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Effect of Different Fertilizers and Effective Microorganisms on Growth, Yield and Quality of Maize

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ABSTRACT

The studies were carried out to determine the effect of different combinations of N, P, FYM and effective microorganisms (EM) on growth, yield and quality of maize (*Zea mays* L.) during autumn 1998. Results revealed that highest grain yield of 4.72 t ha^{-1} was obtained with the application of 150 kg N + 75 kg P_2O_5 + 30 l EM ha^{-1}. The increase in yield was attributed to increased leaf area, more number of grains per cob and higher weight per 1000 grains. The protein content (10.03%) were however, higher with the application of 75 kg N + 37.5 kg P_2O_5 + 60 l EM ha^{-1}.

Key Words: Fertilizer; Organic; Inorganic; EM; Maize yield

INTRODUCTION

Mineral fertilizers are important and quickest way of nutrient supply to soil and play an important role in activating various enzymes (Tisdale *et al*., 1990) However, in addition to other constraints, their high cost and short supply at the time of need deter the farmers from using recommended doses (FAO, 1978). This necessitates to explore alternative potential sources of plant nutrients (organic) with the minimum use of mineral fertilizers. Organic matter is of great importance for the maintenance of soil structure, soil bioactivity, soil exchange capacity and water holding capacity (NFDC, 1998). Organic materials like FYM are used for increasing crop production but pure organic farming can never meet the increasing demand for nutrient supply, as sufficient quantities of organic materials are not available. Another way of supplying nutrients to soil is through biological inoculum but it also needs large amount of organic matter and alone cannot favour the plant nutrient supply to soil eco-system (Hussain *et al*., 1999). So, one of the alternative of nutrient supply is the integration of Effective Microorganisms (EM) inoculum and organic/inorganic materials. The present studies were conducted to develop a production system for the efficient utilization of mineral and organic nutrient resources by amending with EM.

MATERIALS AND METHODS

The studies were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad. The experiment comprised of nine treatments i.e. control 12.5 tonnes FYM + 60 l EM; 75 kg N + 60 l EM+; 37.5 kg P_2O_5 + 60 l EM+; 75 kg N + 37.5 kg P_2O_5 + 60 l EM; 25 tonnes FYM + 30 l EM; 150 kg N + 30 l EM; 75 kg P_2O_5 + 30 l EM; 150 kg N + 75 kg P_2O_5 + 30 l EM ha^{-1}. The crop was sown on a well prepared seedbed in the first week of August, 1998 using a seed rate of 30 kg ha^{-1}. The whole of P, FYM and 1/3rd N were applied at sowing and EM was added with each of the nine irrigations. Remaining N was applied in two splits i.e. when the crop height was 45 cm and at tasseling stage. The experiment was laid out in a randomized complete block design (RCBD) with three repeats and a net plot size of 3m x 5m was used. All the agronomic operations except those under study were kept normal and uniform for all the treatments. The crop was harvested on November 12, 1998. Data on various growth and yield components were collected using standard procedures and analyzed statistically by using Fisher's analysis of variance technique (Steel & Torrie, 1984). Least significant difference (LSD) test at 0.05 probability was employed to compare the means.

RESULTS AND DISCUSSION

Data on final plant height (Table I) indicate that none of the combinations of fertilizer and EM could reach a level of significance. However, maximum plant height of 244.50 cm was recorded in T5 where crop was treated with 25 t ha^{-1} FYM + 30 l ha^{-1} EM and it was the lowest (203.1 cm) in the control (T0). These results are in agreement with those of Ghafoor and Akhtar (1991) who reported that increased fertilization had non-significant effect on plant height of maize cultivar. Maximum number of grains per cob 572.40 was obtained in T8 where N, P and EM were applied @ 150, 75 kg ha^{-1} and 30 l ha^{-1}, respectively. Treatment T2 did not differ significantly from either T3 or T1, which produced 344.50, 334.00 and 308.90 grains per cob, respectively. The lowest number of grains per cob (270.90) was produced in the control, treated with no fertilizer. The results indicate that the number of grains per cob increased with increase in the doses of fertilizer. These findings are in agreement with those of Short *et al*. (1982) and Choudhary (1997). It is evident from the data presented in Table I that maximum 1000-grain weight of 234.30 g was obtained in treatment T8 where nitrogen was applied @ 150 kg ha^{-1} but

Table I. Growth and yield parameters of maize as affected by various combinations of organic fertilizers along with EM

Treatments	Plant height (cm)	No. of grains cob^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Grain protein content (%)
T0 (Control)	203.10	270.90 f	195.60 e	1.66 e	9.23 c
T1 (12.5 t FYM + 60 l EM ha^{-1})	214.40	308.90 ef	214.60 bcd	3.37 bcd	9.38 bc
T2 (75 kg N + 60 l EM ha^{-1})	223.83	344.50 e	211.60 cd	3.18 cd	9.34 bc
T3 (37.50 kg P + 60 l EM ha^{-1})	224.90	334.00 e	215.40 bcd	2.81 d	9.62 b
T4 (75 kg N + 37.50 P + 60 l EM ha^{-1})	239.17	527.90 b	225.00 ab	4.16 ab	10.03 a
T5 (25 t FYM + 30 l EM ha^{-1})	244.50	430.70 d	211.00 cd	3.54 bcd	9.71 ab
T6 (150 kg N + 30 l EM ha^{-1})	230.94	488.60 bc	220.50 bc	3.77 bc	9.48 bc
T7 (75 kg P + 30 l EM ha^{-1})	212.27	461.50 cd	207.10 de	3.02 cd	9.77 ab
T8 (150 kg N + 75 kg P +30 l EM ha^{-1})	243.50	572.40 a	234.30 a	4.72 a	9.99 a

Any two means not sharing a letter in common differ from each other significantly at 5% level of probability.

it did not differ significantly from that recorded in treatment T4 receiving 75 kg N, 37.5 kg P_2O_5 and 60 l EM ha^{-1}. Non-significant difference was found between treatments T3 and T1 but they were significantly different from that of T2 and T5, which were at par with each other. The lowest weight per 1000-grains of 195.60 g was recorded in control treatment. Weight per 1000-grains increased with the increase in N level in addition to P and EM. These findings are in conformity with those of Ahmad (1989) and Choudhary (1997). It also transpires from Table I that fertilizer combinations alongwith EM had a highly significant effect on the grain yield. Grain yield increased with increase in N levels and it was maximum (4.72 t ha^{-1}) when crop was treated with the highest dose of nitrogen (150 kg ha^{-1}) in addition to P and EM @ 75 kg ha^{-1} and 30 l ha^{-1}, respectively. It was followed by T4 (75 kg N ha^{-1}), which produced 4.16 t of grains ha^{-1}. Grain yield recorded in control treatment was the lowest (1.65 t ha^{-1}) of all other treatments. The higher grain yield at the highest dose of N (150 kg ha^{-1}) was attributed to greater leaf area, more number of grains per cob and higher weight per 1000-grains. These results are in line with those obtained by Panchaban (1991), Rashid (1993) and Shahzad *et al*. (1996). Protein percentage in grains was affected significantly by different fertilizer combinations with EM. All the fertilizer combinations significantly enhanced the protein content in grains over the control. The highest protein content (10.03%) in grains was recorded with the application of 75 kg N ha^{-1} in addition to P and EM @ 75 kg ha^{-1} and 30 l ha^{-1}, respectively which was statistically at par with T8 (150 kg N + 75 kg P_2O_5 + 30 l EM ha^{-1}). The protein content in treatments T5 and T7 were statistically at par and were higher than that recorded in T6, T1 and T2 treatments which were statistically the same with one another. The lowest protein content recorded in the control was 9.23%. Similar results were reported by Hera *et al*. (1982), Feng *et al*. (1993) and Iqbal (1997).

The results indicated that maize cultivar Composite-17 should be fertilized @ 150 kg N ha^{-1} and 75 kg P_2O_5 ha^{-1} along with 30 l EM ha^{-1} to obtain maximum yield and highest grain protein content under ecological conditions of Faisalabad.

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