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Short Communication

Effect of different organic manures and nitrogen fertilizers on the nutrient uptake and yield of maize

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Abstract: A field experiment investigated the combined effect of organic manures and nitrogen fertilizers on nutrient uptake and yield of maize (*Zea mays* L.). Three different organic manures, *viz.* FYM (0.50% N, 0.26% P and 0.33% K), vermi-compost (1.1% N, 0.64% P and 0.34% K) and poultry manure (1.51% N, 0.78% P and 0.37% K). Urea, diammonium phosphate (DAP), single super phosphate (SSP) and muriate of potash (MoP) were used as the sources of N, P, and K fertilizer. Plots with recommended N level provided through chemical fertilizer served as the control. Nine treatments were arranged in a randomized complete block design with three replicates. The study showed that neem oil-coated urea could save 20 kg N/ha. Plots that received organic manures + chemical fertilizers recorded a significantly higher ($p<0.05$) grain and stover yield over plots that received N through chemical fertilizer alone.

Keywords: Maize, organic manure, chemical fertilizer, nutrient uptake, yield

Introduction

Maize (*Zea mays* L.) is one of the important cereal crops, next to wheat and rice, in the world. For realizing higher crop yield and quality produce, soil health is a critical factor. Therefore, chemical fertilizers have to be integrated with organic manures to achieve sustainable productivity with minimum negative effects of chemical fertilizers on soil health and environment (Chandrashekhar *et al.,* 2000).

Maize crop requires nitrogen in large quantities and nitrogen deficiency is the most common nutritional problem affecting plants. Although N fertilization has been profitable in most crops its efficiency and utilization has been rather low in cereal crops. Hence, a study was conducted to investigate the combined effect of organic manures and nitrogen fertilizers on the nutrient uptake and yield of maize.

Materials and Methods

A field experiment was conducted at the Zonal Agricultural and Horticultural Sciences, Shivamogga, India to study the effect of three different organic manures, *viz.*, FYM (0.50% N, 0.26% P and 0.33% K), vermi-compost (1.1% N, 0.64% P and 0.34% K) and poultry manure (1.51% N, 0.78% P and 0.37% K) with urea, diammonium phosphate

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(DAP), single super phosphate (SSP) and muriate of potash (MoP) as sources of N, P, and K fertilizer to supply 100:50:25 (N:P:K) kg/ha, and neem oil-coated urea (2 ml and 4 ml neem oil/100 g Urea). The soil used was with a slightly acidic (pH 5.72) sandy loam belonging to *Typic Haplustalf*. Plots that received the recommended level of N through chemical fertilizer served as the control. There were nine treatments in a randomized complete block design with three replicates (Table 1). Hybrid maize was used as the test crop with a spacing of 45 cm x 30 cm. All organic manures were applied one week before sowing. The soil was low in available N (229.72 kg/ha), high in phosphorus (56.31 kg/ha), medium in potassium (145.62 kg/ha) and deficient in available sulphur (8.23 mg/kg). Samples were collected from five randomly selected plants at the time of harvest and dried at 60 ^{o}C in a hot air oven, powdered using grinder, and preserved for further analysis. Nitrogen, phosphorus, potassium, calcium and magnesium were determined by methods prescribed by Jackson (1973), and sulphur by Black (1965).

Results and Discussion

The lowest grain (4560 kg/ha) and stover (5224 kg/ha) yields of maize and were obtained in the plots that received the total amount of recommended N through chemical fertilizer (Table 1). Different sources of organic manures + chemical fertilizer significantly increased ($p<0.05$) the grain and stover yield over plots receiving chemical fertilizer alone.

The treatments where the recommended N content was supplied with neem oil-coated urea recorded a significantly higher grain and stover yields ($p<0.05$), probably due to the longer availability of nitrogen in the plots. Sharma and Prasad (1996) reported that neem-coated urea help reducing leaching and volatilization losses of N. Neem oil-coated urea (T_9: 4 ml neem oil/100 g urea) and the recommended N fertilizer + equivalent amount of recommended N of FYM supplied through poultry manure (T_6), increased the grain yield of maize by 51% and 43%, respectively, over the plots that received the N recommendation only through chemical fertilizer (T_1). The present study showed that neem oil-coated urea could save 20 kg N/ha. The results are in accordance with the findings of Upadhyay and Tripathi (2000).

Treatment T_9 resulted in significantly higher ($p<0.05$) nutrient contents in stove and grain of maize, *i.e.* 0.79% and 1.55% of N, 0.36% and 0.38% of P, 1.44% and 0.53% of K, 0.17% and 0.21% of Ca and 0.08% and 0.12% of Mg, respectively, compared to the rest of the treatments. Neem oil-coated urea also could inhibit the nitrification process resulting in increased nutrient availability. This may be ascribed to increases in the availability of Ca, Mg and S in soil due to mobilization from sources (Sujatha*et al.,* 2008). No significant differences were observed ($p>0.05$) in the case of sulphur content.

The total nutrient uptake (N, P, K, Ca, Mg and S) by maize crop significantly increased with the addition of organic matter + supply of total N recommendation

using chemical fertilizer. The nutrient uptake by the maize crop depends on the release of nutrients from different sources (Mankinde *et al.,* 2011).

Table 1. Effect of organic manures and fertilizers on yield and nutrient uptake by maize

Treatments	Grain	Stover	Nutrient uptake (kg/ha)					
	kg/ha		N	P	K	Ca	Mg	S
T_1: recommended N (CF)[1]	4568	5224	73.6	19.8	76.5	16.9	7.5	10.9
T_2: recommended N (CF) + FYM[2]	5526	6232	102.9	25.9	104.0	20.8	9.9	13.7
T_3: recommended N (CF) + 2 times of recommended FYM	5039	6042	104.2	29.2	104.4	20.7	10.5	13.9
T_4: recommended N (CF) + N equivalent of recommended FYM supplied through vermi-compost	5701	6558	110.5	28.9	113.9	22.2	11.2	14.8
T_5: recommended N (CF) + 2 times of N equivalent of recommended FYM supplied through vermi-compost	5233	6229	114.8	33.2	111.1	21.7	11.1	14.8
T_6: recommended N (CF) + N equivalent of recommended FYM supplied through poultry manure	6552	7353	140.4	38.3	130.6	25.4	12.8	16.8
T_7: 100 % recommended N + 2 times of N equivalent of recommended FYM supplied through poultry manure	6363	7028	140.4	41.7	129.9	24.7	12.8	17.1
T_8: recommended N content supplied through neem oil-coated urea (2 ml neem oil /100 g urea)	6610	7533	157.1	48.5	141.6	29.0	15.2	19.9
T_9: recommended N content supplied through neem oil-coated urea (4 ml neem oil/100 g urea)	6910	8017	171.0	55.6	154.7	35.6	18.3	23.9
S.E. (m)[3]	148	216	3.49	2.06	4.16	1.54	0.78	1.09
C.D.[4] (p=0.05)	342	647	10.45	6.19	12.49	4.62	2.34	3.27

1 = Chemical fertilizer; 2 = Farmyard manure; 3 = standard error of the means; 4 = critical difference

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