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Studies on the Effect of Micronutrient Anions on the Yield of Gram

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A field experiment was conducted in the alluvial soils of Agricultural Farm Banaras Hindu University to see the effect of soil application of boron, molybdenum and chlorine (B at 1.2 and 4 kg/ha; Mo at 0.25, 0.50 and 1.00 kg/ha; Cl at 4,8 and 12 Kg/ha) in combinations, along with a basal dressing of N and P at 10 and 30 kg/ha respectively on the grain yield of gram type-1. Maximum grain yield (17.69 q/ha) was obtained with treatment $B_1 + Mo_1 + Cl_1$ which was significantly more than the yield of control (14.30 q/ha) and some of the other treatments also. A significant decrease in grain yield was noted with increasing application of Molybdenum. Main effect of B & Cl was not significant, but either of the two when combined with Mo gave significant response to grain yield. Grain yield was also found to be related with the uptake of B, Mo and Cl by the crop.

The information about the essential micronutrient anions in relation to crop production in soils of our area is fragmentary. Rao and Raju (1964) did not get any significant response to grain production of applied boron and/or molybdenum. According to Fuchring *et al*. (1970) low rates of chlorine with other elements increased the grain yield of maize.

The present study was made to find out the effect of micronutrient anions separately and in coimbinations on the yield of grain in alluvial soils.

MATERIALS AND METHODS

The experiment was conducted on slightly alkaline, low in micronutrient anions, alluvial soil of Agricultural farm of Banaras Hindu University, Varanasi to see the effect of micronutrient anions (B, Mo, Cl) on grain yield of gram type-I Boron at 1,2 and 4 kg B/ha through sodium borate, molybdenum at 0.25, 0.50, and 1 kg Mo/ha through sodium molybdate and chloriee at 4,8 and 12 kg Cl/ha through Potassium chloride were coimbained statistically to make twenty-eight different treatments including one control, which was common to all treatments. After thorough preperation the field was divided into 56 plots each of 4 x 3 Sq. meter and each plot was basally dressed with 10 kg N/ha. through urea and 30 kg/ha through superphosphate single followed by application of the twenty-eight treatments randomly. All the treatments were replicated twice and seeds of gram were sown in each plot at the rate of

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50 kg/ha. One light irrigation followed by one hand nipping after a week were done after two months of sowing. Grains were separated from the straw and the yield of both were recorded.

Plants and grain samples were analysed for the uptake of B by Curcumin method, Mo by thiocyanate method (Purvis and Peterson 1956) and Cl by Husband and Godden's method.

RESULTS AND DISCUSSION

Data obtained for the treatment effect, main effect and first-order interaction effect on the grain yeild as well as on the boron, molybdenum and chlorine uptake by the gram crop are given in Table I, II and III respectively. Data presented for yield are the average of two years field trial.

Treatment effect : From the data given in Table I it could be noted that treatment $B_1+M_1o+Cl_1$ significantly increased the grain yield (17.69 q/ha) over control as well as some of the other treatments also but the majority of the treatments gave significantly lesser yield than control. This indicated that higher concentration of these elements checked the grain production and hence, it was concluded that the maximum benefit of these elements could be obtained only by their lowest rates. The grain yield was also studied in the light of the total uptake of these elements by the crop but no definite influence could be observed.

TABLE I. Treatment effects of B, Mo and Cl on their uptake and grain yield

Treatments	Grain yield q/ha	Total uptake kg/ha		
		Boron	Molybdenum	Chlorine
Control	14.30	0.024	0.015	8.160
$B_1+Mo_1+Cl_1$	17.69	0.032	0.022	10.804
$B_1+Mo_1+Cl_2$	13.74	0.039	0.012	8.556
$B_1+Mo_1+Cl_3$	12.69	0.024	0.013	10.376
$B_1+Mo_2+Cl_1$	8.53	0.016	0.014	5.463
$B_1+Mo_2+Cl_2$	13.83	0 024	0.019	8.580
$B_1+Mo_2+Cl_3$	15.20	0.024	0.018	11.376
$B_1+Mo_3+Cl_1$	10.82	0.020	0.027	6.480
$B_1+Mo_3+Cl_2$	12.28	0.019	0.027	8.237
$B_1+Mo_3+Cl_3$	8.32	0.014	0.021	7.811
$B_2+Mo_1+Cl_1$	10.20	0.019	0.013	5.924
$B_2+Mo_1+Cl_2$	9.57	0.018	0.011	5.549
$B_2+Mo_1+Cl_3$	13.53	0.028	0.015	10.079
$B_2+Mo_2+Cl_1$	13.32	0.026	0.019	8.384
$B_2+Mo_2+Cl_2$	12.69	0.023	0.017	7.743
$B_2+Mo_2+Cl_3$	12.49	0.025	0.014	10.353
$B_2+Mo_3+Cl_1$	13.53	0.025	0.031	7.188
$B_2+Mo_3+Cl_2$	12.28	0.025	0.026	8.882
$B_2+Mo_3+Cl_3$	10.82	0.017	0.018	7.869
$B_3+Mo_1+Cl_1$	15.40	0.039	0.020	9.569
$B^3+Mo_1+Cl_2$	10.41	0.025	0.015	6.807
$B_3+Mo_1+Cl_3$	12.90	0.032	0.014	10.267
$B_3+Mo_2+Cl_1$	13.53	0.028	0.022	7.144
$B_3+Mo_2+Cl_2$	12.07	0.026	0.019	7.350
$B_3+Mo_2+Cl_3$	10.40	0.027	0.018	8.990
$B_3+Mo_3+Cl_1$	10.41	0.022	0.023	7.132
$B_3+Mo_3+Cl_2$	9.78	0.022	0.022	7.566
$B_3+Mo_3+Cl_3$	13.32	0.023	0.023	10.335
C D. 5%	3.36	0.005	0.008	1.892
1%	4.54	0.007	0.011	2.555

Main effect : Data of Table II showed that the main effect of boron uptake, main effect of molybdenum on grain yield, boron and molybdenum

TABLE II. Main effect of B, Mo & Cl on their uptake and grain yield

Levels of the elements	Grain yield q/ha	Total Uptake Kg/ha		
		Boron	Molybde-num	Chlorine
B_1	12.53	0.024	0.019	8.631
B_2	12.05	0.028	0.018	7.996
B_3	12.02	0.027	0.020	8.351
Mo_1	12.90	0.029	0.015	8.659
Mo_2	12.42	0.024	0.018	8.376
Mo_3	11.28	0.021	0.024	7.944
Cl_1	12.60	0.025	0.021	7.565
Cl_2	11.81	0.024	0.019	7.697
Cl_3	12.19	0.024	0.017	9.717
C. D. 5%	1.10	0.002	0.003	0.891
1%	1.49	0.003	0.004	1.203

uptake and main effect of chlorine on molybdenum and chlorine uptake was statistically significant. From the data it could be seen that at minimum application of Mo its uptake was minimum while the uptake of B and grain yield was maximum. As the doses of Mo increased a gradual decreasing trend was found to be increased. Similar results were also reported by Gupta (1971); Padhiyar *et al.* (1973) and Kadwe & Bodhe (1973) respectively. The hightest grain yield with the main effect of Mo was noted at Mo_1 level but it was significantly more than that obtained at Mo_2 level but was not-significant than that obtained at Mo_3 level. The decrease in yield with increasing Mo supply might be due to its toxic effect.

No significant response of applied boron and chlorine could be noted on grain production when supplied individually but either of the two when coimbined with molybdenum influenced the crop production significantly.

Effect of Boron x molybdenum on grain yield : Of all the interactions of B x Mo studied, B_1 x Mo_1 was found to be the best for grain production, since it gave significantly more yield (14.71 q/ha) than the others. It was observed that any further increase in the levels of B x Mo decreased the grain yield. Result also indicated that boron when applied singly failed to influence the grain production as well as uptake of molybdenum and chloride but when it combined with molybdenum gave significant response to each of the above factors.

Effect of boron x chloride on grain yield : Effect of different interactions of B x Cl were found to be non-significant in relation to grain yield but the uptake of B, Mo, and Cl were sinificantly influenced. Highest uptake of B and Mo was noted with C_3 x Cl_1 which was highly significant than some of the other interactions of B x Cl. Maximum uptake of Cl was noted with B_3 x Cl_2 followed by B_1 x Cl_3 and these interactions were also significant over some of the other interactions of B x Cl. In general, uptake of boron increased with its increasing doses at all the chlorine levels while it decreased at all the chlorine levels while it decreased at all the B levels with an increase in Cl application.

Effect of Molybdenum x Chlorine on grain yield : The interactions of Mo x Cl had significantly affected the

TABLE III. Interactions of B, Mo and Cl on grain yield q/ha.

	B x Mo				B x Cl				Mo x Cl			C.D at	
	B_1	B_2	B_3		B_1	B_2	B_3		Mo_1	Mo_2	Mo_3	5%	1%
					I Grain yield q/ha								
Mo_1	14.71	11.10	12.90	Cl_1	12.35	12.35	13.11	Cl_1	14.43	11.79	11.59		
Mo_2	12.42	12.83	12.00	Cl_2	13.18	11.51	10.75	Cl_2	11.24	12.76	11.45	1.92	2.60
Mo_3	10.47	12.21	11.17	Cl_3	12.07	12.28	12.21	Cl_3	13.04	12.03	10.82		
					II Boron uptake kg/ha								
Mo_1	0.032	0.022	0.032	Cl_1	0.023	0.023	0.029	Cl_1	0.030	0.023	0.022		
Mo_2	0.021	0.025	0.027	Cl_2	0.027	0.022	0.024	Cl_2	0.028	0.024	0.022	0.003	0.004
Mo_3	0.018	0.022	0.022	Cl_3	0.021	0.022	0.027	Cl_3	0.028	0.026	0.018		
					III Molybdenum uptake kg/ha								
Mo_1	0.016	0.013	0.017	Cl_1	0.021	0.021	0.022	Cl_1	0.018	0.018	0.027		
Mo_2	0.017	0.017	0.020	Cl_2	0.020	0.018	0.019	Cl_2	0.013	0.018	0.025	0.004	0.005
Mo_3	0.025	0.025	0.023	Cl_3	0.017	0.016	0.019	Cl_3	0.014	0.017	0.021		
					IV Chlorine uptake kg/ha								
Mo_1	9.912	7.184	8.881	Cl_1	7.582	7.165	7.948	Cl_1	8.766	6.937	6.933		
Mo_2	8.473	8.827	7.828	Cl_2	8.458	7.391	7.241	Cl_2	6.971	7.891	8.228	1.545	2.086
Mo_3	7.509	7.980	8.344	Cl_3	9.854	9.434	9.864	Cl_3	10.241	10.239	8.871		

grain yield as well as uptake of B, Mo and Cl. It could be observed from the data given in Table III that as in the case of B x Mo lowest level of molybdenum and chlorine ($Mo_1 \times Cl_1$) also produced maximum grain (14.43 q/ha) which was found to be highly significant over some of the other interactions of Mo x Cl. However, an increase in the levels of Mo x Cl caused considerble reduction in yield. Data showed that the grain yield was related with B uptake but such relation -ship could not be observed with the uptake of molybdenum and chlorine. This indicated some definite beneficial effect of boron uptake on grain yield. It could also be concluded from the data that in general, increasing concentration of chlorine at all the molybdenum levels decreased the grain yield as well as boron and molybdenum uptake and increased the chlorine uptake but on the orther hand, when molybdenum was applied in increasing concentration at all the chlorine levels only the molybdenum uptake was increased and grain yield, boron and chlorine uptake were found to be decreased considerably.

In general, it could be concluded from the experimental data that the combined effect of micronutrient anions (B, Mo and Cl) in relation to grain yield of gram was much better than their individual effect.

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REFERENCES

FUCHRING, H.D., H.F. MIRREN, N. AHMAD, and P.M. SOLLANPOUR, 1970. Grain yield of maize in relation to nitrogen, Phosphorus, sulphur, chloride, Zinc, Boron, Manganese and plant population. Field Crop Absts. **23**: 171.

GUPTA U.C.; 1971. Boron and molybdenum nutrition of Wheat Barley and Oat grown in Prince Edward Island soil, Can. *J. Soil. Sci. Vol.* 51 : 414-22.

KADWE, R.S. and N. N. BADHE, 1973. Effect of molybdenum and Phosphate, on the growth, uptake of nutrient, and nitrogen fixation by Urd. *Ind. J. Agro. Res.* **7**: 43-46.

PADHIYAR, B.P., B. V. MEHTA, and B.S. TREVEDI, 1973. Effect of Zinc, Copper and molybdenum on the yield and composition of wheat grown on coarse loamy sand of Torna, *Soils & fert.* **36**: 193.

PURVIS, E. R. and N. K. PETERSON., 1956. Methods of soil and plant analysis for molybdenum, *Soil. Sci.*, **81** : 223.

RAO, T.M.V. and K. V. RAJU, 1964. Preliminary Studies on the effect of soil and foliar application of boron and molybdenum on the yield of alfalfa. *J. Ind. Soc. Soil. Sci.*, **12** : 367-69.

SHEKHAWAT, G. S., N. R. BHARI, and G. S. CHUNDAWAT, 1972. Response of hybrid Bajra on micronutrient in arid conditions of Rajasthan. Ind. *J. Agro.* **17** : 95-96.