

Influence of sulphur, phosphorus and farmyard manure on yield attributes and yield of maize (*Zea mays*) in southern Rajasthan conditions

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ABSTRACT

A field experiment was conducted at Instructional Farm, Rajasthan College of Agriculture, Udaipur, during the rainy (*kharif*) seasons of 1999 and 2000 on clay-loam soil, to study the effect of sulphur, phosphorus and farmyard manure on yield attributes and yield of maize (*Zea mays* L.). Cobs/plant, rows/cob, cob weight, grain weight/cob, seed index, seed and stover yields, N, P, S and Fe uptake by seed stover and total uptake by maize increased significantly as a result of sulphur application. Application of 60 kg S/ha significantly recorded higher seed and stover yields over 0 and 30 kg S/ha by 29.1 and 11.0 and 25.1 and 9.5% respectively. Application of 40 kg phosphorus increased significantly the yield attributes and seed and stover yields over 20 kg P_2O_5 /ha, representing a mean increases of 13.6 and 12.5% respectively. Application of 10 tonnes FYM/ha enhanced significantly the yield attributes and yield over no farmyard manure to the magnitude of 13.9 in seed and 11.2% in stover yield, respectively.

Key words: Sulphur, Phosphorus, FYM, Maize crop

Among the production constraints for maize, imbalanced and inadequate nutrition is considered to be one of the important factors especially under areas having alkaline calcareous soils. The extensive studies in India and also elsewhere invariably revealed that sulphur fertilization correct iron deficiency in such soils due to its effectiveness for lowering down the pH of soil media as well as tissue sap of the plants thereby reduce imbalanced nutritional environment in the plant system. Sulphur and phosphorus fertilization is of prime importance needed for normal growth and development of the plants due to its vital role in chlorophyll synthesis and involvement in various physiological and metabolic process of the plant. Farmyard manure (FYM) plays key role in transformation, cycling and availability of nutrients to the crop. Thus, conjoint use of organic manures and chemical fertilizers can help in enhancing and maintaining stability in production with least degradation in chemical and physical properties of the soil. Therefore, a field study was undertaken to study the effect of sulphur, phosphorus and FYM on yield attributes and yield of maize.

MATERIALS AND METHODS

The field experiment was conducted during the rainy (*kharif*) seasons of 1999 and 2000 at Instructional Farm, Rajasthan College of Agriculture, Udaipur. The experimen-

tal soil was clay loam in texture, having organic carbon (0.68%), available N 288.05 kg/ha, P 20.90 kg/ha, K 316.20 kg/ha and calcium carbonate 3.62%. It was slightly alkaline in reaction (pH 8.1). The experiment consisting of 18 treatments having combinations of 3 levels of sulphur (0, 30 and 60 kg/ha), 3 levels of phosphorus (20, 40 and 60 kg P_2O_5 /ha) and 2 levels of FYM (0 and 10 tonnes/ha), having 3 replications in factorial randomized block design. A uniform dose of 90 kg N/ha (through urea) as per recommendation for maize crop, well-rotten FYM and all the sulphur and phosphorus treatments were applied at sowing of maize. Sulphur was applied through gypsum and phosphorus through diammonium phosphate (DAP). The maize variety 'Navjot' was sown on 12 and 7 July 1999 and 2000, respectively, at the seed rate of 25 kg/ha at inter and intra-row spacing of 60 cm × 25 cm, respectively. One life-saving irrigation during first year and 2 irrigations during the second year were applied.

RESULTS AND DISCUSSION

Effect of sulphur

Cobs/plant, rows/cob, cob weight, grain weight/cob, seed index and seed and stover, nitrogen, phosphorus, sulphur and Fe uptake by seed and stover yield increased significantly with the successive increment in sulphur up to

60 kg/ha during both the years (except cobs/plant and rows/cob). On pooled basis, this dose enhanced significantly the mean seed and stover yield respectively, over 30 kg S and no sulphur. However, application of 30 kg S/ha increased significantly these aforesaid parameters over no sulphur. It may be owing to beneficial effect of sulphur on crop growth and development and improvement in nutritional status of plant parts (grain and stover), which affected yield and nutrition positively. The improvement in maize yield attributes with the application of sulphur in this study in cognizance with findings of Singh (2001) and Sinha *et al.* (1995).

Effect of phosphorus

Phosphorus application up to 40 kg P_2O_5 /ha signifi-

cantly improved cobs/plant, rows/cob, cob weight, grain weight/cob, seed index, seed and stover yield, nitrogen, phosphorus, sulphur and Fe uptake by seed, stover and total uptake by maize crop. The seed and stover yield with 40 kg P_2O_5 /ha increased by 13.6 and 12.5% respectively over 20 kg P_2O_5 /ha (Table 2). The favourable effect of phosphorus fertilization on yield and N, P, S and Fe uptake might be owing to better nutritional environment in plants and positive and significant effect in root formation, proliferation and their functional activities. These results are in conformity with the findings of Kumpawat and Rathore (1995).

Effect of FYM

Application of FYM at 10 tonnes/ha significantly im-

Table 1. Effect of sulphur, phosphorus and farmyard manure on yield attributes of maize (Pooled data of 1999 and 2000)

Treatment	Cobs/ plant	Rows/ cob	Cob weight (g)	Grain weight/ cob(g)	Shelling (%)	Seed index
<i>Sulphur (kg/ha)</i>						
0	1.3	12.8	74.1	53.7	73.2	20.1
30	1.4	14.1	86.5	63.8	73.9	20.9
60	1.5	14.6	94.0	71.6	76.5	22.2
CD (P = 0.05)	0.05	0.53	3.01	2.8	NS	0.48
<i>Phosphorus (kg P_2O_5/ha)</i>						
20	1.3	13.0	76.4	56.8	74.6	20.3
40	1.4	14.1	87.3	64.5	74.1	21.2
60	1.5	14.4	91.0	67.7	74.8	21.7
CD (P = 0.05)	0.05	0.53	3.01	2.47	NS	0.48
<i>FYM (tonnes/ha)</i>						
0	1.4	13.6	80.0	59.1	74.2	20.8
10	1.5	14.0	89.7	67.0	74.8	21.4
CD (P = 0.05)	0.04	0.43	2.46	2.01	NS	0.35

Table 2. Effect of sulphur, phosphorus and farmyard manure on seed and stover yields and nutrient uptake by maize (pooled data of 1999 and 2000)

Treatment	Yield (q/ha)		Nutrient uptake (kg/ha)											
	Seed	Stover	Nitrogen			Phosphorus			Sulphur			Fe		
			Seed	Stover	Total	Seed	Stover	Total	Seed	Stover	Total	Seed	Stover	Total
<i>Sulphur (kg/ha)</i>														
0	33.18	75.09	58.3	57.9	116.2	13.6	11.9	25.4	6.4	5.8	12.3	0.27	1.56	1.84
30	38.59	85.79	70.1	68.6	138.7	16.3	14.0	30.3	7.8	6.9	14.7	0.33	1.85	2.18
60	42.83	93.92	79.4	76.7	156.1	18.5	15.5	34.0	9.0	8.0	171	0.39	2.06	2.45
CD (P = 0.05)	1.39	4.53	2.60	361	5.83	0.58	0.77	1.25	0.31	0.37	0.64	0.013	0.105	0.115
<i>Phosphorus (kg/ha)</i>														
20	34.63	77.85	61.4	60.4	121.7	14.1	12.1	26.2	6.3	6.3	13.2	0.31	1.69	1.99
40	39.35	87.57	71.7	70.4	142.1	16.7	14.3	31.0	8.0	7.2	16.2	0.34	1.88	2.23
60	40.61	89.40	74.7	72.4	147.1	17.6	15.0	32.6	8.3	7.3	15.6	0.35	1.91	2.25
CD (P= 0.05)	1.39	4.53	2.60	3.61	5.83	0.58	0.77	1.25	0.31	0.37	0.64	0.013	0.105	0.115
<i>FYM (tonnes/ha)</i>														
0	35.72	80.42	62.6	61.7	124.3	14.7	12.8	27.5	7.1	6.4	13.5	0.30	1.69	1.97
10	40.69	89.45	75.9	73.7	149.7	17.5	14.8	32.3	8.4	7.4	15.8	0.37	1.98	2.34
CD (P = 0.05)	1.14	3.70	2.13	2.95	4.76	0.48	0.63	10.2	0.26	0.30	0.57	0.011	0.086	0.094

proved the cobs/plant, rows/cob, weight of cob, grain weight/cob, seed index and seed and stover yield, nitrogen, phosphorus, sulphur and iron uptake by seed, stover and total uptake by crop over no FYM application (Tables 1, 2). The magnitude of increase in seed and stover yield was to the extent of 13.9 and 11.2% with the incorporation of 10 t FYM/ha over no organic manuring. It may be owing to beneficial effect of FYM on crop growth and various physiological parameters, which affected yield attributes, yield and nutritional status positively. The higher photosynthetic efficiency of plants estimated in terms of biomass accumulation seems to be one of the potential factors for improving various yield components and yield. Khandey and Thakur (1990) also reported similar, effects on seed and stover yields. In general improved nutritional status of seed and stover under farmyard manure application primarily seems to be on account of enrichment of these nutrient in soil while secondarily on maintenance of better physico-chemical and biological properties of the soils. Babariya and Patel (1980) and Sharma and Gupta (1998) also reported increase in uptake of nutrients by

maize when fertilized with FYM.

REFERENCES

- Babariya, C.J. and Patel, C.L. 1980. Effect of application of iron, farmyard manure and sulphur on the availability of iron in medium black calcareous soils at different moisture regimes. *Journal of Indian Society of Soil Science* **28** : 302–306.
- Khandey, B.A. and Thakur, R.C. 1990. Response of rainfed maize to fertilization. *Indian Journal of Agricultural Sciences* **60** : 631–633.
- Kumpawat, B.S. and Rathore, S.S. 1995. Response of maize (*Zea mays*)–wheat (*Triticum aestivum* L.) cropping sequence to fertilizer application. *Indian Journal of Agronomy* **40** : 26–29.
- Sharma, M.P. and Gupta, J.P. 1998. Effect of organic materials on grain yield and soil properties in maize (*Zea mays*)–wheat (*Triticum aestivum*) cropping systems. *Indian Journal of Agricultural Sciences* **68** : 715–717.
- Singh, M.V. 2001. Importance of sulphur in balanced fertilizer use in India. *Fertiliser News* **46** : 31–35.
- Sinha, R.B., Sakal, R. and Kumar, S. 1995. Sulphur and phosphorus nutrition of winter maize in calcareous soils. *Journal of Indian Society of Soil Science* **43** : 413–418.