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Effect of Phosphorous on the Growth and Yield of Mungbean

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Abstract
This study was conducted to find out the optimum phosphorus levels required for obtaining high yield of mungbean under conditions prevailing in D.I.Khan. The effect of various phosphorus levels on two mungbean cultivars NM-92 and NM-54 revealed that all the yield and yield contributing factors were significantly affected by the application P_2O_5. However, no statistical difference between the cultivars was detected. Similarly, the interaction of phosphorus levels with the cultivars was also non-significant. The application of P_2O_5 from 60-90 kg ha^{-1} is recommended for realizing better yield of mungbean.

Introduction
Mungbean (*Vigna radiata* L.) being a legume crop does not require high doses of nitrogenous fertilizer if inoculated properly (Shamim and Ali, 1987). It also improves soil fertility by fixing atmospheric nitrogen through the process of symbiosis with proper rhizobium strain (Mishra and Ahmed,1994). Like other pulses it is high in fiber and low in carbohydrates, thus useful for patients suffering from trouble of digestion (Keys and Margrate,1967). Mung bean plays a leading role in the national economy of Pakistan, if given proper place in cropping pattern. Though the Govt: of Pakistan has given a greater priority to the agriculture sector, yet a greater shortage of pulses still found in the country (Anonymous,1993). Phosphorus fertilization and adoption of high yielding varieties are the important agronomic practices that greatly affect yield and profit of many crops including mungbean (Arya and Kalra,1988). It is therefore necessary to familiarize the farmers with the judicious use of phosphorous at proper times. The present study was therefore, undertaken to find out the optimum phosphorus levels required for obtaining high yield of mungbean under conditions prevailing in Dera Ismail Khan.

Materials and Methods
The field trial was carried out at the Agronomic Research Area, Faculty of Agriculture, Gomal University, D.I.Khan, during 1997. The experiment was laid out in a randomized complete block design (factorial) with three replications having net plot size of 1.8 x 7 m. The varieties under study were NM-92 and NM-54.

The crop was sown on a well prepared seed bed with the help of a single row hand drill. A dose of 50 kg of nitrogen and 60 kg of potash per hectare was applied to all the plots. All the agronomic practices such as weeding, irrigation, plant protection measures were applied uniformly in all treatments. Harvesting was done manually. Standard procedures were followed for recording data on different yield parameters. The data was analyzed statistically by using analysis of variance techniques (Steel and Torrie, 1980) and the difference between treatment means was determined by using LSD test at 5 percent probability level.

Results and Discussion
Plant height at maturity: Plant height is the important component of straw yield and may also effect the grain yield. It is a function of both the genetic makeup of the plant and the environmental conditions which the plant is subjected during the growth. It is revealed from the Table 1 that application of 90 and 120 kg P_2O_5 ha^{-1} resulted in statistically similar plant height. The plants in these treatments were higher than rest of the treatments. The minimum plant height was recorded in plots where no phosphorus was applied.

Table 1: Plant height at maturity as influenced by different levels of phosphorus and varieties

P_2O_5 (kg ha^{-1})	NM-92	NM-54	Means
Control	45.85	46.55	45.20c
30	48.47	47.77	48.12b
60	48.10	48.80	48.45b
90	52.02	51.32	51.67a
120	45.8 5	52.35	52.00a
Means	49.22	49.36	

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

Number of pods per plant: The data given in Table 2 indicated that application of 90 and 120 kg P_2O_5 ha^{-1} resulted highest number of pods per plant and they were at par with each other. The increase in number of pods with these levels might be due to various enzymatic activities which controlled flowering and pod formation. Maximum number of pods per plant was recorded in 120 kg P_2O_5 ha^{-1} as against minimum in control plots where no phosphorus was applied. Shabbir (1982) concluded that application of 20 kg N+60 kg P_2O, ha significantly increased the number of branches per plant, number of pods per plant and 1000 seed weight of gram. Kalita (1989) reported that application of phosphorus at 30 kg ha^{-1} gave 0.90-0.96 t ha^{-1} seed yield as compared to 0.59-0.63 t ha^{-1} in check plots. He also observed that number of pods per plant and seeds per pod increased significantly by application of phosphorus.

Table 2: Number of pods per plant as influenced by different levels of phosphorus and varieties

P_2O_5 (kg ha^{-1})	NM-92	NM-54	Means
Control	19.85	20.25	20.05d
30	21.60	21.20	21.40c
60	22.48	22.88	22.48b
90	23.60	23.20	23.4Oab
120	23.73	24.13	23.93a
Means	22.25	22.33	

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

Number of seeds per pod: Number of seeds per pod is an important factor that directly involved in exploiting yield recovery in leguminous crops. The performance of leguminous plants is determined mainly by their pod and seed bearing capacity. Analysis of mean values showed that maximum number of seeds per pod was recorded in T2. However, numerically minimum number of seeds was recorded in control plots where no phosphorus was applied (Table 3). Gill *et al*. (1985) observed that phosphorus fertilizer significantly increased seeds/pods, grain yield and harvest index compared with check plots.

1000-seed weight (g): The data regarding 1000-seed weight are presented in Table 4. As for as different treatments are concerned, the application of 120 kg P_20 ha^{-1} resulted in maximum 1000-seed weight. Minimum seed index was recorded in plots where no phosphorus was applied. The application of 30 kg P_20_5 ha^{-1} resulted in the same seed weight as control treatment. Likewise the application of 60 or 90 kg P_20_5 ha^{-1} did not differ with each other with respect to 1000-seed weight. It is evident that with increase in the phosphorus level, the 1000-seed weight was also increased which indicated that phosphorus application improve the seed weight of the plant. Kushwaha and Phadauria (1984) concluded that seed yields and 1000-seed weight were increased by increasing the rates of applied P from 0 to 60 kg ha^{-1}, but were not affected by 0-30 kg K ha^{-1}. Patel *et al*. (1984) reported that the application of 40 kg P_20_5 ha^{-1} significantly increased the seed yield, number of pods/plant and 1000-seed weight.

Table 3: Number of seeds per pod as influenced by different levels of phosphorus and varieties

P_2O_5 (kg ha^{-1})	NM-92	NM-54	Means
Control	6.71	6.81	6.76c
30	6.99	9.89	9.94ab
60	10.63	10.68	10.66a
90	10.13	10.21	10.17ab
120	9.29	9.30	9.29b
Mean	9.35	9.38	

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

Seed yield: It is exhibited from Table 5 that application 60, 90 and 120 kg P_2O_5 ha^{-1} resulted in the highest by statistically similar seed yield. It was followed by plant receiving 30 kg P_2O_5 ha^{-1}. While, minimum seed yield recorded in control. Dwangan *et al*. (1992) concluded the seed yield increased with the rate of P application. The was also found that water use efficiency was also increas with phosphorus application, Rao *et al*. (1993) stated the seed yield and phosphorus uptake in seeds were increase with phosphorus application.

Table 4: 1000-seed weight as influenced by differs levels of phosphorus and varieties

P_2O_5 (kg ha^{-1})	NM-92	NM-54	Means
Control	32.97	33.17	33.07
30	33.36	33.16	33.26
60	33.06	33.23	33.13
90	34.17	33.97	34.07
120	34.50	34.70	34.60
Means	33.61	33.65	

Any two means not sharing a letter in common different significantly at 5% A level of probability

Table 5: Seed yield (kg ha^{-1}) as influenced by differ levels of phosphorus and varieties

P_7O_5 (kg ha^{-1})	NM-92	NM-54	Mean
Control	731.78	742.28	737.0
30	865.63	854.63	960.0
60	988.16	999.16	993.6
90	1013.81	1020.81	1026.3
120	1036.18	1041.68	1041.6
Means	930.71	932.81	

Any two means not sharing a letter in common different significantly at 5% level of probability

Table 6: Biological yield as influenced by different level phosphorus and varieties

P_2O_5 (kg ha^{-1})	NM-92	NM-54	Means
Control	2400.32	24460.70	2423.2
30	2982.49	2942.49	2962.4
60	3534.24	3574.24	3554.2
90	3878.10	3838.85	3858.4
120	3898.35	3983.35	3918.3
Means	3338.70	3348.00	

Any two means not sharing a letter in common different significantly at 5% level of probability

Biological yield (kg h a^{-1}): Biological yield of crop shows overall growth performance of crop plants. The regarding the biological yield as influenced by different levels of phosphorus and two mungbean varieties presented in Table 6. The comparison of treatment showed that the yield obtained by the application of 90 120 kg P_2O_5 ha^{-1} was higher as compared to the treatments included in this trial. Ayyoub (1985) concluded that leaf area, number of pods per plant, number of seeds per pod and total biomass per hectare were affected significantly by the application of nitrogen alone and in combination with phosphorus and potash over control in mungbean. Ahmed *et al*. (1986) observed that phosphorus application upto 60 kg ha^{-1} progressively and significantly enhanced the growth and yield parameters. While, P x Zn interaction significantly increased plant height at maturity, number of pods per plant grain and straw yields.

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