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Impact of Phosphorus Levels and Application of Molybdenum of Blackgram (*Vigna mungo* L.) on Growth and Yield Attributes

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ABSTRACT: The aim of this research was to determine the effect of phosphorus and application of molybdenum of blackgram (*Vigna mungo* L.) on growth and yield attributes (Var. Shakher-II). An experimental field investigation was undertaken at the Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, during the *Kharif* of 2020. (U.P.). Phosphorus and Molybdenum are the important factors for increasing the growth and production. The soil in which experiment plot was sandy loam in texture, pH was practically neutral (7.4), organic carbon was low (0.28%), available N was 225 kg/ha, available P was 21.50 kg/ha and available K was 125.9 kg/ha. The Observation Nine treatments were replicated three times in a randomized block design the findings show that yield attributes *viz.* the no. of pods produced for plants (35.07), seeds per pod (4.80) and test weight (24.39 g) obtained with maximum application of 40 kg/ha P_2O_5 along with Mo (Foliar spar 0.8% at 25 DAS). However, seed yield (1369.25 kg/ha), stover yield (2471.98 kg/ha) and harvest index (35.64 %) was also recorded with the application of 40 kg/ha P_2O_5 along with Mo (Foliar spray 0.8% at 25 DAS) respectively.

Keywords: Black gram, Molybdenum, Phosphorus, yield

INTRODUCTION

Black gram is scientifically known as (*Vigna mungo* L.) and commonly known as Urd in India. Pulses are crucial in Indian agriculture because their nodules fix atmospheric nitrogen restoring soil fertility. Pluses are known as a “Marvel of Nature” because of their drought resistance and ability to soil erosion due to their deep root structure and good ground covering. The steady increase in Indian population together with stagnant production of pulses over the past four decades compared to cereals has naturally resulted in decreased per cent availability of pulses. Therefore, much attention has been given to boost up pulse production in India. The World Health Organization (WHO) advices an average of 80gms of pulses/person each day, whereas the Indian council of medical research advices a minimum of 47gms. The normal utilization in India was 56g per person per day (Anonymous, 2004). To raise public awareness of nutritive value of pulse, the United Nations recognized 2016 as the IYP benefit of pulses as part of sustainable food production aimed at food security and nutrition. Pulses are an integrated any part to abundance diet across they are over the world and they have a huge amount of potential to develop human health, converse our soil, preserve the environment and contribute to global food security. Black gram is a tropical leguminous plant (Singh *et al.*, 2017). Black gram many areas of India grow this crop. This crop is produced as a mixed crop, catch crop and sequence crop in cropping system, as well as a solitary crop under residual moisture conditions following the harvest of other summer crops on semi-irrigated and dry land. Its seeds are rich in protein (25-26%), carbs (60%), lipids (1.5%), enzymes, amino acids and vitamins as well as other nutrients. Seed are used in the preparation of many popular dishes. It can be calculated about 42 kg N per hectare in soil. Being a legume, it also enriches soil by fixing atmospheric nitrogen.

In most soils, especially lite textured soils phosphorus is a universally inadequate plant nutrient phosphate application to pulse crops has been proven to the highly successful and has been dubbed the “master key ingredient” for enhancing production. It is essential for proper growth and development and an appropriate supply of phosphorous has been linked to improved growth yield and purity nodule formation in legumes (Sammauria *et al.*, 2009).

Among many crop production constraints, continuous cultivation of traditional low potential cultivars, use of low seed rate, and improper farming techniques are the important factors that produce more seed yield in blackgram. Appropriate phosphorus and molybdenum are the important factors that produce more seed yield in blackgram.

Mo is one of the most well-known nutritional components that are necessary for plant development. Heat and drought stress produced by climate change aggravate food security in the twenty first century, especially in tropical regions legumes are an excellent and comparatively affordable source of proteins, carbs and minerals for developing nations, like India In acidic soils (pH <5.5) As anion adsorption to soil oxides rises, Mo availability declines (Reddy *et al.,* 1997). Because of its critical role in the nitrogen- fixation process, it is widely known that legumes require more Mo then most other plants (Mcbride, 2005) because of its crucial role in the nitrogen-fixation process. Molybdenum has been perceived as an important micro-nutrient as it paucity lead to poor seed yield in pulses. It is structural component of nitrogenase and nitrate reductase enzymes which brings about oxidation-reduction reaction in plant cells (Yadav and LYaY 2017).

Keeping in sight the above details, the present experiment was conducted to study the response of blackgram under impact of phosphorus levels and application of molybdenum treatments under eastern Uttar Pradesh condition.

RESEARCH MATERIAL AND METHODS

The research was carried out during *kharif* season of 2020 at Sam Higginbottom university of Agriculture, Technology and Sciences, Crop Research Farm, Department of Agronomy, Naini Agricultural Institute (SHUATS), Prayagraj (U.P.) which is located at 25°24′ 42″ N latitude, 81°50′ 56″ E longitude and 98 m altitude above the mean sea level (MSL). The experiment consisted of nine treatments, each of which was replicated three times using the Randomized Block Design method with three phosphorus levels *viz.* 20, 30, 40 kg/ha and three levels of application of molybdenum 8 g/kg seeds (seed treatment), 0.4% at 15 DAS and 0.8% at 25 DAS (Foliar spray). The treatment combinations which are T_1: 20 kg/ha P_2O_5 + Mo (Molybdenum) 8 g/kg of seeds (seed treatment), T_2: 20 kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS, T_3: 20 kg/ha P_2O_5 + Mo 0.8% foliar spray at 25 DAS, T_4: 30 kg/ha P_2O_5 + Mo 8 g/kg seeds (seed treatment), T_5: 30kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS, T_6: 30 kg/ha P_2O_5 + Mo 0.8% foliar spray at 25 DAS, T_7: 40kg/ha P_2O_5 + Mo 8g/kg seeds (seed treatment), T_8: 40 kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS and T_9: 40 kg/ha P_2O_5 + Mo 0.8% foliar spray at 25 DAS. The soil in the experimental area had a sandy loamy structure was almost neutral in soil reaction (pH 7.4), had low organic carbon (0.28%), available N (225 kg/ha), available P (21.50 kg/ha) and available K (125.9kg /ha). Fertilizers were applied in bands along the seed rows, with 4-5 cm deep furrows dug by hand hoe as band placement for which 4-5 cm deep furrows were made along the seed rows with hand hoe. The nutrient sources were Urea, SSP and MOP to fulfil the requirement of nitrogen, phosphorus and potassium and also molybdenum source were supplied as ammonium molybdate. Irrigation was based on the necessity and as per the time of sowing. The yield attributes *viz.* number of pods/plant, number of seeds/pod, test weight, grain yield, haulm yield and harvest index were all taken note with standard process of observation. The data was statistically analysed in Randomized Block Design, analysis of variance (ANOVA) is used (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

A. Growth attributes

Table 1 shows the plant height based on the available data (cm) at initial stages 15 DAS there was no statistically significant difference between among treatments and maximum plant height (11.54 cm) was observed in 40 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg Seed) and at 30 DAS there was no significant change difference between treatments highest plant height was observed (18.10 cm) was observed in 40 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS). About 45 and 60 DAS plant height were 40.10 cm and 45.53 cm significantly highest in 40 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS). Phosphorus enhanced plant photosynthetic activity and aided in the formation of more extensive root system, allowing the plant to collect more water and nutrients from deeper soil depths, resulting in improved plant growth and production characteristics also been reported by Vikrant *et al.,* (2005) and Parmar and Thanki (2007).

Table 1: Impact of Phosphorus Levels and Application of Molybdenum Effects on Blackgram on Plant height at Different Growth Intervals.

Sr. No.	Treatments	15 DAS	30 DAS	45 DAS	60 DAS
1.	20 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg Seed)	10.77	16.63	33.67	39.13
2.	20 kg/ha P_2O_5 + Mo (Foliar spray 0.4% @ 15 DAS)	10.23	16.13	33.87	40.33
3.	20 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS)	10.43	15.93	34.27	42.80
4.	30 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg seed)	11.01	16.93	33.67	39.27
5.	30 kg/ha P_2O_5 + Mo (Foliar spray 0.4% @ 15 DAS)	10.59	16.53	35.67	43.07
6.	30 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS)	10.33	16.77	35.03	39.77
7.	40 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg Seed)	11.54	16.53	36.17	41.33
8.	40 kg/ha P_2O_5 + Mo (Foliar spray 0.4% @15 DAS)	10.63	17.80	38.80	44.13
9.	40 kg/ha P_2O_5 + Mo (Foliar spray 0.8 @ 25 DAS)	9.51	18.10	40.10	45.53
	SEm±	0.48	0.76	0.70	1.43
	CD (P = 0.05)	-	-	2.09	4.21

The data pertaining that in Table 2 branches at 30 DAS there was no statistically significant difference among treatments maximum no. of branches was 2.80, at 45 and 60 DAS significantly highest in treatment 40 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS) with 4.73 and 5.33. Highest no. of branches/plant were obtained with the application of 40 kg phosphorus and 30 kg sulphur/ha. Related results were reported by Sune *et al.*, 2006.

The data presented in Table 3 indicated that no. of nodules at 15, 30, 45 and 60 DAS significantly maximum number of nodules were 8.33, 15.90, 26.90, 25.20 was recorded in 40 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS). The rise in nodulation, rooting and growth could be owing to an increase in the number of nodules which could have supplied enough nitrogen through nitrogen fixation, boosting black gram productivity by Prasad *et al.*, 2014. In legume crops, limiting and Mo had a favourable impact on growth, yield, nitrogen content of leafs and roots and nodular formation (Togay *et al.*, 2008).

Table 2: Impact of Phosphorus Levels and Application of Molybdenum Effects on Blackgram number of Branches at Different Growth Intervals.

Sr. No.	Treatments	30 DAS	45 DAS	60 DAS
1.	20 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg Seed)	2.33	3.73	4.20
2.	20 kg/ha P_2O_5 + Mo (Foliar spray 0.4% @ 15 DAS)	2.33	4.13	4.40
3.	20 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS)	2.47	4.33	4.67
4.	30 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg Seed)	2.20	4.33	4.67
5.	30 kg/ha P_2O_5 + Mo (Foliar spray 0.4% @ 15 DAS)	2.40	4.40	4.87
6	30 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS)	2.33	3.73	4.00
7.	40 kg/ha P_2O_5 + Mo (Seed treatment 8 g/kg Seed)	2.33	4.00	4.40
8.	40 kg/ha P_2O_5 + Mo (Foliar spray 0.4% @ 15 DAS)	2.60	4.60	5.13
9.	40 kg/ha P_2O_5 + Mo (Foliar spray 0.8% @ 25 DAS)	2.80	4.73	5.33
	SEm±	0.29	0.11	0.16
	CD (P=0.05)	-	0.32	0.49

Table 3: Impact of Phosphorus Levels and Application of Molybdenum Effects on Blackgram number of Nodules at Different Growth Intervals.

Sr. No.	Treatments	15 DAS	30 DAS	45 DAS	60 DAS
1.	20 kg/ha P_2O_5 + Mo 8 g/kg of seeds (seed treatment)	6.07	10.20	24.17	20.50
2.	20 kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS	6.13	10.77	24.37	18.72
3.	20 kg/ha P_2O_5+ Mo 0.8% foliar spray at 25 DAS	6.37	11.60	25.17	20.10
4.	30 kg/ha P_2O_5 + Mo 8 g/kg of seeds (seed treatment)	6.67	11.80	24.57	18.52
5.	30 kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS	7.33	12.87	24.90	20.70
6.	30 kg/ha P_2O_5+ Mo 0.8% foliar spray at 25 DAS	7.40	13.50	25.63	19.85
7.	40 kg/ha P_2O_5 + Mo 8 g/kg of seeds (seed treatment)	7.50	14.03	25.83	21.09
8.	40 kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS	8.13	15.07	26.03	20.15
9.	40 kg/ha P_2O_5 + Mo 0.8% foliar spray at 25 DAS	8.33	15.90	26.90	25.20
	SEm±	0.13	0.16	0.21	1.17
	CD (P=0.05)	0.40	0.49	0.62	3.50

Yield attributes: Table 4 shows indicated that significantly maximum number of pods per plant (35.07), Seed yield (1369.25 kg/ha), Stover yield (2471.98 kg/ha), Biological yield (3841.23 kg/ha) and Harvest index (35.64 %) was reported in the treatment of 40 kg/ha P_2O_5 + Mo 0.8% foliar spray at 25 DAS. With 40 kg/ha P_2O_5 + Mo 0.4% foliar spray at 15 DAS in yield parameters like no. of pods per plant (34.60), seed yield (1229.55), Stover yield (2439.48), biological yield (3669.03) and harvest index (33.61) was raise statistically at par with 40 kg/ha P_2O_5 + Mo 0.8% foliar spray 25 DAS. According to the statistics in Table 4, indicated that the number of seeds per pod, test weight showed non-significant results. Higher no. of pods per plant by application of Mo might have been possible due to increased availability of nitrogen due to biological nitrogen fixation that induces plant growth to produce huge biomass, pod and grain yield. The present outcome is in conformity with the findings of the above harvest index and test weight was observed with higher levels of phosphorus. It may be due to vigorous start to plant and support straw by the higher dose of phosphorus application. Singha and Sharma (2001). The prenominal due to an increase in blackgram growth and production mutual benefit of these ions in improving absorption and utilization of nutrients. The synergetic interaction of P and Mo also influence the availability of certain essential nutrients that employs better uptake and maintain source and sink relationship. This result is in harmonious with Kumar and Singh (1980), Awomi *et al.*, (2012) and Bhuiyan *et al.*, (2008). The propitious outcome was due to regulatory function of P in photosynthesis that escalates carbohydrate accumulation and sugar metabolism. It also coordinates starch, sucrose ratio and governs proper mobilization of photosynthesis that leads to increased flowering, fruiting and seed formation. The energy obtained from photosynthesis. This result was accordance with Bhattacharya and Pal (2001), Basu *et al.*, (2003) and Biswas *et al.*, (2009).

Table 4: Impact of Phosphorus Levels and Application of Molybdenum Effects of Blackgram on Yield attributes.

Sr. No.	Treatments	Pods/plant	Seeds/pod	Test weight (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
1.	20 kg/ha P_2O_5+ Mo 8 g/kg of Seeds (Seed treatment)	27.33	4.00	23.10	841.15	2069.24	2910.39	28.91
2.	20 kg/ha P_2O_5 + Mo 0.4 % foliar spray at 15 DAS	32.73	3.60	22.44	881.19	2083.13	2992.29	29.s39
3.	20 kg/ha P_2O_5 + Mo 0.8 % foliar Spray at 25 DAS	30.43	4.30	23.94	1032.48	2416.43	3456.51	30.01
4.	30 kg/ha P_2O_5 + Mo 8 g/kg of Seeds (Seed treatment)	32.27	3.93	21.00	889.28	2110.96	3000.18	29.75
5.	30 kg/ha P_2O_5 + Mo 0.4 % foliar Spray at 15 DAS	31.37	3.80	23.58	933.09	2260.88	3193.96	30.70
6.	30 kg/ha P_2O_5 + Mo 0.8 % foliar Spray at 25 DAS	33.67	4.40	24.07	1231.33	2349.73	3581.05	34.32
7.	40 kg/ha P_2O_5 + Mo 8 g/kg of Seeds (Seed treatment)	33.00	4.43	24.09	1167.51	2416.43	3583.93	32.53
8.	40 kg/ha P_2O_5 + Mo 0.4 % foliar Spray at 15 DAS	34.60	4.53	24.15	1229.55	2439.48	3669.03	33.61
9.	40 kg/ha P_2O_5 + Mo 0.8 % foliar Spray at 25 DAS	35.07	4.80	24.39	1369.25	2471.98	3841.23	35.64
	SEm±	0.59	0.25	1.40	64.86	69.38	93.80	1.58
	CD (P=0.05)	1.76	-	-	194.44	208.01	281.22	-

CONCLUSION

Based on the findings it is possible to achieved that for optimum seed yield, the performance of black gram at 40 kg/ha P_2O_5 + Mo 0.8% foliar spray at 25 DAS helpful for producing more yield under East U.P.

FUTURE SCOPE

Since the conclusions are based on study conducted over a single season in Allahabad's agro-ecological circumstances, further trials may be necessary before it can be considered a suggestion.

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Conflict of Interest. Nil.

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