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Integrated phosphorus management in summer green gram (*Vigna radiata* L.)

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ABSTRACT : A field experiment was conducted during summer season of the year 2012 at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat to study the integrated phosphorus management in summer green gram (*Vigna radiata* L.). Significantly higher number of branches plant^{-1}, number of pods plant^{-1}, seed yield and stover yield were observed under the treatment $T_{3.}$ While, the significantly highest pod length was with the treatment $T_{5.}$ Protein content was significantly higher and the highest seed nitrogen content in the treatment $T_{11.}$ Treatment T_3 and T_7 recorded maximum phosphorus content in seed.

Key Words : Integrated phosphorus management, Green gram, Organic, Inorganic fertilizer, PSB

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Green gram *(Vigna radiata* L.) commonly known as "mung" or "mung bean" is one of the most important and extensively cultivated pulse crop of the Indian sub-continent. It is widely cultivated throughout the Asia including India, Pakistan, Bangladesh, Sri Lanka, Thailand, Cambodia, Vietnam, Indonesia, Malaysia and South China.

The importance of phosphorus application by using organic sources like organic manures, phosphate-solubilizing bacteria and other rhizobacteria to green gram crop has been recognized since long. Phosphorus stimulates the symbiotic nitrogen fixation because in presence of phosphorus, bacterial cell becomes mobile, which is pre requisite for migration of bacterial cell to root hair for nodulation. It promotes plant growth and enhances the yield and also helps in root development, nodule production and thereby it increases nitrogen fixation. Phosphorus promotes the flowering and fruiting and aids in setting of the pods. It also governs the maturation of crop and improve the protein content in the legume.

A field experiment was conducted during summer season in the year 2012 at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat to study the integrated phosphorus management in summer green gram (*Vigna radiata* L.). The soil of experimental area was loamy sand in texture; low in total nitrogen (183.40 kg ha^{-1}), medium in available phosphorus (27.08 kg ha^{-1}) and high in available potash (282.93 kg ha^{-1}) with soil pH 7.6. Twelve treatments comprising absolute control (T_1), 20 kg P_2O_5 ha^{-1} from SSP (T_2), 40 kg P_2O_5 ha^{-1}from SSP (T_3), 20 kg P_2O_5 ha^{-1}from DAP (T_4), 40 kg P_2O_5 ha^{-1}from DAP (T_5), 20 kg P_2O_5 ha^{-1} from DAP + 100 kg gypsum ha^{-1} (T_6), 40 kg P_2O_5ha^{-1} from DAP + 200 kg gypsum ha^{-1} (T_7), 20 kg P_2O_5 ha^{-1} from DAP + 5 t ha^{-1} FYM (T_8), 20 kg P_2O_5 ha^{-1} from SSP +5 tonne ha^{-1} FYM (T_9), 20 kg P_2O_5 ha^{-1}from DAP + PSB inoculation @ 5ml kg^{-1} seed (T_{10}), 20 kg P_2O_5 ha^{-1} from SSP+ PSB inoculation @ 5ml kg^{-1} seed, (T_{11}), 10 tha^{-1} FYM + PSB inoculation @ 5 ml kg^{-1} seed (T_{12}) were used in the experiment and tested under Randomized Block Design with four replications.

However, significantly higher number of branches plant^{-1} (5.15), number of pods plant^{-1} (37.6), seed yield (802 kg ha^{-1}) and stover yield (1921 kg ha^{-1}) were observed under the treatment T_3 (40 kg P_2O_5 ha^{-1}from SSP) than treatment T_1 (control), but was found at par with treatment T_{11} (20 kg P_2O_5 ha^{-1}from SSP + PSB inoculation) (Table 1). While pod length was significantly the highest (6.48 cm) with the treatment T_5 (40 kg P_2O_5 ha^{-1}from DAP) which was at par with T_{11}. The increment in seed and straw yield by phosphorus application was due to increase in growth characters and yield attributes of plant over control, which finally contributed in seed and stover yield of green gram.

Number of root nodules (35.00) and dry weight of root nodules plant^{-1} (55.25 mg)were significantly higher under the

Table 1: Yields, quality characters, nutrient uptake by seed of green gram as influenced by different organic inorganic and PSB treatments

Sr. No.	Treatments	No. of branches $plant^{-1}$	No. of root nodules $plant^{-1}$	No. of pods $plant^{-1}$	Pod length (cm)	Seed yield ($kg\ ha^{-1}$)	Stover yield ($kg\ ha^{-1}$)	Protein content (%)	Phosphorus content in seed (%)	Nitrogen uptake by seed ($kg\ ha^{-1}$)	Phosphorus uptake by seed ($kg\ ha^{-1}$)
T_1	Control	2.80	16.63	14.5	5.95	581	1493	20.25	0.34	18.84	1.96
T_2	20 kg $P_2O_5\ ha^{-1}$ form SSP	3.95	23.83	23.6	6.12	703	1651	23.30	0.37	26.22	2.62
T_3	40 kg $P_2O_5\ ha^{-1}$ from SSP	5.15	31.38	37.6	6.29	802	1921	24.16	0.39	31.01	3.11
T_4	20 kg $P_2O_5\ ha^{-1}$ from DAP	3.60	20.75	22.9	6.01	698	1626	23.66	0.38	26.45	2.66
T_5	40 kg $P_2O_5\ ha^{-1}$ from DAP	5.13	30.03	32.6	6.48	765	1810	23.97	0.38	29.33	2.91
T_6	20 kg $P_2O_5\ ha^{-1}$ from DAP + 100 kg gypsum ha^{-1}	3.60	22.25	27.2	6.33	703	1621	23.28	0.38	26.21	2.68
T_7	40 kg $P_2O_5\ ha^{-1}$ from DAP + 200 kg gypsum ha^{-1}	4.68	31.88	33.0	6.37	786	1863	24.09	0.39	30.30	3.10
T_8	20 kg $P_2O_5\ ha^{-1}$ from DAP + 5 t FYM ha^{-1}	3.50	27.00	21.6	5.81	730	1732	23.31	0.37	27.24	2.71
T_9	20 kg $P_2O_5\ ha^{-1}$ from SSP + 5 t FYM ha^{-1}	3.85	29.50	23.2	5.81	741	1706	23.66	0.38	28.07	2.82
T_{10}	20 kg $P_2O_5\ ha^{-1}$ from DAP + PSB inoculation	3.85	30.50	27.1	6.43	751	1768	23.73	0.38	28.54	2.87
T_{11}	20 kg $P_2O_5\ ha^{-1}$ from SSP + PSB inoculation	4.35	35.00	29.0	6.41	775	1892	24.20	0.38	30.02	2.97
T_{12}	10 t FYM ha^{-1} + PSB inoculation	2.95	23.65	24.5	6.00	705	1720	23.23	0.36	26.23	2.52
	S.E. ±	0.89	0.20	2.01	0.12	21.1	53.4	0.30	0.01	0.85	0.10
	C.D. at 5%	2.56	0.58	5.78	0.34	60.7	153.6	0.85	0.02	2.49	0.27
	C.V. %	4.35	10.25	15.22	3.81	5.79	6.16	2.53	2.80	6.31	6.94

treatment T_{11}(20 kg P_2O_5 ha^{-1}from SSP + PSB inoculation). This was due to increase in various metabolic processes, such as cell division, cell development and cell enlargement in plant, which increase the root length. Application of phosphorus solubilizing bacteria release some growth promoting substances, which provide favourable environment for rhizobia, which promotes nodule formation.This result is in partial conformity with those of Chovatia *et al.* (1993).

Quality parameter protein content (24.20%) was significantly higher in the treatment T_{11} (20 kg P_2O_5 ha^{-1}from SSP + PSB inoculation) than treatment T_1 (control). This enhancement in the protein content may be attributed to the significant role of these treatments in root enlargement, better microbial activities resulted in more availability and uptake of nitrogen and thereby increased protein content in seed. The results are in agreement with those of Jat *et al.* (2012).

Phosphorus content and uptake in the seeds were found significant due to different treatments. Treatment T_{11} (20 kg P_2O_5 ha^{-1} from SSP + PSB inoculation) recorded maximum phosphorus content (0.39 %) in the seed. This is due to the fact that phosphorus application increased the root growth and nodulation resulting in increased availability and absorption of nitrogen and phosphorus by the plant and finally more nitrogen and phosphorus assimilation in the seed was also observed by Singh *et al.* (2006).

While an application of 40 kg P_2O_5 ha^{-1} from SSP (T_3) recorded phosphorus (3.11 kg ha^{-1}) uptake by seed. Highest available phosphorus (38 kg ha^{-1}) after harvest of the crop was recorded with treatment T_{11} (20 kg P_2O_5 ha^{-1}from SSP + PSB inoculation). This might be due to combined application of graded doses of phosphorus with inoculation of phosphorus solubilizing bacteria, which showed higher response than the application of phosphorus alone. The increase due to PSB inoculation may be due to increase in P availability through solubilization of phosphate rich compounds throughout the crop period and finally increased available phosphorus in the soil after harvest of crop. This is in accordance with the result of Jat *et al*. (2012).

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