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MINERAL CONTENT OF GRASS (CENCHRUS CILIARIS LINN.) AND GRASS-LEGUME MIXTURES IN VARIOUS INTERCROPPING SYSTEMS

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ABSTRACT

In a field experiment carried out for three consecutive *kharif* seasons (1981-1983), the mixtures of *C. ciliaris* and annual fodder and grain legumes exhibited higher nutrients (N, P, K, Ca and Mg) content and their uptake than the pure stand of *C. ciliaris*. Higher content and uptake of these nutrients were recorded in grass plus fodder legumes than grass plus grain legumes. The grass-cluster bean mixture showed better nutrient content and their uptake followed by the grass-moth bean mixture.

INTRODUCTION

Knowledge of chemical composition of fodder is important in formulating feeding practices. Satyapaul *et al.* (1979) reported that *C. ciliaris,* as a sole source of nutrient supply is inadequate and legumes are necessary as feeding supplements. Improvement in mineral contents of *C. setigerus* grown with legumes was reported by Satyapaul *et al.* (1981). Information on mineral content of grass-legume associations involving *C. ciliaris* which is the most wide spread and important grass of the arid zone is, however, limited and hence this study was conducted.

MATERIAL AND METHODS

The field experiment was conducted at the Central Arid Zone Research Institute, Jodhpur for three consecutive years (1981-1983). The soil of the experimental site was loamy sand, low in available nitrogen (125 kg N/ha), medium in available phosphorus (15 kg P/ha), high in available potassium (270 kg K/ha) and pH 7.8. Total rainfall during 1981 (246 mm) and 1982 (196 mm) was much below normal. In 1983 (406 mm) it, however, exceeded the normal (290 mm) for the growing season. The distribution of rainfall was also erratic causing moisture stress in both, grass and legumes at different stages of growth.

The experiment consisted of eight treatments i.e., two pure stands of grass, one grown in regular rows (60 x 60 cm) and the other in paired rows (30 x60/90 cm) and six (three fodder and three grain) intercrops, i.e. cluster bean, cowpea, and moth bean grown in the interpair spaces of the grass. The *C. ciliaris cv.*

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CAZRI 358 was established in 1980 and legumes were introduced in the subsequent years. Crop varieties grown were: cowpea FS-68 (grain) and HFC 42-1 (fodder), cluster bean FS-277 (both grain and fodder) and moth bean Jadia (grain) and T-23 (fodder). A uniform dose of 30 kg N/ha was applied to all treatments in the establishment year (1980). The experiment was laid out in a randomised block design with four replications.

Three cuttings of the grass and one cut of legumes were taken each year. Samples (500 g) of grass cuttings were pooled every year for chemical analysis. In intercropping treatments both, grass and legume were mixed on their dry matter basis for chemical analysis. The plant nitrogen was analysed by Kjeltec Auto System II. Phosphorus was analysed by vanadomolybdate yellow colour method (Jackson, 1958). Potassium was determined by Flame Photometer and calcium and magnesium by Varian Tectron Atomic Absorption Spectro-photometer.

RESULTS AND DISCUSSION

Nitrogen

Data presented in Table 1 and 2 show that the content and uptake of nitrogen did not differ significantly among the treatments during 1981 and 1982. However, the uptake of nitrogen in mixtures was relatively higher particularly in grass-cluster bean association. The lower nitrogen content of mixtures in 1981 and 1982 could be attributed to low contribution of legumes to the total yield. In 1983, significantly higher nitrogen content and uptake was recorded in grass + fodder cluster bean. Increase over pure grass in nitrogen content and uptake (regular row) were 25 and 19 per cent and 16 and 11 per cent for cluster bean and moth bean, respectively. Higher content and uptake of nitrogen in grass-legume mixtures was reported by Muthuswamy *et al.* (1978) and Kunelius and Narsimhalu (1983). In general, nitrogen content and its uptake were better in grass + fodder legume mixtures than grass + grain legume mixtures. This may be due to higher protein content in fodder legumes. In grain legumes, upto the time of grain formation, some of the nitrogen fixed by legumes is excreted to the soil (Agboola and Fayemi, 1972). Besides, the nitrogen content and total uptake decreased due to more leaf fall.

Phosphorus

Association of legumes did not exert significant effect on the content and uptake of phosphorus (Table 1 and 2). On an average, the phosphorus content and its uptake, increased with cowpea and moth bean. The increase in phosphorus content. in case of these legumes was 6 to 11 per cent (average of three years) over pure grass (regular row). Higher phosphorus content in grass + legume mixtures could be attributed to the fact that legumes, having higher affinity for divalent cations, may release some of phosphate ions from, other wise, unavailable soil source i. e. apatite (Rao and Sharma, 1978).

Potassium

The content and uptake of potassium differed significantly during 1981 and

Table 1. Nitrogen, phosphorus and potassium content (%) in grass and grass +legume mixtures

Treatments	Nitrogen			Phosphorus			Potassium		
	1981	1982	1983	1981	1982	1983	1981	1982	1983
Grass (RR)	1.70	1.47	1.19	0.17	0.19	0.18	0.79	0.70	0.76
Grass (DR)	1.57	1.44	1.10	0.14	0.20	0.24	0.79	0.66	0.82
Grass + cluster bean (F)	1.51	1.54	1.49	0.16	0.19	0.20	0.85	0.60	0.81
Grass + cowpea (F)	1.67	1.34	1.27	0.18	0.20	0.20	0.81	0.58	0.78
Grass + moth bean (F)	1.59	1.38	1.38	0.18	0.21	0.22	0.75	0 64	0.72
Grass + cluster bean (G)	1.70	1 23	1.10	0.18	0.17	0.19	0.88	0.66	0.71
Grass + cowpea (G)	1.53	1.36	1.14	0.23	0.21	0.16	0.72	0.65	0.65
Grass + moth bean (G)	1.50	1 41	1.17	0.20	0.21	0.16	0.84	0.67	0.70
SEm ±	0.065	0 060	0.050	0.007	0.006	0.014	0.028	0.034	0.039
CD 5%	NS	NS	0.15	0.02	0.02	0.04	0.08	NS	0.12

RR = Regular row, DR = Double row, F = Fodder legumes and G = Grain legumes

Table 2. Nitrogen, phosphorus and potassium uptake (kg/ha) in grass and grass + legume mixtures

Treatments	Nitrogen			Phosphorus			Potassium		
	1981	1982	1983	1981	1982	1983	1981	1982	1983
Grass (RR)	38.0	43.8	32.2	3.8	5.8	4.8	17.5	21.0	20.5
Grass (DR)	37.2	40.8	28.5	3.5	5.8	6.0	18.5	18.5	21.3
Grass + cluster bean (F)	40.5	41.8	38.3	3.8	5.5	4.8	22 3	16.8	20.3
Grass + cowpea (F)	49.5	43.5	31.5	5.3	6.8	5.3	23.1	19.0	19.0
Grass + moth bean (F)	47.0	47.8	35.8	5.3	7.5	5.5	22.1	23.5	19.0
Grass + cluster bean (G)	51 0	40.3	30.3	5.4	5.3	5.3	26.4	21.5	20.0
Grass + cowpea (G)	40.0	43.4	27.5	6.0	6.7	3.8	19.0	20.7	16.0
Grass + moth bean (G)	44.8	46.0	36.8	6.0	6.8	4.8	25.0	21.8	22 0
SEm ±	3.56	4.20	1.66	0.35	0.57	0.50	1.90	2.55	1.14
CD 5%	NS	NS	4.9	1.0	1.7	NS	5.6	NS	4.2

Table 3. Calcium and magnesium content (%) and their uptake (kg/ha) in grass and grass + legume mixtures

Treatments	Concentration						Uptake					
	Calcium			Magnesium			Calcium			Magnesium		
	1981	1982	1983	1981	1982	1983	1981	1982	1983	1981	1982	1983
Grass (RR)	1.24	0.88	1.32	0.39	0.21	0.55	27.79	26.10	35.52	8.69	6.34	14.81
Grass (DR)	1.21	0.92	1.29	0.37	0.23	0.56	28.66	25.86	33.75	8.89	6.40	14.56
Grass + cluster bean (F)	1.30	1.02	1.74	0.40	0.24	0.68	33.60	26.12	43.82	10.28	6.13	17.21
Grass + cowpea (F)	1.18	0 85	1.37	0.36	0.20	0.65	33.92	27.51	34.07	10.43	6.42	16.16
Grass + moth bean (F)	1.25	0.99	1.60	0.41	0.21	0.50	36.65	34.64	42.04	12 00	7.26	13.14
Grass + cluster bean (G)	1.20	0.83	1.47	0.40	0.19	0.37	35.34	26.80	40.86	11.70	6.24	10.29
Grass + cowpea (G)	1.24	0.80	1.27	0.42	0.20	0.37	32.48	30.84	31.25	11.05	7.53	9.00
Grass + moth bean (G)	1.19	0.84	1.54	0.39	0.18	0.44	34.72	27.68	48.75	11.46	5.76	13.90
SEm ±	0.04	0.05	0.06	0.02	0.01	0.03	2.63	2.96	2.23	0.90	0.73	1.00
CD 5%	NS	NS	0.18	NS	NS	0.09	NS	NS	6.56	NS	NS	2.94

1983 (Table 1 and 2). In 1981, the mixture having cluster bean (grain) showed significantly higher potassium content than pure grass, grass + fodder moth bean and grass + grain cowpea mixtures. The cluster bean mixture also showed significantly higher uptake than pure grass and grass + grain cowpea. In 1983, the content and uptake of potassium in pure grass and mixtures did not differ significantly except in grass+grain cowpea which showed the lowest value (content 0.65 per cent and uptake 16kg/ha). On an average, grass + cluster bean (either fodder or grain) showed higher potassium content.

Calcium

The differences in calcium con'ent and its uptake in different treatments were non-significant in 1981 and 1982 (Table 3). Average of 1981 and 1982, however, showed 10 and 6 per cent higher ca'cium con'ent and 11 and 32 per cent higher uptake over pure grass, in grass + fodder cluster bean and grass + fodder moth bean, respectively. In 1983, significant differences among treatments were observed. Fodder cluster bean, fodder moth bean and grain moth bean combinations had significantly higher calcium content and its uptake than the pure grass. The increase in content and uptake were 32 and 23 per cent in fodder c'uster bean, 21 and 18 per cent in fodder moth bean and 17 and 37 per cent in grain moth bean, respectively. Higher contents of calcium in grass-legume mixtures, as compared to pure grass, may be attributed to higher uptake of calcium by legumes in mixtures owing to high root cation exchange capacity (CEC) of legumes as compared to grasses (Asher and Ozanne, 1961).

Magnesium

Magnesium content and its up'ake in different treatments broadly followed the trend similar to ca'cium (Table 3). There were non-significant differences among treatments during the first two years. In the third year, the differences were significant. The treatment having fodder cluster bean showed magnesium content sta'istically similar to that of fodder cowpea. It was significantly higher than that in other treatments. The higher uptake of calcium and magnesium in mixtures may be attributed to higher dry matter content and their higher concentration.

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