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Effect of Sulphur and Phosphorus Application on the Uptake of N, P and S by Grain and Straw of Clusterbean Under Dry Land Conditions

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Abstract

Results of this study revealed that uptake of nitrogen, phosphorus and sulphur was appreciably higher with the variety HGS-365 by grain, straw and total produce. The uptake of N.P and S were recorded higher with the application of 30 kg S ha^{-1} closely followed by 60 kg S ha^{-1}. while uptake values of these nutrients increased significantly with every increase in the rate of phosphorus application upto 40 kg $P_2O_5 ha^{-1}$.

Key words: Clusterbean, uptake, nitrogen, phosphorus, sulphur, grain, straw.

Introduction

Sulphur is needed by crops in large amount often comparable to quantities of phosphorus and in crops even more than phosphorus. Legumes and oil seeds need comparatively higher amount than other crops. Legumes respond to sulphur and phosphorus application to sandy to sandy loam soils of North-western India[4,5]. In clusterbean stem and leaves the concentration and uptake of N.P.K. and S increased with the application of sulphur and phosphorus enriched fertilizors. Hence this study was undertaken to evaluate the effect of sulphur and phosphorus application on the nutrient uptake by culsterbean (cyamopsis tetragonoloba) under Dryland conditions of Agra Region.

Material and Methods

Field experiments were conducted during kharif seasouns of 2003 and 2004 at Agricultural Research farm of R.B.S. College, Bichpuri Agra. The experimental soil had ph 8.10, available N, 186.2 kg ha^{-1}, available P_2O_5 28.60 kg ha^{-1},available K_2O 318.56 kg ha^{-1} and available S 9.25 ppm and sandy loam soil. The experimental treatments were three varieties of clusterbean as RGC-1003(V_I), HGS-563 (V_2), and HGS-365 (V_3), three levels of sulphur as 0 (S_1), 30 (S_2) and 60 (S_3) kg S ha^{-1}.and four levels of phosphorus as O (P_0), 20 (P_1), 40 (P_2) and 60 (P_3) kg P_2O_5 ha^{-1}. These treatments were replicated three times in split-plot design. Grain and straw yield of clusterbean were recorded. The plant material was analysed for N, P and S contents using standard methods and uptake values were estimated and analysed statistically.

Results and Discussion

The data presented in Table 1 exhibited that variety HGS-365 had appreciably more uptake of nitrogen in grain and straw as well as in total produce than HGS-563 and RGC-1003 except in straw during 2004. Variety HGS-563 also had significantly higher uptake of nitrogen by grain than RGC-1003 during 2004. The application of 30 kg S ha^{-1} resulted in significantly higher uptake of nitrogen by grain and straw and by total produce than control. The uptake of nitrogen

appreciably increased with every increase in the rate of phosphorus application upto 40 kg P_2O_5 ha^{-1} by grain and total produce. The nitrogen uptake is associated with the metabolic activities of the plants with the concentration and distribution of ions in the external medium as well as in the plants tissues, the cation exchange capacity of roots and relative mobility of the hydrated ion. Higher grain and straw yield with nutrients application affected nutrient contents are responsible for variation in uptake values of nitrogen[3,5,8].

Table 1 Uptake of nitrogen (kg ha^{-1}) in grain and straw and in total produce as influenced by varieties and levels of sulphur and phosphorus fertilization

Treatments	Uptake of nitrogen (kg ha^{-1})					
	2003			2004		
	Grain	Straw	Total	Grain	Straw	Total
Varieties						
RGC-1003	39.13	22.84	61.97	50.86	29.06	79.92
HGS-563	42.38	22.97	65.35	54.95	30.21	85.16
HGS-365	45.63	24.46	70.09	58.31	31.10	89.41
SEm ±	0.78	0.43	1.32	0.91	0.59	1.38
CD (P=0.05)	2.33	1.27	3.94	2.73	1.76	4.12
Levels of sulphur (kg ha^{-1})						
0	39.05	21.67	60.72	50.76	27.85	78.61
30	44.74	24.41	69.13	57.51	31.21	88.72
60	43.37	24.18	67.55	55.84	31.32	87.16
SEm ±	0.78	0.43	1.32	0.91	0.59	1.38
CD (P=0.05)	2.33	1.27	3.94	2.73	1.76	4.12
Levels of phosphorus (kg $P_2O_5ha^{-1}$)						
0	34.53	19.17	53.70	45.87	25.95	71.82
20	41.53	22.35	63.88	53.65	29.28	82.93
40	47.70	25.52	73.22	60.51	31.87	92.38
60	45.77	26.65	72.42	58.79	33.40	92.19
SEm ±	0.56	0.39	0.99	0.69	0.49	1.21
CD (P=0.05)	1.60	1.10	2.80	1.96	1.39	3.42

Clusterbean variety HGS-365 had remarkable higher uptake of phosphorus by grain, straw and total produce (Table 2). The application of sulphur at 30 kg ha^{-1} had appreciably higher uptake of phosphorus in grain and straw as well as in total produce than control. These results confirm the findings of many others [3,5]. The uptake of phosphorus significantly increased with every increase in the rate of phosphorus application upto 40 kg P_2O_5 ha^{-1} in grain, straw and total produce. Phosphorus content, grain and straw production are responsible for such effects as also reported earlier[1,3,8].

Table 2 Uptake of phosphorus (kg ha^{-1}) in grain and straw and in total produce as influenced by varieties and levels of sulphur and phosphorus fertilization

Treatments	Phosphorus uptake (kg ha^{-1})					
	2003			2004		
	Grain	Straw	Total	Grain	Straw	Total
Varieties						
RGC-1003	7.81	4.74	12.55	10.17	5.90	16.07
HGS-563	8.30	4.82	13.12	10.69	6.10	16.79
HGS-365	8.93	5.14	14.07	11.40	6.36	17.76
SEm ±	0.18	0.10	0.26	0.20	0.12	0.30
CD (P=0.05)	0.54	0.30	0.79	0.60	0.37	0.89
Levels of sulphur (kg ha^{-1})						
0	7.68	4.39	12.07	9.85	5.47	15.32
30	8.79	5.16	13.95	11.32	6.44	17.76
60	8.57	5.15	13.72	11.10	6.45	17.55
SEm ±	0.18	0.10	0.26	0.20	0.12	0.30
CD (P=0.05)	0.54	0.30	0.79	0.60	0.37	0.89
Levels of phosphorus (kg P_2O_5ha^{-1})						
0	6.43	3.77	10.20	8.66	4.98	13.64
20	8.12	4.68	12.80	10.45	5.92	16.37
40	9.60	5.44	15.04	12.04	6.64	18.68
60	9.23	5.71	14.94	11.87	6.94	18.81
SEm ±	0.14	0.09	0.21	0.16	0.11	0.27
CD (P=0.05)	0.39	0.24	0.60	0.46	0.32	0.77

Clusterbean variety HGS-365 had remarkable more uptake of sulphur by grain, straw and total produce than HGS-563 and RGC-1003 [Table 3]. The application of sulphur at 30 kg ha^{-1} resulted in maximum uptake of sulphur and being at par with 60 kg S ha^{-1} but both rates gave significantly higher uptake of sulphur than the control by grain, straw and total produce[1,3,4,6]. The uptake of sulphur improved with every increase in the rate of phosphorus application upto 40 kg P_2O_5 ha^{-1} by grain, straw and total produce. Sulphur content and grain and straw production might be held responsible for increasing sulphur uptake with increasing phosphorus application upto 40 kg P_2O_5 ha^{-1} as also reported by other investigators in the past [2,4,6,7] .

Table 3 Uptake of Sulphur (kg ha^{-1}) in grain and straw and in total produce as influenced by varieties and levels of sulphur and phosphorus fertilization

Treatments	Sulphur uptake (kg ha^{-1})					
	2003			2004		
	Grain	Straw	Total	Grain	Straw	Total
Varieties						
RGC-1003	2.172	2.583	4.755	2.941	3.368	6.309
HGS-563	2.267	2.649	4.917	3.084	3.430	6.514
HGS-365	2.446	2.185	5.261	3.302	3.554	6.856
SEm ±	0.040	0.044	0.077	0.047	0.066	0.092
CD (P=0.05)	0.120	0.130	0.230	0.141	0.197	0.275
Levels of sulphur (kg ha^{-1})						
0	2.095	2.539	4.634	2.889	3.256	6.145
30	2.420	2.777	5.197	3.253	3.531	6.785
60	2.370	2.731	5.101	3.185	3.565	6.750
SEm ±	0.040	0.044	0.077	0.047	0.066	0.092
CD (P=0.05)	0.120	0.130	0.230	0.141	0.197	0.275
Levels of phosphorus (kg P_2O_5 ha^{-1})						
0	1.821	2.212	4.033	2.571	3.055	5.626
20	2.240	2.591	4.831	3.036	3.384	6.419
40	2.610	2.922	5.532	3.442	3.617	7.060
60	2.509	3.005	5.514	3.388	6.746	7.134
SEm ±	0.037	0.039	0.068	0.043	0.061	0.085
CD (P=0.05)	0.105	0.112	0.191	0.120	0.172	0.240

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