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Research Communication

Effect of phosphorus levels and varieties on yield and yield attributes of mung bean (*Vigna radiata*) in climate condition of Badghis, Afghanistan

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ABSTRACT

A field experiment was conducted during the spring season of 2020 at research farm of Badghis Institute of Higher Education, Badghis, Afghanistan to evaluate the effect of phosphorus levels and varieties on yield and yield attributes of mung bean [*Vigna radiata* (L.) R. Wilczek]. The experiment was laid out in a randomized complete-block design with 3 replications. The experiment was comprised 2, viz. varieties 'Mai 08' and 'Nayab 98' of mung bean with 4 phosphorus levels, viz. control, 40, 60 and 80 kg P_2O_5/ha. The results revealed that, mung bean crop fertilized with 80 kg/ha P_2O_5 gave the maximum branches/plant (6.4), pods/plant (24.88), pod length (6.28), seeds/plant (243.3), 1,000-grain weight (32.74), grain yield (1230.43 kg/ha), and harvest index (39.42). Phosphorus @ 80 kg P_2O_5/ha was found more economical for getting higher grain yield of mung bean crop. The maximum and higher number of branches/plant, number of pods/plant, number of seeds/plant, 1,000-grain weight, grain yield kg/ha, and harvest index were recorded with 'Mai 08' variety.

***Key words*:** Mung bean, Phosphorus, Yield, Yield components

Mung bean [*Vigna radiata* (L.) R. Wilczek] is a short-duration leguminous crop, and can be grown in various cropping patterns owing to its ability to adapt to the poor environmental stresses such as low soil fertility and drought (Bourgault *et al*., 2010). It is widely cultivated throughout the Asia, (Choudhary *et al*., 2015). Mung bean contains about 51% carbohydrate, 10% moisture, 4% minerals and 3% vitamins (Ali *et al*., 2010). It contains 27% protein and has good amount of essential amino acids comparable with that of soybean (*Glycine max* (L.) Merr.]. Afghanistan is an agriculture-based economy where wheat (*Triticum aestivum* L.), rice (*Oryza sativa* L.), maize (*Zea mays* L.) and pulses are major field crops. Among these, pulses constitute the main source of plant-based protein for the ever-rising human population in the country. The pulses are also excellent source of protein nutrition for livestock. In developing countries like Afghanistan where protein energy malnutrition is a serious challenge due to cereal-based dietary pattern. Inclusion of pulses in staple diet could help in overcoming the crisis of malnourishment. Further, the protein obtained from pulses is comparatively cheaper than animal-based protein sources, i.e. meat, egg and fish, owing to the low market prices of pulses (Jahish, 2016). In Afghanistan, farmers sow pulse crops with only 1 ploughing and hardly use any fertilizers and irrigation due to their poor socio-economic status and lack of know-how. As a result, the crop yield is very low (Hamim, 2016). However, mung bean yield is very poor in Afghanistan due to non-availability of high-yielding varieties, poor nutrient management, especially phosphorus (P), broadcasting of seeds and being a rainfed crop due to poor irrigation infrastructure (Choudhary *et al*., 2015; Noorzai *et al*., 2017).

The yield and quality of mung bean can be improved by applying best agronomic practices and use of high-yielding cultivars. The cultivars of mung bean vary in yield potential and yield components. The application of phosphorus to mung bean has been stated to increase dry-matter at harvesting, number of pods plant/plant, seeds pod/plant, 1,000-grain weight, seed yield and total biomass (Mitra *et al*., 1999). Phosphorus has been reported to have a significant role in growth and development of the plant and also in nitrogen fixation. Mung bean, being a leguminous crop, requires high phosphorus, but the optimum dose under Afghanistan condition is yet to be standardized. Ayub *et al*. (1999) obtained significantly higher seed yield from recent mung bean cultivars. Two promising mung bean varieties 'NM-92' and 'NM-54' were tested by Ayub *et al*.,

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(1999) and they reported higher number of pod-bearing branches/plant, number of pods plant and number of seeds pod/plant which highlight the importance of adoption of high-yielding varieties and high P requirement. Yadav *et al.* and Singh (2011) also found significant differences in yields and yield components of different mung bean cultivars in response to phosphorus application. Keeping in view the importance of phosphorus levels and mung bean cultivars, the present investigation was carried out to know the effect of P levels and different variety on yield and yield components of mung bean.

A field experiment was conducted during the spring season, 2020 at the research farm of Badghis Institute of Higher Education under Badghis, Afghanistan to evaluate the effect of phosphorus levels and varieties on yield and yield attributes of mung bean. The experiment was laid out in a randomized complete-block design with 3 replications. The treatments, comprised 2 mung bean varieties 'Mai 08' and 'Nayab 98' with 4 phosphorus levels (control, 40, 60 and 80 kg P_2O_5/ha) with a basal dose of nitrogen @ 20 kg/ha. Diammonium phosphate and urea fertilizer were used as source of phosphorus and nitrogen, respectively. All phosphatic and nitrogenous fertilizer were applied before sowing. The soil of the experimental site was low in available nitrogen and phosphorus and medium in available potassium. The crop was sown at the seed rate of 25 kg/ha and hand weeding were done at 30, 45 days after sowing. The data on number of pods/plant, number of seeds/pod, pod length, 1,000-grain weight, grain yield, straw yield and harvest index were recorded and analyzed statistically using Fisher's analysis of variance technique.

The data regarding the effect of different phosphorus management and varieties on number of branches/plant, number of pods/plant, pods length, number of seeds/plant, 1000-grain weight (g), grain yield (kg/ha), straw yield (kg/ha) and harvest index are given in Table 1. The result showed that, branches/plant significantly varied with the varieties. The maximum branches/plant were recorded with 'Mai 08' mung bean (5.1) over 'Nayab 98' (4.981). Different levels of phosphorus resulted in significant difference for number of branches/plant. The maximum branches/plant (6.4) were obtained from mung bean when fertilized with 80 kg P_2O_5/ha. It was followed by treatment 60 kg P_2O_5 and 40 kg P_2O_5/ha with 5.4 and 4.1 branches/plant, respectively. Significantly least number of branches/plant was recorded in control plot. The effect of varieties on number of pods/plant was found significant. The maximum pods/plant were recorded with the 'Mai 08' variety (21.013) compared with 'Nayab 98' (20.13). A significant variation in pods/plant of mung bean was observed owing to phosphorus application. Among different phosphorus doses, the higher values of pods/plant (24.88) were recorded form treatment 80 kg P_2O_5/ha, followed by 60 kg P_2O_5 and 40 kg P_2O_5/ha. The higher number of pods/plant might have been recorded owing to more vigour and strength attained by the plants. This resulted in attaining sufficient absorption of nutrients and a higher test weight. It was observed that, pod length due to varieties showed a significant difference. The highest pod length was recorded with 'Mai 08' (5.79 cm) compared with 'Nayab 98' (5.51 cm). The pod length of mung bean was significantly affected by different levels of phosphorus. Among different levels of phosphorus, a significantly higher pod length (6.49 cm) was recorded from treatment 60 kg P_2O_5/ha followed by 80 kg P_2O_5/ha and 40 kg P_2O_5/ha. The pod length from treatment of 60 kg P_2O_5/ha treated mung bean was significantly higher than all treatments and the lowest pod length was recorded in the control plot.

The difference in number of seeds/plant was significant due to the varieties. The maximum number of seeds/plant recorded with the variety 'Mai 08' (201.4) over 'Nayab 98' (196.3). Seeds/plant were significantly affected

Table 1. Effect of phosphorus levels and varieties on branches/plant, pods/plant, pod length, seed/plant, 1,000-grain weight, grain yield, straw yield and harvest index (%) of mung bean

Treatments	Branches/ plant	Pods/ plant	Pod length (cm)	Seeds/ plant	1,000-grain weight (g)	Grain yield (t/ha)	Straw yield (kg/ha)	Harvest index (%)
Phosphorus levels (P_2O_5/ha)								
0 kg	4.1	16.7	4.38	149.5	26.78	0.86	1,490	36.7
40 kg	4.3	18.8	5.47	175.5	28.86	0.95	1,677	36.3
60 kg	5.4	21.9	6.49	227.1	30.82	1.14	1,823	38.4
80 kg	6.4	24.9	6.28	243.3	32.74	1.23	1,891	39.4
SEm±	0.04	0.18	0.065	1.505	0.181	0.006	15.8	0.27
CD (P=0.05)	0.13	0.56	0.198	4.565	0.552	0.019	48.1	0.82
Varieties								
'Nayab 98'	4.98	20.1	5.51	196.3	29.54	1.03	1,759	36.8
'Mai 08'	5.15	21.0	5.79	201.4	30.06	1.07	1,682	38.7
SEm±	0.03	0.13	0.463	1.064	0.128	0.004	11.2	0.19
CD (P=0.05)	0.09	0.394	0.140	3.228	0.390	0.013	34.0	0.58

by different levels of phosphorus. A significantly higher number of seeds/plant was recorded with 80 kg P_2O_5/ha (243.3), followed by 60 and 40 kg P_2O_5/ha which also significantly differed from each other producing 227 and 175 seeds/plant, respectively. The data pertaining to 1,000-grain weight showed significant difference between varieties. The higher 1,000-grain weight was recorded with 'Mai 08' (30.1 g) than 'Nayab 98' (29.5 g) variety. Among different levels of phosphorus, significantly higher 1,000-grian weight (32.7 g) was recorded from treatment 80 kg P_2O_5/ ha, followed by the treatment 60 kg P_2O_5/ ha and 40 kg P_2O_5/ha and all these treatments showed markedly higher values than the control. The result showed that, the grain yield between varieties varied significantly. The maximum grain yield was recorded with the variety 'Mai 08' (1,065 kg/ha) over variety 'Nayab 98' (1,028 kg/ha). A significantly higher grain yield (1,230.4 kg/ha) was recorded from treatment 80 kg P_2O_5/ha, followed by the application of 60 kg P_2O_5/ha and 40 kg P_2O_5/ha. All phosphorus fertilizer treatments resulted in significantly higher grain yield than the control. It was observed that, the straw yield showed significant difference due to varieties. The highest straw yield was recorded with 'Nayab 98' variety (1758.8 kg/ha) over 'Mai 08' (1,681.8 kg/ha). Different levels of phosphorus application showed significant difference on straw yield of mung bean. The maximum straw yield was recorded with treatment 80 kg P_2O_5/ha (1,891 kg/ha). Treatment with 80 kg P_2O_5/ha was found significantly superior to all treatments. The response to applied phosphorus was also obtained due to low availability in the soil (10.72 kg P_2O_5/ha). The data regarding harvest index between varieties showed a significant difference. The maximum harvest index was recorded with 'Mai 08' variety (38.66%) over 'Nayab 98' (36.78%). The varying levels of phosphorus applications indicates a significant effect on harvest index. A higher harvest index (39.42%) was noted with treatment 80 kg P_2O_5/ha, followed by treatment 60 kg P_2O_5/ha and 40 P_2O_5/ha. Kumar *et al.* (2012) also reported that, the increasing rate of phosphorus application significantly increased harvest index over the control plots.

Yadav *et al.* (2011) also found that the highest number of branches/plant in mung bean were recorded with the high dose of phosphorus application under P-deficit areas (Tesfaye *et al.,* 2007). Singh *et al.* (2007) also reported that varieties had a significant effect on number of pods/plant of mung bean. Muhammad *et al.* (2004) and Prasad *et al.* (2005) found that the number of pods/plant increased with the phosphorus application. It is evident from the results of Nadeem *et al*. (2003) that, pod length increases with increase in the phosphorus levels. The difference in number of grains/plant among the varieties might be due to genetically determined difference in uptake of nutrient (Uddin *et al.,* 2009). Uddin *et al.* (2009) reported that, the differences in 1,000-grain weight of these cultivars might be due to hereditary superiority, growth rate and potential of yield. The enhancement in mung bean yield with combined application or rhizobium and phosphorus might be owing to increase in phosphorus availability that lead to better translocation of photosynthesis towards sink with consequent improvement in yield attributes (Muhammad *et al*., 2004).

The results of the one-year study indicates that selection of suitable variety (Mai-08) when combined with Appropriate dose resulted in highest growth yield attributes & yield mung bean.

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