GAU Res. J. 1990. 16 (1) : 33–38

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

B. A. Golakiya, M. S. Patel and G. S. Sutaria

Department of Agricultural Chemistry and Soil Science, Gujarat Agricultural University, Junagadh Campus, Junagadh

ABSTRACT

A pot experiment was conducted to study the interaction of moisture, FYM and active lime on yield attributes, yield, concentration and uptake of nutrients (P, Zn and Ca) by wheat CV GW - 120. The grain and straw yield were almost doubled and the nutrient uptake was raised considerably due to FYM application under M_2 and the adverse effect of the stress on the yield and nutrient uptake under this moisture condition was buffered. The earhead length was significantly reduced with increase in the moisture tension and active lime alongwith the considerable reduction in the concentration and uptake of P, Zn and Ca. However, FYM incorporation under AL X F or M X F X AL interaction mitigated the adverse effect of active lime and leveled off these differences. (Key words : Interaction, moisture, FYM, active lime and wheat).

(Received on 14th Aug. 1989)

INTRODUCTION

No any reaction in the soil takes place in utter isolation, rather it occurs in the midst of a number of interactions simultaneously. While interacting with the FYM and moisture regimes a so called adverse effect of active lime in the calcareous soils changes its direction and magnitude as evinced by the alteractions in the yield, yield attributes and chemical composition of wheat CV GW-120.

MATERIALS AND METHODS

A pot experiment was conducted on a vertisol (medium black calcareous soil) during winter 1986 with twelve treatment combinations consisted of two levels each of moisture —0.5 (M_1) and —1.0 bar (M_2), FYM 0 (F_0) and 2 per cent (F_1) and three levels active lime 0 (AL_0), 5 (AL_1) and 25 per cent (AL_2) of the total 30 per cent lime added in the soil. Some of the soil characteristics are : send 13.0%, silt 30.3%, clay 56.7%, pH 7.8, EC 0.18 ds m^{-1}, $CaCo_3$ 3.3%, CEC 53.0 m. e. 100 g^{-1}, exhangeable 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 polythylene 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

Yield attributes and yield

Moisture and FYM exerted significant interaction on the yield attributes and yield (Table 1). Incorporation of FYM at both the moisture levels produced positive effect on yield attributes especially the earhead length, the test weight and the yield, however, its magnitude was comparatively low under high moisture tension. Application of FYM under M_1 almost doubled the grain and straw yield to that recorded under M_2F_0. Application of FYM to the crop under M_2 mitigated the adverse effect of moisture stress on the straw and raised the grain yield which was almost equal to that realized under M_1F_0. The credit goes to the phenomenal increase (8%) in the water holding capacity of the soil on account of FYM application as also reported by some earlier workers (Vaughan and Malcolm, 1985).

Interaction effect of moisture and active lime was significant only in case of earhead length, which decreased with increasing moisture tension and active lime. This is attributed to diminished water holding capacity (14%) of soil with increasing active lime.

TABLE 1

Interaction effect of M x F, M x AL and M x F x AL on yield attributes and yield of wheat CV GW-120.

Treatments combinations	*Plant (cm)*	*Effective tillers*	*Earhead length (cm)*	*Test weight (g)*	*Grain (g pot^{-1})*	*Straw (g pot^{-1})*
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*
M_1F_0	42.71	15.88	5.66	40.71	12.44	25.73
M_1F_1	56.48	20.15	7.73	43.29	16.59	45.17
M_2F_0	40.52	12.29	4.33	36.48	9.60	20.90
M_2F_1	44.10	18.19	5.26	37.68	13.66	23.89
CD (0.05)	5.78	3.03	1.06	1.57	4.10	8.67
M_1AL_0	54.48	18.52	6.95	42.42	18.58	36.98
M_1AL_1	47.53	17.98	6.78	41.69	14.41	35.20
M_1AL_2	46.77	17.53	6.36	41.90	13.56	34.18

1.	2.	3.	4.	5.	6.	7.
M_2AL_0	43.01	15.39	4.97	37.50	12.64	23.86
M_2AL_1	42.16	14.91	4.78	37.11	11.27	21.68
M_2AL_2	41.75	15.42	4.65	36.63	10.99	21.64
CD (0.05)	NS	NS	1.07	NS	NS	NS
F_0AL_0	42.43	14.17	5.28	39.31	12.52	25.11
F_0AL_1	41.52	13.61	5.06	38.25	10.65	22.42
F_0AL_2	40.89	14.47	4.65	38.23	9.90	22.41
F_1AL_0	55.06	19.73	6.65	40.60	15.70	35.73
F_1AL_1	48.18	19.28	6.50	40.55	15.03	34.45
F_1AL_2	47.63	18.48	6.35	40.31	14.65	33.41
CD (0.05)	NS	NS	1.07	NS	4.38	8.62
$M_1F_0AL_0$	49.79	16.63	6.07	41.43	14.01	28.28
$M_1F_0AL_1$	47.64	15.81	5.83	39.97	12.25	24.86
$M_1F_0AL_2$	46.00	15.19	5.10	40.75	11.05	24.07
$M_1F_1AL_0$	57.13	20.41	7.84	43.41	17.15	45.69
$M_1F_1AL_1$	56.00	20.16	7.74	43.41	16.57	45.54
$M_1F_1AL_2$	55.00	19.98	7.62	43.05	16.07	44.29
$M_2F_0AL_0$	44.83	11.72	4.49	37.20	11.04	21.45
$M_2F_0AL_1$	43.63	11.41	4.30	36.59	9.01	19.98
$M_2F_0AL_2$	43.54	13.75	4.21	35.70	8.73	20.76
$M_2F_1AL_0$	47.88	19.06	5.45	37.80	14.24	25.76
$M_2F_1AL_1$	48.21	18.41	5.26	37.68	13.50	23.37
$M_2F_1AL_2$	47.25	37.04	5.08	37.57	13.25	22.53
CD (0.05)	5.18	NS	2.20	NS	6.03	11.16

Interaction between FYM and active lime was significant in case of the earhead length and grain and straw yield. At a given level of FYM, increase in the active lime affected the earhead length and yield adversely. However, FYM application buffered the adverse effect of active lime and leveled off the differences among different active lime treatment under F_1. One can expect the ameliorative role of FYM here, in terms of soil physical, chemical and biological conditions (Chen and Avnimelech, 1986).

All the three soil factors interacted significantly over plant height, earhead length, grain and straw yield, which registered the highest values under $M_1F_1AL_0$ combination and the lowest under $M_2F_0AL_2$ except in case of straw yield which was lowest under $M_2F_0AL_1$ meaning that higher moisture tension and

higher level of active lime were additive in adverse effect in absence of FYM. The difference between the grain and straw yield under $M_1F_0AL_0$ and $M_2F_0AL_2$ were levelled off by FYM application ($M_2F_1AL_2$).

Concentration and up'ake of phosphorus, zinc and calcium

The concentration and uptake of P, Zn and Ca were affected significantly by moisture X FYM interaction (Table 2, 3). Concentration effect on P and dilution effect on Zn and Ca in the grain and straw were intensified with the incorporation of FYM. The uptake of all three nutrients was affected positively by FYM under both moisture levels. Contrary to this in case of moisture × active lime interaction, the concentration and uptake of P, Zn and Ca in the grain and straw were significantly but adversely affected by incorporation of active lime along with each level of moisture. However, this adverse effect of active lime on the concentration and uptake of P, Zn and Ca in the grain and straw was mitigated when FYM was incorporated under F x AL and M x F x AL interactions. (Table 2, 3).

TABLE 2

Interaction effect of M x F, M x AL, F x AL and M x F x AL on the concentration and uptake of phosphorus by wheat CV GW-120.

Treatment combinations	*P concentration (mg g^{-1})*		*P uptake (mg pot^{-1})*	
	Grain	*Straw*	*Grain*	*Straw*
1.	*2.*	*3.*	*4.*	*5.*
M_1F_0	1.86	0.71	48.02	18.26
M_1F_1	5.03	0.78	83.44	35.23
M_2F_0	4.71	0.94	45.21	19.64
M_2F_1	5.32	1.15	72.94	27.47
CD (0.05)	0.76	0.14	11.46	10.09
M_1AL_0	4.59	0.87	71.51	32.17
M_1AL_1	4.62	0.74	66.57	26.05
M_1AL_2	4.13	0.62	56.00	21.19
M_2AL_0	5.20	1.20	65.73	28.63
M_2AL_1	5.08	0.99	57.25	21.46
M_2AL_2	4.77	0.95	52.42	20.56
CD (0.05)	0.87	0.21	11.79	10.74
F_0AL_0	4.35	0.95	54.66	23.85
F_0AL_1	4.31	0.79	45.90	17.71
F_0AL_2	4.19	0.72	41.48	16.13
F_1AL_0	5.44	1.11	85.41	39.66

1.	2.	3.	4.	5.
F_1AL_1	5.39	0.94	81.01	32.38
F_1AL_2	4.71	0.85	69.00	28.40
CD (0.05)	0.87	0.21	11.79	10.74
$M_1F_0AL_0$	4.00	0.83	56.04	23.47
$M_1F_0AL_1$	3.94	0.76	48.26	17.40
$M_1F_0AL_2$	3.63	0.59	40.14	14.20
$M_1F_1AL_0$	5.18	0.91	88.82	41.57
$M_1F_1AL_1$	5.29	0.78	87.65	35.52
$M_1F_1AL_2$	4.63	0.66	75.00	29.23
$M_2F_1AL_0$	4.70	1.07	51.89	23.48
$M_2F_0AL_1$	4.69	0.88	42.39	17.58
$M_2F_0AL_2$	4.76	0.86	41.58	17.85
$M_2F_1AL_0$	5.69	1.32	81.02	34.00
$M_2F_1AL_1$	5.48	1.10	73.98	25.70
$M_2F_1AL_2$	4.79	1.04	63.47	23.43
CD (0.05)	1.10	NS	32.53	NS

TABLE 3

Interaction effect of M x P, M x AL, F x AL and M x F x AL on concentration and uptake of zinc by wheat CV GW-120.

Treatment combinations	*Zn concentration ($g\ g^{-1}$)*		*Zn uptake ($g\ pot^{-1}$)*		*Ca concentration ($mg\ g^{-1}$)*		*Ca uptake ($mg\ pot^{-1}$)*	
	Grain	*Straw*	*Grain*	*Straw*	*Grain*	*Straw*	*Grain*	*Straw*
1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*
M_1F_0	80.68	59.05	1003	1519	1.17	3.28	14.55	84.39
M_1F_1	66.97	69.11	1111	3121	1.16	3.10	19.24	140.03
M_2F_0	66.13	54.61	634	1141	1.02	3.35	9.79	70.01
M_2F_1	60.96	49.32	832	1178	0.93	3.11	12.70	74.30
CD (0.05)	0.33	0.20	24	25	0.03	0.03	0.56	1.43
M_1AL_0	73.68	75.30	1147	2784	1.27	3.11	19.78	115.00
M_1AL_1	74.33	62.71	1071	2207	1.06	3.23	15.27	113.69
M_1AL_2	73.47	54.24	996	1853	1.17	3.22	15.86	110.05

1.	2.	3.	4.	5.	6.	7.	8.	9.
M_2Al_0	66.19	45.39	836	1083	1.00	3.40	12.64	81.42
M_2Al_1	60.53	55.18	682	1196	1.03	3.28	11.61	71.11
M_2Al_2	63.92	55.33	702	1197	0.89	3.00	9.78	64.92
CD (0.05)	0.10	0.24	29	31	0.04	0.04	0.69	1.75
F_0Al_0	73.37	55.60	918	1396	1.24	3.10	15.52	77.84
F_0Al_1	75.65	57.28	805	1284	1.11	3.53	11.82	79.74
F_0Al_2	71.20	57.62	704	1291	0.94	3.30	9.30	73.95
F_1Al_0	66.50	65.04	1044	2325	1.03	3.41	16.17	121.83
F_1Al_1	59.21	60.61	889	2088	0.98	2.98	14.73	102.66
F_1Al_2	66.18	51.95	969	1735	1.12	2.93	16.41	97.89
CD (0.05)	0.40	0.24	23	31	0.01	0.04	0.69	1.75
$M_1F_0Al_0$	81.43	62.82	1140	1776	1.39	2.91	19.47	82.29
$M_1F_0Al_1$	85.18	52.96	1043	1316	1.14	3.56	13.96	88.50
$M_1F_0Al_2$	75.43	61.38	834	1477	0.97	3.36	10.73	80.87
$M_1F_1Al_0$	65.93	87.77	1130	4010	1.14	3.31	19.55	151.21
$M_1F_1Al_1$	63.48	72.46	1051	3299	0.98	2.90	16.21	132.06
$M_1F_1Al_2$	71.50	47.11	1148	2046	1.37	3.09	22.00	136.85
$M_2F_0Al_0$	65.31	48.37	721	1061	1.09	3.30	12.03	72.43
$M_2F_0Al_1$	66.11	61.60	597	1236	1.07	3.51	9.67	70.12
$M_2F_0Al_2$	66.97	53.05	584	1101	0.90	3.24	7.85	67.26
$M_2F_1Al_0$	67.08	42.41	955	1092	0.92	3.51	13.10	90.42
$M_2F_1Al_1$	51.95	48.76	741	1139	0.94	3.06	13.36	71.51
$M_2F_1Al_2$	60.87	56.80	806	1279	0.98	2.77	12.98	62.41
CD (0.05)	0.57	0.35	41	43	0.05	0.05	0.97	2.47

REFERENCES

Chen, Y. and Avnimelech, Y. (1986). *The role of organic matter in modern agriculture.* Martinus Nijhoff Pub. Boston. P. 306.

Jackson, M. L. and Ulrich, A. (1969). Analytical methods for use in plant analysis, California Agric. Exp. Stn, Bull. 766.

Jackson, M. L. (1958). *"Soil Chemical Analysis"* Prentice Hall Inc., Englewood, Chiffs.

Vaughan, D. and Malcolm, R. E. (1985). *Soil organic matters and biological activity.* Martinus Nijhoff Pub. Boston Pp. 468. Chapt. 2 Influence of humic substances on biochemical processes in plant by Vaughon, D.; Malcolm; R. E. and Ord, B. G. pp. 100.