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

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**ABSTRACT**

An experiment was conducted at agronomic research area, Badghis higher education institute during spring season of 2020 to evaluate the effect of phosphorus levels on yield attributes, yield of mungbean (*Vigna radiata* L.) varieties under Badghis, Afghanistan climate condition. The experiment was laid out in randomized complete block design with three replications. The treatment was comprised of the experiment i.e.; tow mungbean varieties Mai-08 and Nayab-98 with four phosphorus levels viz., control, 40, 60 and 80 kg/ha.

Results revealed that mung bean crop fertilized with 80 kg/ha phosphorus gave maximum number of branches per plant, number of pods per plant, pod length, number of seeds per plant, 1000-grain weight, grain yield kg/ha, and harvest index. Phosphorus at the rate of 80 kg/ha was found more economical for getting higher grain yield of mung bean crop. Maximum and higher number of branches per plant, number of pods per plant, number of seeds per plant, 1000-grain weight, grain yield kg/ha, and harvest index were record with Mai-08 varieties. It is concluded form the study that variety of Mai-08 variety and phosphorus at rate of 80 kg/ha is more productive.

**Key words:** Mung bean, Phosphorus, yield and yield components.

Mungbean (*Vigna radiata* L.) is a short-lived leguminous plant, and can be grown in various cropping patterns due to its ability to adapt to the poor environmental stresses such as low soil fertility and drought (Bourgault *et al*., 2010; Nair *et al*., 2012). It is widely cultivated throughout the Asia, including India, Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia, south China and Argentina. In Africa and U.S.A (Choudhary *et al*., 2015). Mungbean contains 51% carbohydrate, 10% moisture, 4% minerals and 3% vitamins (Ali *et al*., 2010). It also contains 27% protein and has good amount of essential amino acids composition compares favorably with that of soybean (El-Adawy 1996, Prasad *et al*., 2016). Afghanistan is an agricultural based economy where wheat, rice, maize and pulses are major field crops. Among these, pulses constitute the main source of plant-based protein for the ever-rising human population. The pulses are excellent source of protein nutrition for livestock too. 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 this crop with only one 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, mungbean yield is quite poor in Afghanistan because of non-availability of high yielding varieties, poor nutrient management especially phosphorus (P), broadcasting of seeds and being a rain fed crop due to poor irrigation infrastructure (Choudhary *et al*., 2015; Noorzai *et al*., 2017).

Growth and development of crops depend largely on the development of root system. Phosphorus is one of the three macro nutrients that plants obtain from the soil. Phosphorus is a major component of compounds whose functions relate to growth, root development, flowering, and ripening (Raboy, 2003). Most of the soils throughout the world are phosphorus deficient (Batjes, 1997). Hence, the effect of phosphorus on root development is well known (Hossain and Hamid, 2007). Addition of phosphorus fertilizer improve root development, which enhance the act of other nutrients and water to the growing parts of the plants, resulting in an increased photosynthetic and more dry matter production. The application of phosphorus to mungbean has been stated to increase dry matter at harvest, number of pods plant per plant, seeds pod per plant, 1000 grain weight, seed yield and total biomass (Mitra *et al*., 1999). The yield and quality of mungbean can be improved by applying best agronomic practices and use of high yielding cultivars. Cultivars of mungbean vary in yield and yield components. Ayub *et al*. (1999) obtained significantly higher seed yield of mungbean cultivars. NM-92 over NM-54 due to higher number of pods bearing branches plant per plant, number of pods and number of seeds pod per plant, However, Khan *et al*. (1999) found statistical difference between the yield components of mungbean cultivars under observation. For every climate, there are cultivars of different crops. Yaday and Warsi (1988) found significant differences in yields and yield components of different mungbean cultivars. Keeping in view the importance of phosphorus levels and mungbean cultivars, the present research was designed to investigate the effect of P levels and different variety on yield and yield components of mungbean cultivars.

**MATERIAL AND METHODS**

Field experiments were conducted to evaluate the effect of two mungbean cultivars with different phosphorus levels under Badghis condition during spring 2020 at the Agronomic research area, Badghis higher education institute Afghanistan. The experiment was laid out in randomized complete block design with three replication. The treatment was comprised of the experiment i.e.; tow mungbean varieties Mai-08 and Nayab-98 with four phosphorus levels viz., control, 40, 60 and 80 kg/ha with a basal dose of Nitrogen @ 20 kg/ha. Di ammonium phosphate and urea fertilizer were used as source of phosphorus and nitrogen respectively, all phosphate and nitrogenous fertilizer were applied before sowing. Crop was sown at the rate of 25 kg seeds/ha and hand weeding were done at 30, 45 days after sowing. Data on number of pods per plant, number of seeds per pod, pod length, 1000 grain weight, and number of nodules per plant, grain yield, straw yield and harvest index was recorded and analyzed statistically using Fisher’s analysis of variance technique.

**RESULT AND DISCUSSION**

**Number of branches per plant**

Number of branches per plant of mungbean showed significant difference due to varieties (Table 1). Maximum number of branches per plant was recorded with the variety Mai-08 (5.145) over variety of Nayab-98 (4.981). Yadav *et al.* (2011) found similar variation in mungbean varieties on number of branches per plant. Different levels of phosphorus application showed significant difference on number of branches per plant of mungbean. Maximum number of branches per plant 6.394 were obtained from the treatment fertilized with 80 kg P2O5/ha, it was followed by treatment 60 kg P2O5 and 40 kg P2O5/ha with 5.413, 4.111 number of branches per plant respectively. While significantly least number of branches per plant was counted in control plot. Similar result also reported by (Tesfaye *et al.,* 2007).

**Number of pods per plant**

Effect of varieties on number of pods per plant was significant (Table 1). The highest pods per plant was recorded with the varieties of Mai-08 (21.013) over Nayab-98 (20.125). Same result has been reported by Singh *et al.* (2007) who studied that variety has significantly effects on number of pods per plant of mung bean. Significantly variation in the number of pods per plant of mungbean was observed due to phosphorus application. Among different nutrient higher values of pods per plant was recorded form treatment 80 kg P2O5/ha followed by 60 kg P2O5 and 40 kg P2O5/ha. Higher number of pods per plant might have been possible due to more vigor and strength attained by the plants as a result of attained by the plants due to sufficient absorption of nutrients might have resulted in higher test weight. These results are in favour of the findings of Muhammad *et al.* (2004) and Prasad *et al.* (2005) who also reported an increased in number of pods per plant in response to phosphorus application.

**Pod length**

It was observed that pod length due to varieties showed significant difference (Table 1). The highest pod length was recorded with Mai-08 (5.79 cm) over Nayab-98 (5.51 cm). According to Habib and Zamin (2003) pod length varies among different pea cultivars. Pod length of mungbean significantly affected by different levels of phosphorus. Among different levels of phosphorus significantly higher pod length (6.49 cm) was recorded from P2 (60 kg P2O5/ha) followed by P3 (80 kg P2O5/ha) and P1 (40 kg P2O5/ha). Pod length form P2 (60 kg P2O5/ha) was significantly higher than all treatment and the lowest pod length was in control plot. Similar results reported by Nadeem *et al.* (2003).

**Number of seeds per plant**

The difference in number of seeds per plant due to varieties was significant (Table 1). Maximum number of seeds per plant recorded with the variety Mai-08 (201.4) over Nayab-98 (196.3). These results agree with those of Uddin *et al.* (2009) who reported difference in number of grains per plant among the varieties might be due to genetically determined difference in uptake of nutrient. The data regarding number of seeds per plant were significantly affected by different levels of phosphorus. Maximum number of seeds per plant was recorded with 80 kg P2O5/ha (243.3) followed by 60 and 40 kg P2O5/ha which are also significantly differ from each other producing 227.1 and 175.5 seeds per plant respectively. This result was in agreement with Swapna *et al*. (2012).

**1000-grain weight (g)**

Data pertaining to 1000-grain weight showed significantly difference between varieties (Table 1). Higher 1000-grian weight was recorded with variety of Mai-08 (30.06 g) over variety Nayab-98 (29.54 g). These results were similar to those reported by Uddin *et al.* (2009) that differences among the 1000 grains weight in these cultivars might be due to hereditary superiority, growth rate, crop potential of yield. Among different levels of phosphorus significantly higher 1000-grian weight (32.74 g) recorded form treatment 80 kg P2O5/ha followed by treatment 60 kg P2O5/ ha and 40 kg P2O5/ha. All were markedly higher over control. Results supported by Muhammad *et al*. (2004).

**Grain yield kg/ha**

The result showed that grain yield difference between varieties was significant (Table 1). Maximum grain yield was recorded with the variety Mai-08 (1065.21 kg/ha) over variety Nayab-98 (1028.75 kg/ha). These results are in agreement with Naeem *et al.* (2000) who reported that differences between the yield in these cultivars might be due to hereditary superiority, growth rate, crop yield potential. Significantly higher grain yield (1230.43 kg/ha) was recorded from treatment 80 kg P2O5/ha followed by treatment 60 kg P2O5/ha and 40 kg P2O5/ha. All phosphorus fertilizer results significantly higher grain yield than control. These results were same as by Bhattarai *et al*. (2003).

**Straw yield kg/ha**

It was observed that straw yield due to varieties showed significant difference (Table 1). The highest straw yield was recorded with Nayab-98 variety (1758.76 kg/ha) over Mai-08 (1681.81 kg/ha). Similar results were also reported by Nagarjaiah *et al.* (2005). Different levels of phosphorus application showed significant difference on straw yield of mungbean. Maximum straw yield was recorded with treatment 80 kg P2O5/ha (1891.23 kg/ha). Treatment with 80 kg P2O5/ha was significant than all treatments. Results are in close conformity with the findings of Meena *et al.* (2002).

**Harvest index**

Data regarding harvest index between varieties showed significantly difference (Table 1). Maximum harvest index was recorded with Mai-08 variety (38.66 %) over Nayab-98 (36.78 %). These results agree with the findings of Singh *et al.* (2007). Varying levels of phosphorus applications indicates significant effect on harvest index. Higher harvest index (39.42 %) was noted with treatment 80 kg P2O5/ha followed by treatment 60 kg P2O5/ha and 40 P2O5/ha. Minimum harvest index (36.73 %) was recorded in control plot. These results are in agreement with Kumar *et al.* (2012) who reported that increasing rate of phosphorus application significantly increased harvest index over control plots.

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| **Treatments** | **No. of branches/plant** | **No. of**  **pods/plant** | **Pod length (cm)** | **No. of seed/plant** | **1000 grain weight (g)** | **Grain yield (kg/ha)** | **Straw yield (kg/ha)** | **Harvest index (%)** |
| P0-0 kg P2O5 ha-1 | 4.111 | 16.68 | 4.38 | 149.5 | 26.78 | 864.52 | 1489.95 | 36.73 |
| P40-40 kg P2O5 ha-1 | 4.335 | 18.83 | 5.47 | 175.5 | 28.86 | 954.25 | 1676.55 | 36.28 |
| P60-60 kg P2O5 ha-1 | 5.413 | 21.88 | 6.49 | 227.1 | 30.82 | 1138.72 | 1823.414 | 38.44 |
| P80-80 kg P2O5 ha-1 | 6.395 | 24.88 | 6.28 | 243.3 | 32.74 | 1230.43 | 1891.23 | 39.42 |
| S. Em. ± | 0.0425 | 0.183 | 0.065 | 1.505 | 0.181 | 6.220 | 15.866 | 0.269 |
| CD at 5% | 0.129 | 0.557 | 0.198 | 4.565 | 0.552 | 18.867 | 48.126 | 0.818 |
| Varieties |  |  |  |  |  |  |  |  |
| Nayab-98 | 4.981 | 20.125 | 5.51 | 196.3 | 29.54 | 1028.75 | 1758.76 | 36.78 |
| Mai-08 | 5.145 | 21.013 | 5.79 | 201.4 | 30.06 | 1065.21 | 1681.81 | 38.66 |
| S. Em. ± | 0.030 | 0.129 | 0.463 | 1.064 | 0.128 | 4.398 | 11.219 | 0.190 |
| CD at 5% | 0.091 | 0.394 | 0.140 | 3.228 | 0.390 | 13.341 | 34.030 | 0.578 |

**Table 1. Effect of phosphorus levels and varieties on No. of branches per plant, No. of pods per plant, pod length (cm), No. of seed per plan, 1000 grain weight (g), grain yield kg/ha, straw yield kg/ha and harvest index (%) of mungbean.**

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