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Response on various soil properties as a result of broad bean crop under phosphorus and molybdenum treatments

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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 influence the nutrients in soil 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. The levels of molybdenum also affected significantly the nutrients in soil. However, the phosphorus @ 90 kg^{-1} and molybdenum @ 3.0 mg kg^{-1} provided significantly higher nutrients in soil over rest of the treatments.*

Key words: Broad bean, nutrient composition

Introduction

The soil of Agra region has developed on the alluvium of river Yamuna. Alkaline pH and severe salinity/ sodicity problems are common throughout the district. The alluvium is divided in two sub groups (i) old (Pleistocene) alluvium known as Bangar and (ii) recent alluvium known as Khaddar Bangar is rich in concentration and nodules of impure calcium carbonate of various size, while Khadar is free of lime nodules and alluvium are tertiary in age. 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. 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.

Materials and Methods

The field experiments were conducted at the Agriculture Research farm of R.B.S. College Bichpuri, Agra (located in semi arid 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

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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.

Soil Sampling and Analysis

Soil samples were collected during 2008 from the plow layer (0-15 cm depth) from the experimental plot after the crop harvest. These samples were partitioned and passed through standard prescribed sieves for further use in a different kind of analysis. The soil samples that passed through the 0.2-mm sieve was used for estimating organic carbon (OC). For the rest of the soil quality parameters such as chemical (pH), available N, available P, available K, and Mo parameters, soil samples that passed through 2-mm sieves were used. Soil pH was measured in a 1:2 soil/ water suspension (Richards, 1954), (Rhoades 1982), organic carbon by wet oxidation with sulfuric acid (H_2SO_4) + potassium dichromate ($K_2Cr_2O_7$) (Walkley and Black 1934), available N by alkaline-$KMnO_4$ oxidizable N method (Subbaiah and Asija 1956), available P by 0.5 M sodium bicarbonate ($NaHCO_3$) extraction method (Olsen et al. 1954), available K (Hanway and Heidal 1952) using inductively coupled plasma spectrophotometer (ICP-OES, GBC Australian model) (Lindsay and Norvell 1978),.

Results and Discussion

Effect of experimental treatments on soil properties:

The representative soil samples from the experimental plots were collected after broad bean crop harvest during both the years of experimentation and analyzed for pH, Organic Carbon available N, P, K and Mo. The treatment combination wise average data have been presented in Table 1 and some have been discussed in the following paragraphs.

Effect on soil pH

The data representing the average pH value of soil given in Table 1 show that the initial pH value of the experimental soil was 8.50 as a result of conducting experimentation it has been recorded 8.56. The maximum pH value 8.79 was observed under P_2M_1 treatment combination, however minimum pH value was recorded 8.04 under P_0M_0 treatment combination.

Effect on organic carbon of soil

The data representing the average organic carbon of soil given in Table 1 show that the initial organic carbon of the experimental soil was 0.44% as a result of conducting experimentation it has been recorded 0.447%. The maximum organic carbon 0.48%

Table 1: Effect of Phosphorus and Molybdenum on soil properties after harvesting the broad bean crop (Pooled).

Treatment combination	pH	Organic Carbon (%)	Nitrogen (Kg ha^{-1})	Phosphorus (Kg ha^{-1})	Potassium (Kg ha^{-1})	Molybdenum (Mg ha^{-1})
P_0M_0	8.04	0.40	180.50	16.00	200.00	0.051
P_0M_1	8.50	0.44	185.00	17.00	201.00	0.053
P_0M_2	8.56	0.42	188.38	18.00	203.00	0.054
P_0M_3	8.63	0.41	190.20	18.50	206.50	0.052
P_1M_0	8.5.	0.45	182.70	18.00	208.80	0.050
P_1M_1	8.54	0.46	190.75	19.00	210.60	0.054
P_1M_2	8.12	0.47	195.88	19.50	210.00	0.058
P_1M_3	8.49	0.44	198.00	19.80	218.00	0.057
P_2M_0	8.74	0.47	200.08	20.00	212.70	0.053
P_2M_1	8.79	0.48	193.06	20.20	218.30	0.056
P_2M_2	8.66	0.45	186.00	20.60	216.60	0.058
P_2M_3	8.56	0.43	203.00	20.80	213.90	0.062
P_3M_0	8.63	0.47	205.12	21.00	215.60	0.055
P_3M_1	8.67	0.48	197.42	21.50	218.80	0.059
P_3M_2	8.75	.43	188.87	21.80	214.00	0.060
P_3M_3	8.80	0.46	201.14	22.00	219.50	0.061
Average	8.56	0.44	192.88	19.60	211.70	0.055

was observed under P_2M_1 treatment combination, however minimum organic carbon was recorded 0.40% under P_0M_0 treatment combination.

Effect on nutrients composition of soil

The data representing the average N, P, K and M_0 of soil given in Table (1) show that the initial N, P, K and M_0 value of the experimental soil was 190.20, 19.40, 211.00 and 0.050 as a result of conducting experimentation it has been recorded 192.88, 19.60, 211.70 and 0.055 respectively. The maximum N, P, K and M_0 205.12, 22.0, 219.5 and 0.062 was observed under P_3 M_0, P_3M_3, P_3M_3 and P_2M_3 treatment combination, however minimum N, P, K and M_0 was recorded 180.50, 16.00, 200.00 and 0.050 under P_0 M_0, P_0M_0, P_0M_0 and P_1M_0 treatment combination respectively.

Over all the phosphorus and molybdenum application could not result any remarkable changes in soil properties.

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