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Effect of Active Lime, FYM and Moisture Regimes on the Yield and P-Zn Composition of Wheat CV GW-120

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ABSTRACT

A pot experiment was conducted to study effect of soil treatment (FYM, Active lime) on the yield ttributes, yield concentration and uptake of nutrients (P, Zn and Ca) by wheat CV GW-120. Under noisture deplition cycle M_2, there was a considerable reduction in the yield attributes,grain (20 %), straw 37 %) yield and the nutrient content and uptake. Application of FYM increased the grain (41 %) and straw (33 %) yield through its positive effect on the yield attributes and content and uptake of P, Zn and Ca by the crop. Active lime (AL_2) application reduced the grain (13%) and straw (8 %) yield through its adverse effect on the yield attributes and the accumulation of P, Zn and Ca in the plant (Key words : Moisture, FYM, active lime and wheat).

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INTRODUCTION

More than one third of the world's cultivable oils are calcareous where the problem of nutrient vailability is acute apart from the other ill effects f excess $CaCO_3$ on crop growth (Dahiya and Singh, 982). In such soils availability of phosphorus (P) nd Zinc (Zn) has been limiting and posing serious hreat to successful crop production (Kanzaria and atel, 1985). This experiment was conducted to erive some information on the effect the degree of lcareousness of the soils alongwith the FYM and oisture regimes on the yield, yield attributes and Zn and Ca absorption by the wheat CV GW-120.

MATERIALS AND METHODS

A pot experiment was conducted on a Vertisol edium black calcareous soil) during winter 1986 h two levels namely, -0.5 (M_1) and -1.0 (M_2) bar of moisture, two levels namely 0 (F_0) and 2 (F_1) per cent of FYM and three levels namely, 0 (AL_0), 5 (AL_1) and 25 (AL_2) per cent of active lime of the total 30 per cent lime added in the soil with two replications in a completely randomised factorial design. Some of the soil characteristics are : sand 13.0%, silt 30.3%, clay 56.7%, pH 7.8, EC 0.18 dSm^{-1}, $CaCO_3$ 3.3%, CEC 53.0 m.e. 100 g^{-1}, exchangeable Ca 44.5 and Mg 6.4 m.e. 100 g^{-1}, organic carbon 0.84%, Olsen's P 5.73 ppm P_2O_5, available K 172.5 ppm K_2O and DTPA extractable Zn 0.62, Fe 6.53, Cu 3.22 and Mn 11.56 ppm. The polyethylene lined earthen pots (12 liter volume) were filled with 12 kg of the treated soil. Wheat CV GW-120 was sown, which was thinned to nine plants per pot a week after germination. The plant samples were digested in a di-acid mixture as described by Jackson and Ulrich (1969). The acid extract was used for analysis of different nutrients viz. P, Ca and Zn. Phosphorus in the acid extract was determined by vanadomolybdophosphoric yellow colour method, Ca by Versanate method (Jackson, 1958) and Zn by atomic absorption spectrophotometry (Shimadzu Model AA-640-13).

RESULTS AND DISCUSSION

The results of the effect of moisture, FYM and active lime are set out in tables 1, 2 and 3. Under M_2, effective tillers, earhead length and test weight were reduced by 15, 28 and 12 per cent, respectively, over their respective values under M_1, which ultimately curtailed the grain yield by 20 per cent under the former. Similarly, the corresponding decrease in the straw yield was by 37 per cent which was due to the corresponding reduction by 15 per cent in the plant height. These results are in conformity with the work of Padmani *et al.* (1976) and Tomar *et al.* (1977) who also reported similar performance of wheat crop under low moisture content.

The addition of FYM application at the rate of 2 per cent significantly augmented the grain and straw yield by 41 and 33 per cent, respectively over that of control. This increase in the yield could be a resultant of 21, 36, 30 and 5 per cent increase in the plant height, effective tillers, earhead length and test weight, respectively, in this treatment over control. These observations support the work reported elsewhere (Singh *et al.*, 1976).

In general, active lime application affected the yield attributes and yield adversely, however, the effect was significant only in case of earhead length, test weight, grain and straw yield, the reduction in these parameters being 8, 2, 13 and 8 per cent, respectively, under AL_2 over AL_0. Though adverse effect of active lime increased in magnitude with its fineness, it was significant only for the earhead length and grain yield which curtailed marginally under AL_2 when compared with AL_1. Similar results were also reported for groundnut (Golakia and Patel, 1986); bajara (Verma and Kachroo, 1984).

The concentration of P in the grain and straw was increased significantly by 13 and 41 per cent and that of uptake decreased by 10 and 11 per cent, respectively, under M_2 over that of these nutrients under M_1, most probably due to the reduced growth and yield under M_2. In case of Zn, concentration in the grain and straw significantly reduced by 14 and 19 per cent and that of uptake by 31 and 50 per cent respectively under M_2 over M_1. The results ar comparable with those reported for P by Saxen (1970) and for Zn by Tiwari *et al.* (1976). Th concentration of Ca in the grain and straw wa reduced significantly under M_2, over that under M so also the uptake to the extent of 34 and 72 pe cent, respectively, over M_1. Mass flow, the principa mode of Ca transport in the soil (Mengal an Kirkby, 1982) which suffers most unde comparatively low moisture content. This could b the probable reason for the reduced concentratio and uptake of Ca under M_2.

As expected, the concentration of P in the grai and straw was raised by 21 and 18 per cent, and s also its uptake by 70 and 75 per cent with FYM application over that under control, respectively Similar findings were reported by More an Ghonsikar (1988). Contrary to the expection, the concentration of Zn in the grain and straw reduce by 13 and 4 per cent, respectively, under FYM application over control. However, this is plainly a result of dilution effect as is evident from the Zn uptake values which were higher to the extent of 23 and 54 per cent in the grain and straw, respectively, in FYM application than those in control. Similarly, the corresponding values of Ca concentration were also decreased slightly but those of uptake were increased to the tune of 36 and 39 per cent.

Active lime diminished the concentration and uptake of P and Zn by the grain and straw. Though differences between P and Zn concentration under AL_1 and AL_2 in the grain and straw were small, they were statistically significant. The uptake of P by the grain and straw reduced to 21 and 30 per cent under AL_2 over AL_0, respectively. Abbas *et al.* (1976) also reported reduction in the nutrient composition of pea with increasing active lime content of soil in potted conditions. Significant reduction in the Ca concentration of the grain and straw with increasing levels of active lime is an interesting controversy. We tried to seek the explanation in content of the exchangeable Ca content in the soil and lime in the soil which were 44 and 3.0 me 100 g^{-1}, respectively. Thus, the soil was more potent source of available Ca rather than sparingly soluble active lime itself. This is how the application of active lime reduced the Ca content in the plant. The reduction in the uptake of Ca by the grain and straw is attributed to reduced growth and yield of the crop.

TABLE 1
Mean effect of moisture, FYM and active lime on yield attributes and yield of wheat CV GW-120.

Treatments and levels	Plant height (cm)	Effective tillers	Earhead length (cm)	Test weight (g)	Grain yield (g pot^{-1})	Straw yield (g pot^{-1})
M_1	49.59	18.01	6.70	42.00	14.52	35.45
M_2	42.31	15.24	4.80	37.09	11.63	22.39
CD (0.05)	4.09	1.73	0.14	0.41	1.22	6.47
F_0	41.61	14.08	5.00	38.60	11.02	29.32
F_1	50.29	19.17	6.50	40.49	15.53	34.53
CD (0.05)	4.09	1.73	0.14	0.41	1.22	6.47
AL_0	48.75	16.95	5.96	39.96	14.11	30.42
AL_1	44.85	16.45	5.78	39.40	12.84	28.44
AL_2	44.26	16.48	5.50	39.27	12.28	27.91
CD (0.05)	NS	NS	0.16	0.50	0.27	0.58

TABLE 2
Mean effect of moisture, FYM and active lime on the concentration and uptake of phosphorus by wheat CV GW-120.

Treatments and levels	P concentration (mg g^{-1})		P uptake (mg pot g^{-1})	
	Grain	Straw	Grain	Straw
M_1	4.45	0.74	74.61	26.23
M_2	5.02	1.04	58.38	23.28
CD (0.05)	0.34	0.28	8.3	2.10
F_0	4.29	0.82	47.27	19.12
F_1	5.18	0.97	80.44	33.49
CD (0.05)	0.34	0.28	8.3	2.10
AL_0	4.89	1.03	68.99	31.33
AL_1	4.85	0.86	62.27	24.46
AL_2	4.45	0.79	54.64	22.04
CD (0.05)	0.41	0.34	10.16	4.41

TABLE 3

Mean effect of moisture, FYM and active lime on the concentration and uptake of zinc and calcium by wheat CV GW-120.

Treatment and levels	*Zn concentration (μg g⁻¹)*		*Zn uptake (μg pot⁻¹)*		*Ca concentration (mg g⁻¹)*		*Ca uptake (mg pot⁻¹)*	
	Grain	*Straw*	*Grain*	*Straw*	*Grain*	*Straw*	*Grain*	*Straw*
M_1	73.83	64.08	1072	2307	1.7	3.19	16.98	113.08
M_2	63.55	51.96	739	1163	0.97	3.13	11.28	72.32
CD (0.05)	1.23	1.14	117	117	0.02	0.02	1.40	NS
F_0	73.41	56.83	808	1325	1.09	3.31	12.01	77.19
F_1	63.97	59.22	993	2044	1.05	3.10	16.30	107.04
CD (0.05)	1.23	1.14	117	117	0.02	0.02	1.40	NS
AL_0	69.94	60.34	986	1835	1.14	3.26	16.08	99.16
AL_1	67.43	58.94	865	1176	1.05	3.25	13.48	92.43
AL_2	68.69	54.79	843	1529	1.03	3.11	12.64	86.80
CD (0.05)	1.28	1.17	120	121	0.03	0.02	1.48	NS

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