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Efficacy of Phosphorus and PSB Response in Different Varieties of Summer Moongbean and Its Residual Effect on Fodder Sorghum in Western Uttar Pradesh

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ABSTRACT

An experiment is conducted during two consecutive year 2010 and 2011 at Agriculture research Farm, Amar Singh (PG) College, Lakhaoti, Bulandshahr, Uttar Pradesh. The soil of the experimental site was sandy loam with pH (8.10) and EC (0.36 dSm^{-1}) of soil water suspension. Low in organic carbon 3.9 g kg^{-1}.soil and status of soil in available nitrogen, phosphorus and potassium was medium. The experiment was designed in factorial RBD (Random Block Design) keeping three treatments of bold seeded moongbean varieties (Pusa Vishal, Pant Mung-5 and Pusa 9531) in main plots and six treatment (T_1 0 kg P_2O_5 ha^{-1}, T_2 0 kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1}, T_3 25 kg P_2O_5 ha^{-1} T_4 25kg P_2O_5 + 25 kg PSB ha^{-1},T_5 50 kg P_2O_5 ha^{-1} and T_6 50kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1}) of phosphorus and bio-fertilizer in sub-plots with four replication. The total number of treatment were 18 and number of plots was 72. Results revealed that the different varieties of moongbean to phosphorus up to 50 kg P_2O_5 ha^{-1} and inoculation of seed with PSB (25kg ha^{-1}) increased the number of pods $plant^{-1}$, number of seeds pod^{-1} grain and straw yield (q ha^{-1}) and uptake of NPK by succeeding fodder Sorghum. The net return also increased with increased levels of phosphorus and inoculation of seed with PSB (25kg ha^{-1}).

INTRODUCTION

Pulses are considered to be life blood of Indian agriculture because of their unique position in the every known system of the farming. According to Food Agriculture Organization the daily recommended dietary allowances of pulses is 80 gm per capita per day but availability is just like slightly than half only 44 gm per capita per day. Therefore, it is need to increase the pulses production and productivity both in the country at the faster rate. Green gram locally called as moong (*vigna radiata*) belong to the family leguminaceae, which fixed atmospheric nitrogen and improved soil fertility by adding 20-25 kg.N ha ¯. Being a short duration crop and having wide adaptability, it can be grown in kharif as well as in summer seasons. Green gram is nutritious, containing protein (25%), carbohydrate (58%), fat (1.1 %), water (9.7%), fibre (3.4% - 3.8%) and ash (4.2% - 4.8%). It is rich in vitamin B (Purseglove, 1968).There are various reasons for low yields of green gram *i.e.* unfavorable weather condition, un availability of bio fertilizers, cultivation mostly in barren land, use of minimum tillage and lack of knowledge about new technology, traditional varieties and imbalance use of fertilizers. Among them proper use of fertilizer is one of the most critical input, for utilizing the yield potential of improved high yielding crop varieties. The values of growing legumes in sustaining and improved soil fertility have been known since long. However, in recent days due to indiscriminate nutrient mining, soil fertility depleting at alarming rate and to provide food for more than 130 crore peoples, there is need to adding proper dose of phosphorus, PSB to maintain soil fertility and sustainability. Phosphorus plays a key role in various physiological process like

root growth, dry matter production, nodulation, nitrogen fixation and also in metabolic activities specially in protein synthesis, it helps in establishing seeding quickly and also hastens maturity as well as improves the quality of crop produce. The most obvious effect of phosphorus is on the root systems of plant, it promotes the formation of lateral and fibrous root, which facilitate bacteria for nodulation and ultimately increase the nitrogen fixation in leguminous crops. The PSB like Pseudomonas and Bacillus also enhance the availability of phosphorus to the plant by converting insoluble form (Patil *et al* 2011).

MATERIALS AND METHODS

The field experiment was conducted during two consecutive years of 2010 and 2011 during the summer and kharif season at Research Farm of A, S. (P.G.) College, Lakhaoti (Bulandshahr), Uttar Pradesh. The farm is situated on the Bulandshahr-Garghmuktesrwa road at a distance of 18 km from Bulandshahr (U.P.) towards Syana town. The latitude and longitude of the experimental site are 28.4° N and 77.1°E respectively with an elevation of about 207 m above mean sea level. It has semi-arid and subtropical climate characterized by extreme hot summer and cool winter. The soil of the experimental site was sandy loam with pH (8.10) and EC (0.36 dSm^{-1}) of soil water suspension, low in organic carbon 3.9 g kg'1, and the status of soil low in available nitrogen, phosphorus and potassium was medium. The Experiment was designed in factorial Randomized Block Design keeping three treatments of bold seeded moongbean varieties (Pusa Vishal, Pant Moong-5 and Pusa 9531) in main plots and six treatments (T_1 0 kg P_2O_5 ha^{-1}, T_2 0 kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1}, T_3 25 kg P_2O_5 ha^{-1} T_4 25 kg P_2O_5 + 25 kg PSB ha^{-1},T_5 50 kg P_2O_5 ha^{-1} and T_6 50kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1}) of phosphorus and bio-fertilizers in sub-plots with four replications. The total numbers of treatments were 18 and number of plots was 72. The gross plots size was 12 m^2 (5m x 2.4m). The nutrient phosphorus was supplied through single supper phosphate (16% P_2O_5) and PSB was inoculated @ 25 g kg^{-1} of seed and 2 hrs shade dried before sowing. Normal recommended agronomic practices were followed along with plant protection measures. In the present investigation, the grain and straw yield of each plot was calculated separately just after harvesting and converted in q ha^{-1}. The cost of cultivation and net return were also calculated. Nitrogen and phosphorus content in grain and straw were determined by Kjeldahl and Vanadomolybdo phosphoric yellow colour method. All variety of moongbean sown @ 15 Kg seeds ha^{-1} with a spacing of 30 x 20 cm. The crop of moongbean was sown in second week of March and harvesting was done in the first week of June during both the years of study. Three moongbean varieties (Pusa Vishal, Pant Moong-5 and Pusa 9531) were fertilized at rates of 0, 25 and 50 kg P_2O_5 ha^{-1} from single super phosphate (16% P_2O_5). Starter dose of nitrogen was applied at the rate of 25 kg ha^{-1} form urea. The whole quantity of nitrogen and potassium was side drilled at sowing time.

RESULT AND DISCUSSION

Yield and Yield Attributes

The data (Table-1) indicate that the plant height and yield attributes like number of pods $plant^{-1}$ and seeds pod^{-1} showed significantly effect was produced in Pusa Vishal (19.09 pods $plant^{-1}$) and (12.72 seeds pod^{-1}) with the application of T_6 - 50kg P_2O_5 ha $^{-1}$ + 25 kg PSB ha^{-1} which proved significantly instrumental in improving this attributes as compare to other treatments (Table-1) than Pant Moong-5 (17.58 pods $plant^{-1}$) and (12.01 seeds pod^{-1}) the lowest no. of pods plant-1 (15.18 pods $plant^{-1}$) and (11.81 seeds $pods^{-1}$) was recorded in variety Pusa 9531. The highest seeds and Stover yield 11.74 and 30.78 q ha $^{-1}$ which was recorded with variety Pusa Vishal as compared to Pant Moong-5 11.12 and 29.55 q ha $^{-1}$ and Pusa 9531 10.50 and 58.84 q ha^{-1} respectively. Where fertilizer was applied alone and with combination (T_6 - 50kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1}) over control T_1 - 0kg P_2O_5 ha^{-1} found highest increase growth and yield attributing characters in genotype Pusa Vishal than Pant Moong-5 and Pusa 9531.

Kumar, *et.al.* (2012). It may be due to better availability of nutrient to plant during both the year pooled data (Table 1). Response of bold seeded variety Pusa Vishal of moong bean with respect to grain and straw yield (q ha^{-1}) significant increased, similar result moong bean variety have been also reported by Singh, *et.al.* (2006). The probable causes of higher grain pod^{-1} of Pusa Vishal could be maximum grain $plant^{-1}$ and some extent higher plant population in Pusa Vishal at maturity stage might be responsible for higher yield per hectare. Pusa Vishal over other verities plant root development is important characterization which are might be affected by phosphorus. Phosphorus is the second most critical plant nutrient for crop production after nitrogen. Application of phosphorus under semi arid climates is found to improve crop growth, yield, yield components and crop quality, while its deficiency causes significant loss in crop productivity and profitability. Phosphorus has favorable effects on leguminous crops and also has positive effect on crop quality as increases protein content in moong bean. PSB plays a vital role in solubilization of various insoluble inorganic and organic phosphorus present in the soil. Production of organic acids by micro organisms appears to the major factor involved (Gaur, 1990).

Table 1 : Effect of different varieties, phosphorus and PSB on growth and yield attributes of moong bean pooled data of 2010 and 2011

Treatments	Plant height at maturity (cm)			Pod Plant^{-1} Seed			Seeds pod^{-1} Stover			Yield qha^{-1}					
	Pusa Vishal	Pant M-5	Pusa-9531	Pusa Vishal	Pant M-5	Pusa-9531	Pusa Vishal	Pant M-5	Pusa-9531	Pusa Vishal	Pant M-5	Pusa-9531	Pusa Vishal	Pant M-5	Pusa-9531
0Kg P_2O_5 ha^{-1}	29.80	28.17	27.45	12.43	11.14	9.81	7.24	7.17	6.95	5.73	4.49	4.36	14.47	15.31	13.58
0Kg P_2O_5 ha^{-1}+25 Kg PSB	34.12	32.69	32.32	13.86	13.15	11.66	9.34	9.22	8.94	6.50	5.40	5.73	17.30	16.51	16.71
25 Kg P_2O_5 ha^{-1}	36.81	37.00	34.86	15.19	14.04	13.59	9.31	9.27	9.32	8.41	7.74	7.85	23.81	22.62	21.69
25 Kg P_2O_5 ha^{-1}+25 Kg PSB ha^{-1}	44.43	43.26	42.29	18.18	16.11	15.76	11.25	11.03	10.53	10.66	9.77	9.44	27.52	26.58	25.80
50 Kg P_2O_5 ha^{-1}	42.75	41.23	40.65	16.48	15.67	14.97	10.21	10.01	9.76	10.07	9.27	8.95	26.21	25.01	23.80
50 Kg P_2O_5 ha^{-1}+25 Kg PSB	50.14	49.33	48.02	19.09	17.58	15.18	12.72	12.01	11.81	11.74	11.12	10.50	30.78	29.55	28.84
CD between Varieties	0.19			0.44			0.21			0.09			0.61		
CD between fertilizers	0.37			0.21			0.42			0.17			1.22		

Table 2 : Uptake of Nitrogen, phosphorus and Potassium succeeding fodder sorghum crop as influenced by residual effect of moong bean varieties phosphorus and PSB during 2010 and 2011.

Treatments	Nitrogen			Phosphorus			Potassium		
	Pusa Vishal	Pant M-5	Pusa-9531	Pusa Vishal	Pant M-5	Pusa 9531	Pusa Vishal	Pant M-5	Pusa-9531
0Kg P_2O_5 ha^{-1}	21.71	17.86	15.06	4.74	4.08	3.33	31.38	29.26	26.19
0Kg P_2O_5 ha^{-1}+25 Kg PSB	25.41	24.41	18.82	5.45	4.77	4.07	34.69	31.63	28.88
25 Kg P_2O_5 ha^{-1}	28.42	28.41	21.98	6.16	5.43	4.78	37.49	34.12	31.26
25 Kg P_2O_5 ha^{-1}+25 Kg PSB ha^{-1}	32.81	32.82	26.01	6.98	6.22	5.52	40.88	37.32	34.56
50 Kg P_2O_5 ha^{-1}	31.63	31.64	24.42	6.66	5.95	5.26	38.9	35.88	32.97
50 Kg P_2O_5 ha^{-1}+25 Kg PSB	37.42	37.43	29.89	7.67	6.87	6.15	42.91	42.47	40.19
CD between Varieties (P=0.05)	0.06			0.01			0.12		
CD between fertilizers (P=0.05)	0.12			0.02			0.23		

Response of nutrient uptake:

Application of different nutrient management treatments in moong bean and its residual effect on succeeding fodder sorghum increase significantly the uptake of NPK by sorghum crop. With each increment in dose of phosphorus had been gradual significant increase in uptake of nitrogen (37.43 and 37.42 kg ha^{-1}) phosphorus (7.67 and 6.87 kg ha^{-1}) and potassium (42.91 and 42.47 kg ha^{-1}) Table 2. The highest NPK uptake was recorded with the application of T_6 - 50kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1} as compared to other treatment. The higher uptake might be due to higher availability of nutrients and seeds and Stover yield. Similar findings have been reported by Mishra and Tiwari (2001). Residual effect of verities, phosphorus and PSB produce higher NPK content in fodder sorghum compared to control plots. This might due to better growth and fodder yield of sorghum resulted by enhanced available N and P in soil by proceeding moong bean crop. The uptake of NPK due to residual effect, of varieties and application of phosphorus were attributed due to higher control of NPK in fodder sorghum yield (q ha^{-1}) as previously similar result were reported by Singh, *et. al.* (2008).

CONCLUSION AND RECOMMENDATION

The present findings it may be recommended that the phosphorus and PSB level of 50 kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1} showed best in moong bean cultivar Pusa vishal. As a general rule the higher fertilizer rate up to some extent result in better production of crop based on the optimum input availability. It is clear that moong bean variety Pusa Vishal with 50kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1} applied for higher productivity in the climatic condition of western Uttar Pradesh. Application of 50kg P_2O_5 ha^{-1} + 25 kg PSB ha^{-1} gave higher yield of moong bean and also maintain soil fertility and Productivity under moong bean fodder sorghum cropping systems.

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