindicus* in its third year of growth and to the rain fall (328.3 mm) and its distribution (26 days). The min.mum forage yield (6.1 q/ha) in 1980 can be attributed to the lowest rainfall (107.0 mm). By and large, yield attributes of the strains did not vary significantly but the forage production of strains No. 353 and 565 was higher over other strains.

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