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Growth and yield response of two cultivars of mungbean (*Vigna radiata* L.) to various levels of phosphorus

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Abstract

Response of two mungbean cultivars namely NM-54 and NM-92 to phosphorus levels of 0, 50, 100 and 150 kg ha^{-1} was studied in field conditions during the autumn 1997. The growth and yield parameters like plant height, pods plant, seeds $pant^{-1}$, 1000-seed weight and seed yield were influenced significantly by both phosphorus application and cultivars. However, number of pod bearing branches $plant^{-1}$ were not influenced significantly by both cultivars and fertilizer levels. the maximum seed yield of 1095 kg ha^{-1} was obtained by the application of 100 kg P_20_5 ha^{-1}, The cultivar NM-54, yielding 1060.09 kg ha^{-1} seed proved to be superior than NM-92 (956.77 kg ha^{-1}). The application of 100 kg P_20_5 ha^{-1} was found to be the optimum level for obtaining higher yield of mungbean in Faisalabad conditions.

Introduction

Mungbean (*Vigna radiata* L.) is one of the most important conventional pulses grown in Pakistan. Average yield of nungbean in Pakistan is 462 kg ha^{-1}, which is much lower than yields obtained in many other countries of the world Ike Egypt, Lebanon, Ireland having average yield of 2824, 2273, 4595 kg ha^{-1} respectively (Anonymous, 1997). Among the various possible factors responsible for low field, phosphorus is considered the most important nutrient for increasing the yield of green gram (Dubey *et al*., 1993). Saraf (1983) reported that phosphorus deficiency is the aredominant cause of low yield of pulses in India. Studies have shown that phosphorus application to mungbean increased plant height, number of pod bearing branches $slant^{-1}$, number of seeds pod^{-1}, 1000-grain weight, grain yield and protein content of grain (Ayub *et al*., 1998; Khan *et al*., 1999). Similarly Ali *et al*. (1999) applied 0, 35, 30 and 85 kg phosphorus to mungbean and obtained highest seed yield (961.9 kg ha^{-1}) with phosphorus application of 85 kg ha^{-1} but was statistically similar to 65 P_20_5 ha^{-1}. The increase in yield was associated with ncreased number of pods $plant^{-1}$ and 1000-grain weight. Whereas, Balachandran and Sasidhar (1991) reported that phosphorus application increased number of pods $plant^{-1}$ and number of seeds pod^{-1} but not 1000-seed weight.

Reddy and Palaniappan (1979) concluded that application of 10.40 kg P_20_5 to soil or as a foliar spray had non-significant effect on yield component and seed yield of green gram, when soil had medium phosphorus content. Varieties vary in yield and yield components (Bilal, 1994) and response to phosphorus application (Rao *et al*., 1993). Panwar *et al*. (1978) applied 0-90 kg P_20_5 ha^{-1} to five cultivars of mungbean and observed a significant yield response up to 60 kg P_20_5 ha^{-1} but the interaction between phosphorus and varieties was not significant. Similarly Khan *et al*. (1999) reported that yield and yield contributing parameters were significantly affected by phosphorus application. However, no statistical difference between cultivars was detected. The interaction of phosphorus with cultivars was also non-significant.

The present study was, therefore, planned to evaluate the effect of different levels of phosphorus on two mungbean cultivars in Faisalabad conditions.

Materials and Methods

The experiment was carried out to evaluate the effect of different levels of phosphorus on the growth and yield of two mungbean cultivars at the Agronomic Research Area, University of Agriculture, Faisalabad on a sandy clay loam soil having 0.42 percent N, 9.1 PPM available P and 137 PPM K. The experiment was laid out in split plot design with four replications. The net plot size measured 1.8 x 6 m. Phosphorus levels were randomized in main plots and varieties were kept in sub plots. Mungbean varieties NM-54 and NM-92 were sown in the first week of August, 1997 on a well prepared seedbed in 30 apart rows with single-row hand drill. The experiment comprised 0, 50, 100 and 150 kg P_20_5 ha^{-1}. The nitrogen was applied at the rate of 30 kg ha^{-1}. The entire quantity of N and P_20_5 was side drilled just after sowing in the form of urea and triple super phosphate. The crop was sown at the seed rate of 20 kg ha^{-1}. Plant to plant distance of 10 cm was maintained by thinning out the surplus plants one week after germination. All other agronomic practices were kept uniform and normal for all the experimental units. The crop was harvested manually in October, 1997. For recording individual plant observations like plant height, number of branches and number of pods $plant^{-1}$, ten plants were selected randomly from each subplot and averages were computed. For number of seeds $plant^{-1}$ total number of pods from ten plants were threshed and seeds were separated and averages were calculated. 1000-seed weight was taken by electrical balance. Data collected were analysed statistically using Fisher's analysis of variance technique and treatments means were compared by using least significant difference (LSD) test at 5% probability level (Steel and Torrie, 1984).

Results and Discussion

The data regarding various parameters recorded are given in Table 1. The plant height was affected significantly by phosphorus application. All levels of P_20_5 produced significantly taller plants than control. The differences between 50, 100 and 150 kg P_20_5 ha^{-1} were else significant. The tallest plants were produced by the application of 150 kg P_20_5 ha^{-1}. The minimum plant height was recorded in control. Increase in plant height by P_20_5 application has also been reported by Ayub *et al*. (1998).

Table 1: Growth and yield of two mungbean cultivars as influenced by phosphorus levels

P_70^5, Levels (kg ha^{-1})	Plant height (cm)	No. of pod bearing branches	No. of pod $plant^{-1}$	No. of seed pod^{-1}	1000-seed weight (g)	Seed Yield (kg ha^{-1})
0	61.11 d	3.06^{NS}	10.31 b	6.35^{Ns}	47.76 c	887.93 d
50	62.80 c	3.12	11.39 a	6.73	50.28 b	992.60 c
100	64.17 b	3.37	12.27 a	6.87	52.76 a	1095.00 a
150	66.02 a	3.61	11.40 a	6.86	51.86 a	1058.00 b
Varieties						
NM-54	71.45 a	3.37^{NS}	10.78 b	7.42 a	51.55 a	1060.09 a
NM-92	55.60 b	3.21	11.91 a	5.99 b	49.93 b	956.77 b

Means followed by the same letters did not differ significantly at 5% probability level

NM-54 produced significantly taller plants than NM-92. The results are contradictory to those of Khan *et al.* (1999). These contradictory results might have been due to different genetic traits of crop plants.

The number of pod bearing branches $plant^{-1}$ were not affected significantly by the application of phosphorus. The maximum and minimum number of pod bearing branches $plant^{-1}$ was recorded with the application of 150 kg P_70_5 ha and control respectively. The results are contradictory to those of Yasin (1981) and Ayub *et al*. (1998). Both the varieties also have statistically similar number of pod bearing branches $plant^{-1}$ and numbers noted were 3.37 and 3.21 for NM-54 and NM-92 respectively. The results indicate that both varieties have similar genetic potential for number of pod bearing branches $plant^{-1}$. Phosphorus application at the rate of 50, 100 and 150 kg ha^{-1} produced statistically similar number of pods $plant^{-1}$ but significantly higher than control. The maximum number of pods plant was recorded with the application of 100 kg P_20_5 ha^{-1}. Significant effects of phosphorus application on the number of pods per plant have been reported by Ayub *et al*. (1998), Ali *et al*. (1999) and Khan *et al*. (1999). NM-92 produced significantly more number of pods plant' than NM-54. The number of seeds pod^{-1} was not affected significantly by different levels of phosphorus. However, Balachandran and Sasidhar (1991), Ayub *et al*. (1998), Ali *et al*. (1999) and Khan *et al*. (1999), had reported significant effects of phosphorus application on number of seeds pod^{-1}. The cultivar NM-54 produced significantly more number of seeds pod^{-1} than NM-92. The cultivar NM-54 possesses better genetic potential than NM-92 for seeds pod^{-1}. Non-significant differences among the cultivars for number of seeds pod have been reported by Khan *et al*. (1999). 1000-seed weight was affected significantly by phosphorus application. The application of 100 and 150 kg P_20_5 ha^{-1} remaining at par with each other produced significantly higher 1000-seed weight than 50 kg P_20_5 ha^{-1} and control. Significant effects of phosphorus application on 1000-seed weight have been reported by Ayub *et al*. (1998), Ali *et al*. (1999) and Khan *et al*. (1999), but the results are contradictory to those of Balachandran and Sasidhar, (1991). NM-54 produced significantly heavier seeds than NM-92. Khan *et al*. (1999) have reported nonsignificant differences among the two cultivars of mungbean.

All the P_20_5 levels produced significantly higher seed yield over control. The differences within phosphorus levels were also significant. A significant decrease in seed yield occurred at phosphorus application of 150 kg ha^{-1}. The maximum seed yield was obtained by the application 100 kg P_20_5 ha^{-1}. The reduction in the yield might be due to nutritional imbalance and genetic inability of the cultivars to get more phosphorus beyond certain limit. The increase in seed yield at 100 kg P_20_5 ha^{-1} has been mainly due to higher num of pods $plant^{-1}$ and 1000-seed weight. Ayub *et al*. (1998), Ali *et al*. (1999) and Khan *et al*. (1999) had a reported similar results. NM-54 produced significant higher yield (1060.09 kg ha^{-1}) than NM-92 (956.77 ha^{-1}). The increase in yield has been due to higher num of pods $plant^{-1}$, number of seeds pod and 1000-weight, Significant Ent differences among cultivars mungbean for seed yield have been reported by Bilal (1994) (Table 1).

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