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Effect of phosphorus and molybdenum on nutrients content of broad bean (*Vicia faba* L)

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Abstract
A field experiment was conducted during *Rabi* season at Agricultural Research Farm R.B.S. College Bichpuri Agra to study the effect of phosphorus and molybdenum on nutrients content of broad bean (*Vecia faba* L.). The experiment was laid out in randomized block design with four levels of phosphorus (control, 30, 60 and 90 kg P_2O_5 ha^{-1}) and four levels of molybdenum (control, 1.0, 2.0 and 3 kg ha^{-1}) The levels of phosphorus influences the nutrients content of broad bean crop and increased significantly with P_1 @ 30 kg ha^{-1}, P_2 @ 60 kg ha^{-1} and P_3 @ 90 kg ha^{-1} levels of phosphorus as compared to control during both the years. The levels of molybdenum also affected significantly the nutrients composition of broad bean crop in both the years. However the phosphorus @ 90 kg^{-1} and molybdenum @ 3.0 mg kg^{-1} provided significantly higher nutrients content of broad bean crop over rest of the treatments.

Keywords: Broad bean, nutrient composition

Introduction
Phosphorus is essential element required for plant growth and root development. It is found in every living cell of the plant and animals. It is known to be associated with several vital functions in the plant body such has utilization of sugar and starch, photosynthesis, nuclear formation, cell division, fat and albumin formation, cell organization and transfer of the heredity, the availability of phosphorus from soil to plants depends upon the equilibrium adjustment around the root zone. The equilibrium is influenced mainly by salt concentration pH, Calcium Carbonate, Nature of exchangeable complex and organic matter. The essential role played by trace elements in nutrition and metabolism of plants is established beyond any controversy. Molybdenum, one of the important members of this group is of special significance due to its contribution in activation of several enzyme systems and physiological activities encountered inside the plant body. Molybdenum is a constituent part of the enzyme nitrate reductase concerned with the reduction of nitrate to nitrite in both microorganisms and higher plants. It is also known to be specific inhibitor for acid phosphates. Deficiency of molybdenum has also been shown to decrease the concentration of sugar, particularly reducing sugars, suggesting an involvement of molybdenum in carbohydrate metabolism. It also results in a decrease in the ratio of organic phosphorus/inorganic phosphorus, an effect that could perhaps be explained in the light of the known role of molybdenum as an inhibitor or acid phosphates. Excessive molybdenum level in herbage seldom retards the plant growth, but is toxic to ruminant animals that are fed such molybdenum rich herbage; the excessive intake of molybdenum causes a disease in the animals called moly bdenosis. Hence, molybdenum is important in fodders as it determines the suitability of fodder for animal use. On the other hand, besides nitrogen, phosphorus and molybdenum application has been of farmer's interest for proper nodulation and increasing fodder production. Anderson (1956) [1] concluded that phosphorus and sulphur deficiencies often occur in the same conditions as that of molybdenum deficiency and no response to molybdenum most legume crops. In the eastern part of the United States, at succeeds without the addition of time.

Vicia hirsute and *Vicia faba* are found in cultivated areas as need in Uttar Pradesh, Madhya Pradesh, West Bengal and Bihar. Even these are grown in Nepal and up to 2,000 M. of the Nilgiris. In India, garden bean (*Vicia faba* L.) and hairy Vetch (*Vicia hirsute*) seed should be sown in succession from the middle of September to the end October the seed should be soaked in warm water for 6 to 8 hours before sowing. The seed should be put i the ground 5 cm. deep in rows of double drill 10 cm apart. The broad bean are mostly used in the Southern part of United States as a cover and green manure crop although occasionally they are cut for hay except the Pacific North- West where it is used for hay either alone or in mixtures with small grains. Generally, broad bean is not grown in India, but some authorities consider that

They have same future in India for fodder and green manure purposes.

Materials and Methods

The field experiments were conducted at the Agriculture Research farm of R.B.S. College Bichpuri, Agra (located in semiarid or gray steppe arid region of South-Western Uttar Pradesh. the intersect of 27.2 0 N attitude and 77.9 0 E longitude), during two consecutive rabi seasons of 2006-07 and 2007-08 on sandy loam soil. The soil had EC 0.16 dSm^{-1}, pH 8.4, organic carbon 4.4 g kg^{-1}, available N 190, P 19.4, K 211 kg ha^{-1}, and molybdenum 0.05 mg kg^{-1}. The experiment was laid out in randomized block design with four levels of phosphorus (control, 30, 60 and 90 kg P_2O_5 ha^{-1}) and four levels of molybdenum (control, 1.0, 2.0 and 3 kg ha^{-1}) with three replications. The recommended doses of N and K @ 25 and 60 kg K_2O ha^{-1}, respectively were applied as urea and muriate of potash. Phosphorus and molybdenum were supplied through single super-phosphate and ammonium molybdate as per treatments. The Plants were thinned out 15 days after sowing. Equal amount of water was supplied to every plot at the time of irrigation. The crop was harvested after maturity and grain and stover yield were also recorded by keeping the samples in air drier at 40ºC temperature. Plant samples were analyzed for their N P K and Mo content. Nitrogen was analyzed by fallowing the procedure as given by the Snell and Snell (1955) [9], phosphorus by Jonson and Ulrich (1959) [3], potash by flame photometer method and molybdenum by Atomic Absorption Spectrophotometer (AAS) method.

Results and discussion

Nitrogen Content

It was observed that the nitrogen content in grain and straw of broad bean varied with the increasing level of nitrogen application. Nitrogen content in grain and straw of broad bean varied from 2.68 to 2.84 and 1.48 to 1.58%. The highest level of phosphorus (P_3) contained higher nitrogen in comparison to P_0, P_1 and P_2 levels of phosphorus during both the years of experimentation Singh *et al.* (2008) [5]. Significantly higher nitrogen content in grain and straw of broad bean (2.68 and 1.59) were observed with application of molybdenum @ 3 kg ha^{-1} followed by @ 2 kg ha^{-1} (2.28 and 1.52) and 1 kg ha^{-1} (2.27 and 1.52) compared to control (2.63 and1.47) respectively. On the basis of pooled data of two years (table.1). Similar results were obtained by Lal *et al*. (2016) [4].

Table 1: Effect of phosphorus and molybdenum on nitrogen, phosphorus, potassium and molybdenum content in grain and stover of broad bean crop during pooled data of two years

Treatment	Nitrogen (%)		Phosphorus (%)		Potassium (%)		Molybdenum (ppm)	
	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover
Phosphorus Levels								
P_0	2.68	1.48	0.55	0.22	1.19	1.53	3.66	2.11
P_1	2.74	1.52	0.60	0.24	1.21	1.58	4.03	2.42
P_2	2.80	1.56	0.66	0.26	1.22	1.61	4.38	2.64
P_3	2.84	1.58	0.72	0.28	1.23	1.65	4.79	2.91
S.Em±	0.0045	0.0023	0.0024	0.0019	0.0026	0.0022	0.0713	0.0314
C.D. at 5%	0.0127	0.0064	0.0069	0.0053	0.0074	0.0062	0.1998	0.0881
Molybdenum Levels								
M_0	2.63	1.47	0.58	0.21	1.17	1.52	3.21	2.04
M_1	2.72	1.52	0.62	0.23	1.19	1.57	3.86	2.32
M2	2.80	1.57	0.65	0.26	1.23	1.62	4.51	2.68
M_3	2.68	1.59	0.68	0.28	1.25	1.65	5.27	3.03
S.Em±	0.0078	0.0023	0.0024	0.0019	0.0026	0.0022	0.0713	0.0314
C.D. at 5%	0.0227	0.0064	0.0069	0.0053	0.0074	0.0062	0.1998	0.0881

Phosphorus Content

On the basis of pooled data of two years, that the phosphorus content in grain and stover of broad bean varied from 0.55 to 0.72 and 0.22 to 0.28%. Significantly higher phosphorus content in grain and stover yield of broad bean (0.72 and 0.28) was observed with application of phosphorus @ 90 kg ha^{-1} followed by @ 60 kg ha^{-1} (0.66 and 0.26) and 30 kg ha^{-1} (0.60 and 0.24) compared to control (0.55 and 0.22) (table.1). These results in favor of Singh *et al.* (2016), Singh and Singh (2003) [6] and Singh *et al.* (2008) [5]. That the phosphorus content in grain and stover of broad bean crop increased significantly with increasing levels of molybdenum. The highest level of molybdenum @ 3 kg ha^{-1}, contained higher phosphorus content in comparison to M_0, M_1 and M_2 levels of molybdenum during both the years of experimentation (table.1). Similar to these findings are Lal *et al.* (2016) [4] and Singh and Singh (2003) [6].

Potassium Content

Concentration of potassium in grain and stover of broad bean crop was significantly influenced by application of phosphorus and it varied from 1.19 to 1.23 and 1.53 to 1.56%. Significantly higher potassium content in grain and stover of broad bean crop (1.23 and 1.56%) was observed with the application of phosphorus @ 90 kg ha^{-1} followed by @ 60 kg ha^{-1} (1.23 and 1.61) and 30 kg ha^{-1} (1.21 and 1.58) compared to control (1.19 and 1.53) during both the years of experimentation and pooled analysis. Molybdenum application significantly increased the potassium in grain and stover of broad bean crop and it varied from 1.17 to 1.29 and 1.52 to 1.65% across the treatments (table-1). The maximum potassium content significant increase was noted at highest level of molybdenum @ 3 kg ha^{-1} over control with respect to potassium control in grain and stover during both the years of experimentation. Similar to these findings are Lal *et al.* (2016) [4] and Singh and Singh (2006).

Molybdenum Content: (ppm)

As indicated in (table-1) that the molybdenum content in grain and straw of broad bean linearly increased significantly with each level of phosphorus in comparison to control. The maximum significant increase in molybdenum content in grain and stover broad mean was observed with @ 90 Kg ha^{-1} of phosphorus during each year of investigation. (Hala *et al.* 2013) [2]. Further it is seen from table (1) that each higher level of molybdenum resulted significantly higher

molybdenum content in grain and straw of broad bean as compared to control during both years of investigation. It is also evident that each higher level of molybdenum resulted significantly higher molybdenum value should be added content in grain and straw of broad bean crop in comparison to preceding lower levels of molybdenum. The maximum enhancement in molybdenum content was noted at M_3 @ 3 Kg ha^{-1} level of molybdenum at both the years of experimentation. Singh *et al.* (2014) [8].

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