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EFFECT OF NITROGEN AND PHOSPHORUS ON GROWTH AND YIELD OF MUNGBEAN GROWN IN SALINE SOIL OF KHULNA, BANGLADESH

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Response of mungbean (*Vigna radiata* var. BARI Mug-5) to applied nitrogen (0, 50, 100kg N ha^{-1}) and phosphorus (0, 75, 150 kg P ha^{-1}) in saline soil showed an improvement in growth and yield characteristics. Most of the growth and yield attributes increased significantly due to application of nitrogen alone. Phosphorus played significant role to stimulate the setting of pod and seeds of the plant. Root growth was significantly improved by individual and combined application of the fertilizers. Interactions of the fertilizers stimulated the formation of pod and seed together with grain yield of the crop.

Keywords :Grain yield; Mungbean, Nitrogen; Phosphorus; Saline soil.

Introduction

Mungbean is one of the most important food grain legume generally grown round the year[1]. It occupies about 8.18% of the total area of pulse production in Bangladesh[2]. Chandra[3] stated that about 70% of the mungbean crop is cultivated during the monsoon (*kharif*) season while the remaining 30% is grown in the winter (*rabi*) season. Mitra *et al*[4] reported that the nitrogen requirement for seed development of mungbean is very high. Similar views were also proposed by other investigators[5,6].

Mungbean is a popular item of food legume among the grain legumes and pulses. Nutritionally, it contains two-to-three times more protein than cereal grains and has remained the cheapest source of protein for people since the dawn of civilization[7]. Practically, pulses are the major source of protein of the average diet of the vast majority of the people of Bangladesh[8].

The costal zone of Bangladesh covering about 30% of the total cultivable area where only one crop (rice) with poor yield is grown[9]. Moreover, very limited works have been done on mungban in Bangladesh[1,8]. Therefore, an attempt has been made to assess the impact of nitrogen and phosphorus on growth and yield of mungbean in coastal soil of Khulna, Bangladesh.

Materials and Methods

Collected saline soil (0-15 cm) from Batiaghata seires of Khulna was processed. For greenhouse experiment of soil sample was grounded to 2 mm size and that for laboratory analysis to 100 mesh.

Greenhouse Experiment : Five kg processed soil was taken into a series of clean-dry twenty seven earthenware pots (20 cm x 25 cm). Nitrogen (0, 50, 100 kg N ha^{-1}) and phosphorus (0, 75, 150, kg P ha^{-1}) in all possible combinations together with a basal dose of potassium (50 kg K ha^{-1}) were applied to the soil. The fertilizers were added to the soil in the form of aqueous solutions of urea, TSP and MP in water. Extra calculated amount of water was added to bring the soil into a suitable potting consistency. A 3^2 factorial experiment with three replications was arranged during *rabi* season using mungbean (*Vigna radiata* var. BARI Mug-5) as the test crop.

Analytical Techniques : Determinations were made for mechanical analysis[10] (clay), pH (6.6, electrochemically), organic matter[11] (1.83), cation exchange capacity[12] (26 meq 100 g^{-1}), exchangeable cations[12] (Ca-8.0, Mg - 8.15, Na-9.0, K-0. 85 meq 100 g^{-1}) by spectrophotometrically and flame phtometrically using atomic absorption spectrophotometer and flame analyzer, total and available N[12] (0.18%, 6.21 mg 100 g^{-1}), and available phosphorus[13] (9.5 $\mu g\ g^{-1}$).

Results and Discussion

Growth and yield of mungbean as influenced by added nitrogen and phosphorus have been measured and the results thus obtained are presented in Table 1.

Results revealed that height of the plant increased significantly due to applied nitrogen and phosphorus fertilizers over the control (Table 1). Application of nitrogen alone improved the height of the plant significantly. However, the single supply of phosphorus promoted the height but not significantly. Likewise, the interaction of the fertilizers also showed a positive impact to stimulate the height of the mungbean plant. Lower dose of nitrogen and phosphorus ($N_{50}0P_{75}$) played the best role attaining the maximum height (18.92 cm) of the plant. Supply of 50 kg N ha^{-1} together with 50 kg P ha^{-1} rather retarded the height (18.46 cm) though not significantly. Identical result was also revealed by the treatment where only 100 kg N ha^{-1} was applied. Highest dose of nitrogen with either levels of phosphorus showed slightly retardation in height of the plant than lower dose of nitrogen with both the levels of phosphorus. Increase in height of mungbean plant due to applied phosphorus was also reported by BINA[14].

Number of leaves pot^{-1} showed no significant variation among the treatments even when nitrogen and phosphorus were applied either alone or in combination (Table 1). Fertilization of mungbean with phosphorus alone increased the number of leaves up to 20% when 150 kg P ha^{-1} was applied. Contrary to this, addition of nitrogen improved the situation up to 5.8% only in the presence of 100 kg N ha^{-1}. Lower doses of nitrogen and phosphorus together showed almost equal foliation to higher dose of phosphorus treated mungbean plants. Interaction of the fertilizers in other combinations also stimulated the foliation of leaves but not markedly showing an almost identical impact.

Setting of pod in mungbean plants due to single fertilization with nitrogen and phosphorus increased significantly over the treatment receiving no fertilizer (Table 1). Incorporation of phosphorus alone promoted the setting of pod up to 23.3 and 44.4% in the presence of 75 and 150 kg P ha^{-1} respectively. Similarly, the setting of pod also improved up to 18.5 and 55.6% when the plant received 50 and 100 kg N ha^{-1} respectively. Higher level of nitrogen played significantly better role than phosphorus alone. Among the interactions, lower dose of nitrogen and phosphorus decidedly modified the plant in setting of pod attaining the highest number (43.6 pot^{-1}). However, in general, though the joint contributions of the fertilizers promoted the setting of pod but not statistically significant.

Number of seed pod^{-1} varied positively and significantly due to supply of nitrogen and phosphorus alone (Table 1). Seed number increased significantly with the increase of application of both the fertilizers. Higher dose of nitrogen and phosphorus encouraged the plant to set more seed than lower level of the fertilizers. Number of seed increased about 24.4 and 31.1% more over the control due to supply of 75 and 150 kg P ha^{-1} respectively. In contrast, lower dose of nitrogen increased the same only about 5.4%. However, higher dose of nitrogen recovered about 36.6% more seeds than

Table 1. Effect of nitrogen and phosphorus on growth and yield of mungbean.

Treatments	Plant height (cm)	No. leaf	No. pod	No seed	.Dry matter yield (g pot^{-1})				Grain yeild (g pot^{-1})
		$plant^{-1}$		Pot^{-1}	Pod	leaf	stem	root	
N_0P_0	13.55	180.3	27.0	123.0	1.48	3.51	2.95	0.60	2.86
N_0P_{75}	14.86	196.7	33.3	153.0	1.68	3.60	3.14	0.66	3.37
N_0P_{150}	15.85	216.7	39.0	161.3	1.71	4.12	3.83	0.84	3.58
$N_{50}P_0$	17.52	185.0	32.0	129.7	1.51	4.27	4.40	0.93	3.78
$N_{50}P_{75}$	18.92	213.1	43.6	175.3	1.84	4.57	4.53	0.94	4.70
$N_{50}P_{150}$	18.46	182.3	34.0	142.3	1.53	3.68	4.22	0.85	3.57
$N_{100}P_0$	18.67	190.7	42.0	168.0	1.60	3.88	4.08	0.91	3.91
$N_{100}P_{75}$	17.44	190.3	34.0	168.7	2.13	3.97	4.01	0.73	4.38
$N_{100}P_{150}$	16.61	195.3	35.0	170.3	2.39	4.35	4.64	0.84	4.17
LSD N	2.20	NS	3.21	0.40	NS	NS	0.81	0.10	0.53
(P=0.05) P	NS	NS	2.55	0.33	NS	NS	NS	0.10	NS
NxP	NS	NS	NS	0.70	0.59	NS	NS	0.18	0.92

the control. This suggests that mungbean plant needs both nitrogen and phosphorus for setting of seeds. Interactions of the applied fertilizers promoted the setting of mungbean seeds significantly too. Highest number of seeds was recored in plants treated with 50 kg N along with 75 kg P ha^{-1}. Results clearly demonstrated that both nitrogen and phosphorus are essential for setting of seeds but higher level of the fertilizers reduces the number significantly.

Dry weight of pod increased with increase in rate of nitrogen and phosphorus but not significantly (Table 1). In contrast, interactions of the fertilizers resulted significant improvement in weight of pod. However, the variations in dry weight of pod yielded by dual application of fertilizers were not significant except in $N_{50}P_{150}$ and $N_{100}P_{150}$ treated plants. Higher dose of nitrogen and phosphorus increased the yield of pod about 8.1 and 15.5% more over the control. Highest level of nitrogen with phosphorus produced about 43.9 and 61.5% more weight than control which were around 1.8 and 2.5 times more than the treatment receiving lower dose of nitrogen and phosphorus.

Weight of foliage of mungbean plant increased nonsignificantly due to main effects of nitrogen and phosphorus as well as their interactions (Table 1). Highest leaf weight was recorded in the plants treated with 50 kg N and 75 kg P ha^{-1} together.

Dry weight of stem was found to be increased significantly due to application of nitrogen only (Table 1). Phosphorus alone and in combination with nitrogen irrespective of rates failed to improve the weight of stem. Maximum yield (4.64 g) was achieved by the plant supplied with highest dose of nitrogen and phosphorus. However, identical result was also obtained from the pot provided with lower level of the said fertilizers.

Mungbean plants showed an interesting result on growth of root (Table 1). Nitrogen and phosphorus applied either alone or in conjunction showed significant increase in yield of root. Phosphorus alone increased the root growth between 10 and 40% more when applied at the rate of 75 and 150 kg P ha^{-1} respectively. However, nitrogen played better role yielding about 55 and 51.6% more weight due to supply of 50 and 100 kg ha^{-1} respectively. Best yield of root was recorded in plants supplemented with 50 kg N and 75 kg P ha^{-1} together. Interaction of the fertilizers with highest dose of nitrogen and phosphorus showed a retardation in root growth though not significantly.

Yield of grain improved significantly due to addition of nitrogen alone and in association with phosphorus. Contrary to this, supply of phosphorus alone increased the yield of grain but not significantly. However, interaction of the fertilizers improved the situation significantly to a great extent yielding about 24.8 to 64.3% more than the control. Plants provided with 50 kg N along with 75 kg P ha^{-1} resulted the yield maximum (4.70 g pot^{-1}). The joint contribution of nitrogen and phosphorus fertilizers stimulated the better production of grain in comparison to their single application. Results showed that increase in amount of nitrogen from 50 to 100 kg ha^{-1} could not improve the yield significantly either alone or in combination with phosphorus. Similar results were also reported by other investigators. Mitra *et al*[4] observed that nitrogen acts as a limiting factor for mungbean yield and supply of which significantly increased the yield of grain. BINA[14] also found the significant response of mungbean yield to applied phosphorus.

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