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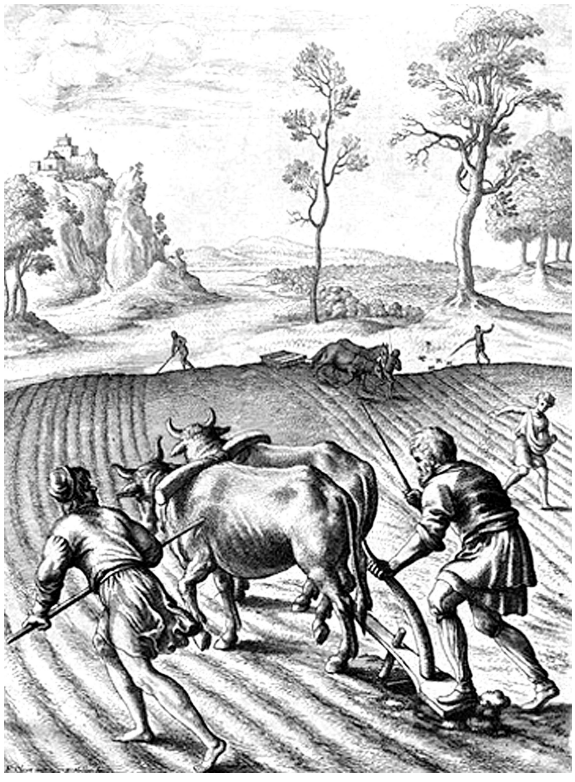

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Effect of Seed Inoculation and Different Fertilizer Levels on the Growth and Yield of Mungbean (*Vigna radiata* L.)

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Abstract: Response of mungbean (*Vigna radiata* L.) cultivar NM-98 to seed inoculation and different levels of fertilizer (0-0, 15-30, 30-60 and 45-90 kg N-P_2O_5 ha^{-1}) was studied under field conditions. Number of pod bearing branches $plant^{-1}$, number of seed pod^{-1}, 1000-seed weight, seed yield and protein contents were affected significantly by seed inoculation. The application of fertilizer significantly increased the seed yield and maximum seed yield was obtained when 30-60 kg N-P_2O_5 ha^{-1} was applied. This increase in seed yield was mainly due to more number of pod bearing branches $plant^{-1}$, number of seed pod^{-1} and 1000-seed weight. Seed protein contents were also increased significantly by seed inoculation and fertilizer application. Based on the present findings it can be concluded that mungbean cultivar NM-98 should sown after seed inoculation and given 30-60 kg N-P_2O_5 ha^{-1} for obtaining higher seed yield.

Key words: Inoculation, nitrogen phosphorus, mungbean

INTRODUCTION

Mungbean is an important pulse crop having high nutritive value. In Pakistan it occupies an area of 261.4 thousand ha with total seed production of 134.4 thousand tones having an average yield of 514 kg ha^{-1} [1]. Its seed contains 24% protein, 58% carbohydrates and 36% minerals. It not only plays an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen. However under agro-ecological conditions of Pakistan the nodulation of mungbean is poor. Inoculation of mungbean with Rhizobium increased the seed yield, photosynthetic activity and dry matter production[2]. Singh *et al.*[3] reported that seed inoculation and application of NP fertilizer significantly increased the seed yield of mungbean. Chovatia *et al.*[4] reported that higher seed yield of mungbean was obtained with seed inoculation. They further reported that application of Phosphorus significantly increased the seed yield up to 40 kg P_2O_5 ha^{-1}. Similarly, Pandhar *et al.*[5] have also reported increase in number of nodules and seed yield with seed inoculation with single and multiple strains. Khan *et al.*[6] reported that phosphorus application significantly increased the yield of mungbean. The present research was therefore, carried out to study the effect of seed inoculation, various combinations of nitrogen and phosphorus on growth and yield of mungbean.

MATERIALS AND METHODS

A field experiment to study the effect of seed inoculation and different fertilizer levels (0-0, 15-30, 30-60 and 45-90 kg N-P_2O_5 ha^{-1}) on the growth and yield of mungbean (*Vigna radiata* L.) cultivar NM-98 was conducted at Agronomic Research Area, University of Agriculture, Faisalabad, Pakistan. The experiment was laid out in randomized complete block design with factorial arrangement having a net plot size of 2.4x6.0 m and was replicated thrice. The crop was sown in 30 cm apart rows with single row hand drill using a seed rate of 25 kg ha^{-1}. The prescribed doses of nitrogen and phosphorus were applied at sowing time in the form of urea and triple super phosphate, respectively. All other Agronomic practices were kept normal and uniform for all the treatments. Ten plants were selected at random from each plot to determine the number of pod baring branches $plant^{-1}$, number of pods $plant^{-1}$ and number of seeds pod^{-1}. Two samples of 1000 seeds were weighed to determine the 1000-seed weight. Protein contents were determined using the Gunning and Hibbard's method of H_2SO_4 digestion using the micro Kjeld method for distillation[7]. Data collected was analyzed statistically using Fishers' analysis of variance technique and least significant difference (LSD) test was employed at 5% probability level to compare the significance of treatments' means[8].

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RESULTS AND DISCUSSION

Plant density plot^{-1} was not affected significantly both by seed inoculation fertilizer levels. The statistically similar plant population might have been due to the use of uniform seed rate and maintaining plant to plant distance by thinning (Table 1).

Number of pod bearing branches plant^{-1} were not affected significantly by seed inoculation treatment. Inoculated seeds produced more pods plant^{-1} than un-inoculated seed treatment. More number of pod bearing branches plant^{-1} might have been due to enhanced growth in this treatment (Table 1). Significant increase in the number of pod bearing branches plant^{-1}by inoculation has also been reported by Ali *et al.*[9] and Brar and Lal[10]. The maximum number of pod bearing branches plant^{-1} were recorded by 15-30 kg N-P_2O_5 ha^{-1} however, the differences among fertilizer levels could not reach to a level of significance. The interaction between seed inoculation and fertilizer levels was non-significant (Table 1).

The effect of seed inoculation on number of pods plant^{-1} was significant the inoculated seeds produced significantly higher number of pods plant^{-1} than un-inoculated seeds (Table 1). The results are in line with those of Pandher *et al.*[5] and Ali *et al.*[9] who also reported an increase in number of pods plant^{-1} by seed inoculation. Application of fertilizer significantly increased the number of pods plant^{-1}. Each increased fertilizer level significantly increased the number of pods plant^{-1} up to 30-60 kg N-P_2O_5 ha^{-1}. Further increase in the fertilizer level did not produce significantly higher number of pods plant^{-1} (Table 1). The results are supported by the findings of Mishra[11] who has also reported a significant effect of fertilizer application on number of pods plant^{-1}.

Number of seeds pod^{-1} was also affected significantly by seed inoculation. The inoculated seeds produced significantly higher number of seeds pod^{-1} than un-inoculated seeds (Table 1). This can be attributed to the fact that inoculation increased the nodulation and thus enhanced the utilization of atmospheric nitrogen and availability of phosphorus. Increase in number of seeds pod^{-1} by seed inoculation has also been reported by Ali *et al.*[9]. Number of seeds pod^{-1} was affected significantly by various fertilizer treatments. All the fertilizer levels produced higher number of seeds pod^{-1} over control. The maximum number of seeds pod^{-1} were produced by 45-90 kg N-P_2O_5 ha^{-1} but was statistically at par with 30-60 kg N-P_2O_5 ha^{-1}.

Different inoculation treatments significantly affected the 1000-seed weight. The inoculated seeds produced heavier seeds than un-inoculated seeds (Table 1). The results are in confirmatory with those of Thakur and Panwar[2] who reported that inoculation enhanced the dry matter accumulation. Different NP levels have a significant affect on seed weight. The maximum test weight was produced when 45-90 kg N-P_2O_5 ha^{-1} was applied. It was, however, at par with that of 30-60 kg N-P_2O_5 ha^{-1}. The minimum seed weight was recorded in control treatment where no fertilizer was applied and it was statistically at par with 15-30 kg N-P_2O_5 ha^{-1}.

Seed yields of inoculated and un-inoculated treatments significantly differed from each other. Inoculated seed treatment resulted in higher seed yield than un-inoculated seed treatment. The higher seed yield by inoculated seed treatment can be attributed to higher number of pods plant^{-1}, number of seeds pod^{-1} and 1000-seed weight (Table 1). Similar results have also been reported by Ali *et al.*[9] and Pandar *et al.*[5] who also found an increase in seed yield with seed inoculation. Seed yield was also affected significantly by various fertilizer treatments. The seed yield was increased significantly with each increased fertilizer level up to 30-60 kg N-P_2O_5 ha^{-1}. However, the difference between 30-60 and 45-90 kg N-P_2O_5 ha^{-1} could not reach to a level of significance. The higher seed yield at higher fertilizer levels can be

Table 1: Effect of seed inoculation and different fertilizer levels on the growth and yield of Mungbean

	Plant density per plot	No. of pod bearing branches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	1000-seed wt. (g)	Seed protein (kg ha^{-1})	Seed yield contents (%)
Seed inoculation							
Inoculated seeds	266.15NS	5.52b	15.65b	7.99b	46.89b	779.45b	20.45b
Uninoculated seeds	266.85	5.94a	18.79a	10.88a	51.59a	1084.56a	22.41a
Fertilizer levels (kg N-P_2O_5 ha^{-1})							
0-0	258.25NS	5.84NS	15.04c	8.21b	46.27b	871.65c	19.98c
15-30	262.45	5.89	17.29b	9.86a	46.80b	970.46b	22.45b
30-60	266.15	5.78	20.36a	9.89a	52.18a	1078.56a	29.99a
45-90	263.15	5.78	20.58a	9.94a	52.59a	1058.54a	28.78a
Inoculation x fertilizer	NS						

Any two means not sharing a letter in common differ statistically at 5% probability level NS: Non-significant

attributed to higher number of pods plant^{-1}, number of seeds pod^{-1} and 1000-seed weight. These results are supported by the findings of Chavatia *et al.*[4] who have also reported an increase in seed yield with increased fertilizer level.

Seed protein contents were increased with inoculation of seeds. The higher protein content with seed inoculation can be attributed to the enhanced supply of nitrogen in this treatment. The seed protein contents were also affected significantly by various fertilizer levels. The increase in NP levels significantly increased the protein contents up to 30-60 kg N-P_2O_5 ha^{-1} and further increase in NP level resulted in statistically similar protein contents (Table 1).

Based on the present findings it can be concluded that mungbean cultivar should be sown after seed inoculation and 30-60 kg N-P_2O_5 ha^{-1} should be applied for obtaining higher seed yield of good quality under agro-ecological conditions of Faisalabad.

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