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Production Efficiency of Mungbean (*Vigna radiata* L.) as Affected by Seed Inoculation and NPK Application

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ABSTRACT

Response of Mungbean (*Vigna radiata* L.) to seed inoculation and NPK application in various combinations was studied under field conditions. Plant growth, nodulation, number of pods plant^{-1}, seed yield and harvested index were significnatly increased by seed inoculation and NPK application in various combinations. Treatment T_5 (seed inoculation 50-50+0 kg ha^{-1} NPK) gave the highest harvest index and grain yield

Key Words: Mungbean; Fertilizers; Rhizobia culture

INTRODUCTION

Mungbean is one of the most important conventional pulses grown in Pakistan. It plays an important role not only in human diet, but also in improving the soil fertility by fixing atmospheric nitrogen into available form with the help of Rhizobia species present in the nodules of its roots. However, under our agro-ecological conditions, the nodulation of mungbean is poor, which is the major cause of its low yield. Inoculation of mungbean with Rhizobium increased plant height, leaf area, photosynthetic rate and dry matter production (Thakur & Panwar, 1995). Brar and Lal (1991) found an increase in number of nodules plant^{-1} and seed yield with inoculation. They obtained seed yield of mungbean ranging from 0.78 t ha^{-1} without seed inoculation to 0.81 t ha^{-1} with *Rhizobium phaseoli* inoculation. There is common notion that legume crop does not need nitrogenous fertilizer for their proper growth. However, Singh *et al*. (1993) reported that grain yield of mungbean was increased by the application of 20 kg N and 40 kg P_2O_5 where as K application had no significant effect. Therefore, the present studies were executed to determine the optimum NP level with seed inoculation under irrigation conditions in Faisalabad.

MATERIALS AND METHODS

The investigations to determine the effect of seed inoculation and NPK application on the production efficiency of mungbean were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad. A field experiment was laid out in randomized complete block design, in three replications with a net plot size measuring 1.6 x 8 m on a soil containing 0.046% N, 7 ppm phosphorus, 148 ppm potash.

The experiment comprised of seed inoculation only, seed inoculation + 20-50-0, 30-50-0, 40-50-0, 50-50-0 and 50-50-50 kg ha^{-1} NPK and control. Mungbean variety NM-98 was planted using a seed rate of 20 kg ha^{-1} in 30 cm apart row. All the fertilizers were side drilled at sowing in the form of urea, SSP and K_2SO_4. Pre-isolated rhizobium strain (*Rhizobium phaseoli*) will be obtained from Dept. of Soil Bacteriology, Ayub Agriculture Research Institute, Faisalabad. Sugar solution was made in the composition of 50 g sugar and 250 mL distilled water and mungbean seeds were coated with it. After that, inoculum mixed with sugar solution coated mugbean seeds and dried up under shade. Ten plants were selected randomly at maturity from each plot for recording plant height, nodules plant^{-1} and pods plant^{-1} where as yield was recorded on net plot basis. The data collected were analyzed by using analysis of variance techniques and Duncan's New Multiple Range Test was applied to test the significance of treatment means (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

The data regarding various parameters are presented in Table I. Plant population per unit area was not affected by the application of fertilizer or inoculation. The non-significant differences in the number of plants m^{-2} at harvest was due to very low plant mortality during the growing period and use of uniform seed rate and maintaining uniform inter row and inter plant spacing. Similar findings were report by Shamim and Ali (1987).

Maximum plant height (69.93 cm) was recorded in plots where seed was treated with *Rhizobium phaseoli* and fertilizer @ 50-50 kg N P ha^{-1}. Hussain (1994), and Thakur and Panwar (1995) who reported an increase in plant height by seed inoculation and NPK application.

Maximum number of pods (32.9) was recorded in plots where seed was treated with *Rhizobium phaseoli* and fertilized @ 50-50 kg NP ha^{-1} which was statistically at par with T_6, T_4 and T_3. Increase in number of pods can be attributed to better plant development under these conditions. Similar findings were reported by Malik *et al*. (1990) and Ali *et al*. (2000).

Data revealed that fertilizer application in addition to

Table I. Effect of seed inoculation and NPK application on yield and protein content of mungbean

Treatments	Number of Plant m^{-2}	Plant height (cm)	Number of nodules $plant^{-1}$	Number of pods $plant^{-1}$	Seed yield (kg ha^{-1})	Harvest index
T_0 = Control	32.3	59.96e	10.2e	17.3c	676.41d	19.8d
T_1 = Seed inculcation alone	32.3	64.56d	24.4d	21.16b	836.84c	22.2c
T_2 = Seed inoculation + 20-50-0 kg ha^{-1} NPK	32.6	64.8cd	25.3d	22.29b	746.41b	24.9b
T_3 = Seed inoculation + 30-50-0 kg ha^{-1} NPK	33.3	66.46bc	29.5bc	28.97a	1053.11a	26.35ab
T_4 = Seed inoculation + 40-50-0 kg ha^{-1} NPK	33	68.20ab	29.13c	30.56a	1060.44a	25.23b
T_5 = Seed inoculation + 50-50-0 kg ha^{-1} NPK	33.3	69.93a	30.4b	32.90a	1074.74a	24.7b
T_6 = Seed inoculation + 50-50-50 kg ha^{-1} NPK	32.6	68.06b	31.8a	32.56a	1071.89a	27.5b

seed inoculation tended to affect nodulation in general positively and produced significantly higher number of nodules than that of control. The maximum number of nodules (31.8) per plant was produced by fertilizer level of 50-50-50 kg NPK ha^{-1} in addition to seed inoculation. These results go quite in line with those of Brar and Lal (1991).

Seed inoculation and fertilizer application had significant effect on seed yield per hectare. As regards fertilizer application, grain yield per hectare increased with increasing level of N. Maximum grain yield (1074.74 kg ha^{-1}) was recorded in treatment T_5 (Seed inoculation + 50-50 kg NP ha^{-1}) and it was at par with that of treatments T_6 (Seed inoculation + 50-50-50 kg NPK ha^{-1}), and T_3 (Seed inoculation + 30-50-0 kg NPK ha^{-1}). This increase in seed yield ha^{-1} can be attributed to better plant growth and yield components like number of pods per plant, 1000 grain weight and number of grains per pod. The increase in seed yield ha^{-1} due to inoculation and fertilizer application was also reported by Saimnazarov *et al.* (1995) and Ali *et al.* (2000).

The physiological ability of a crop plant to convert total dry matter into economic yield is measured in terms of harvest index. Both the rhizobium and fertilizer application improved the harvest index significantly over control. The significantly highest harvest index was obtained with the application of 50-50-50 NPK kg ha^{-1} + *Rhizobium phascoli* and it was statistically at par with T_3 (30-50 kg NP ha^{-1} + Seed inoculation). These results are similar to the findings of Arif (1999).

CONCLUSION

It is concluded that mungbean crop should preferably be grown by seed treatment with *Rhizobium phascoli* culture and fertilized @ 30-50 kg NP ha^{-1} under agro-ecological conditions of Faisalabad for obtaining maximum seed yield.

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