International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(4): 1198-1200

Received: 23-05-2020
Accepted: 24-06-2020

Ghadage AD
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Badnapur, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

Mane SS
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Badnapur, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

Jadhav KT
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Badnapur, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

Corresponding Author:
Mane SS
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Badnapur, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

Growth, yield, quality and uptake of nutrients in soybean as influenced by PSB and AM Fungi

Ghadage AD, Mane SS and Jadhav KT

DOI: https://doi.org/10.22271/chemi.2020.v8.i4j.9767

Abstract
A Field experiment was conducted during 2017-18 at College of Agriculture Badnapur, VNMKV, Parbhani to study effect of application of PSB and AM fungi on growth, yield, quality and uptake of nutrients by soybean. The results showed that various plant height, number of nodules, dry matter, seed yield, protein content in seed and N, P, K, uptake was increased due to application of 100% RDF along with 5 ton compost ha^{-1} (T_3). It was also inferred from the results that application of 100 % RDF + PSB +AM fungi (T_5) was found superior over (T_3) for only P availability.

Keywords: Biofertilizers, protein, PSB, AM fungi

Introduction
Phosphate Solubilizing Bacteria are known to solubilize the inorganic phosphates occurring in soil or added as rock phosphate but also mineralize organic phosphate present in the soil as well as added through crop residues and organic manures. PSB inoculants play an important role in making P available to crop plants (Guar and Gaind, 1992) [4]. The VAM fungi are known to increase the nutrient uptake, particularly the phosphorus to the host plant which in turn stimulate the nitrogen fixation by *Rhizobium*, (Balachandra and Nagarajan, 1999) [1].

Material and Methods
The experiment was conducted during 2017-18 at College of Agriculture, Badnapur in randomized block design with six treatment combinations, replicated four times. The treatment consists of T_1 Absolute control (No fertilizer application), T_2 (100% RDF), T_3 (100% RDF + Compost 5 t ha^{-1}), T_4 (100% RDF + PSB), T_5 (100% RDF + AM Fungi), T_6 (100% RDF + PSB + AM Fungi). Each treatment consisted of 10 rows with row to row spacing of 45 cm. The soil was clayey in texture. NPK fertilizer application (30:60:30) and other agronomic practices were carried out uniformly according to the recommendations. physico – chemical properties of experimental site were as, 7.85 pH, 0.28 dSm $^{-1}$ EC, 5.4 g kg^{-1} Organic carbon, 65 g Kg $^{-1}$ 220.4 Kg ha^{-1} Available Nitrogen, 12.60 Kg ha^{-1} Available Phosphorus and 480.60 Kg ha^{-1} Available Potassium. Random five plants were taken from each treatment for counting of number of nodules, noting plant height, dry matter Plant^{-1}, economic yield, Protein content was estimated by multiplying N content with 6.25.
(Note:- Full dose of N,P & K had been applied to all treatment except T_1. Seeds were treated with PSB @ 20 gm kg^{-1} for T_4 and T_6. VAM had been applied @ 200-250 spores/per m^2 for T_5 and T_6 treatment after sowing of seed.)

Result and Discussion
Plant height: The height of soybean was monitored at harvesting of crop are presented in Table.1. The plant height was significantly highest in treatment 100% RDF + 5 ton compost ha^{-1} (T_3) (65.20 cm) at harvesting stage over the control (T_1) which was at par with treatment 100% RDF+ PSB+AM fungi(T_6) (59.92 cm). This increase in plant height might be due to greater availability of macro and micro nutrients from organic sources which helped in acceleration of various metabolic processes. Secondly it might be the availability of optimum levels of N, P and K which helped in better absorption of nutrients coupled with proper distribution of assimilates. Similar result was also noted by More *et al.* (2008) [8].

Number of nodules per plant

The data presented in Table 1 indicated significant impact of application of 100 % RDF + 5 ton compost ha^{-1} (T3) on number of nodules per plant (46.95) at flowering stage followed by application of 100% RDF + PSB +AM fungi (T6) (41) 100 % RDF + PSB (T4) (38.35). Application of 5 tone compost ha^{-1} improved the soil environmental condition, availability of N, P, and K reflected through nodulation of soybean. Singh *et al*. (2007) [9] also noted similar results.

Table 1: Impact of VAM and Phosphorus solubalizing microbes on plant height, no. of nodules, dry matter, yield, protein content, uptake of N, P and K by soybean.

Treatment	Plant height (cm)	No. of nodule plant^{-1}	Dry matter (Kg ha^{-1})	Yield (Kg ha^{-1})	Protein content (%)	N uptake (Kg ha^{-1})	P uptake (Kg ha^{-1})	K uptake (Kg ha^{-1})
T1	33.9	26.6	1022.50	770.75	23.4	115.95	8.375	101.22
T2	44.4	28.27	1370.00	1225.00	25.51	245.55	15.00	160.00
T3	65.20	46.95	1920.00	1830.50	34.61	313.35	18.48	229.35
T4	53.18	38.35	1635.00	1485.75	30.72	294.38	16.40	190.53
T5	51.18	32.78	1505.00	1285.27	28.60	279.68	13.75	171.50
T6	59.92	41.00	1775.00	1774.25	33.31	305.2	20.85	214.42
SEm±	1.65	1.08	39.78	35.37	0.91	11.64	0.49	5.41
CD at 5%	4.89	3.22	118.21	105.08	2.70	34.57	1.46	16.09

Dry matter: The mean dry matter was found to be highest due to application of 100% RDF + 5 compost ha^{-1} (T3) (1920 kg ha^{-1}) which was significantly higher than other treatments, where as 100% RDF + PSB +AM Fungi (T6) was found at par (1775 kg ha^{-1}). Minimum dry weight was found in absolute control treatment (T1), i.e.1022.5 kg ha^{-1}. Similar finding were also noted by Dhawan *et al*. (2006) [3].

Economic yield: Application of 100 % RDF + 5 ton compost ha^{-1} (T3) had recorded highest seed yield (1830.50 kg ha^{-1}) followed by 100% RDF + PSB +AM fungi (T6) and 100% RDF + PSB (T4). While lowest grain yield was recorded in absolute control (T1) i.e.770.75 kg ha^{-1}. Application of 100% RDF along with 5 t compost ha^{-1} (T3) increased the grain yield of soybean by 42.10% over control. The increment in supply of essential elements through organic and inorganic sources, their availability, mobilization and influx into the plant tissues increased and improved growth and yield components and finally the seed yield of soybean. Wandkhekar *et al*. (2005) [10] also recorded similar findings.

Protein content: The highest protein content (34.61 %) was recorded by application of 100 % RDF + 5 ton compost kg ha $^{-1}$ (T3), followed by 100 % RDF + PSB +AM Fungi (T6) (33.31 %). Nitrogen is main constituent of amino acid biosynthesis and helps in formation of protein. Bisht and Chandel (1996) [2], Goswami *et al*. (1999) [6] also observed similar findings.

Uptake of nutrients: Application of 100% RDF + 5 t compost ha^{-1} (T_3) had also recorded significantly higher uptake of N and K after harvest (313.35 and 229.35 kg ha^{-1} respectively). This was followed by 100 % RDF + PSB +AM fungi (T_6) (305.2 and 214.42 kg ha^{-1} respectively), while minimum uptake of N and K was found in absolute control (T_1) (115.95 and 101.22 kg ha^{-1}). The increase in N and K uptake could be attributed to enhanced vigour of crop growth, increased utilization and translocation of N in to plant and synergy between N and K in soil system. Similar trend was also reported by Kurhade *et al.*, (2014) [7].

The higher amount of soil P found from the 100 % RDF + PSB +AM fungi (T6) (25.25 kg ha^{-1}) followed by 100 % RDF + 5 t compost ha-1 (22.00 kg ha^{-1}). The lowest soil P was found in absolute control (T1) (14.25 kg ha^{-1}).VAM is known to help the crop by absorbing more phosphorus with the hyphae extended in soil while phosphorus availability due to PSB also helped the plant indirectly to accumulate more phosphorus. Hall *et al*. (1977) documented that inoculation of VAM to legume stimulated the uptake of phosphorus at low level of phosphorus.

An application of organic manure may have caused reduction in K fixation and consequently increased K content in soil due to interaction of organic matter with clay besides the direct addition to the soil. These results were in accordance with the findings of Gharpinde *et al*. (2014) [5].

References

1. Balachandar D, Nagarajan P. Dual inoculation of *vesicular arbuscular mycorrhiza* and *Rhizobium* in green gram. Legume Res. 1999; 22(3):177-180.
2. Bisht JK, Chandel AS. Effect of integrated nutrient management on yield attributed, yield and quality of soybean. Annual Agricultural Research. 1996; 17(4):360-365
3. Dhawan AS, Karle AS, Deshmukh MS, Shendge BB. (Optimization of phosphorus management in soybean-safflower cropping sequence through integrated nutrient supply in vertisol. Journal of Oilseeds Research. 2006; 23(2):340-341.
4. Gaur AC, Gaind Sunita. Role of phosphorus solubilizing micro organisms in crop productivity and enriched organic manure. Proceeding of the National Seminar on Organic Farming organized by J.N.K.V.V. Jabalpur and I.G.K.V.V., Raipur, during September 28-29, Indore (M.P), 1992, 134-142.
5. Gharpinde B, Gabhane VV, Nagdeve MB, Sonune BA, Ganvir MM. Effect of integrated nutrient management on soil fertility, nutrient balance, productivity and economics of soybean in an Inceptisol of semi arid region of Maharashtra. Karnataka Journal Agriculture Science. 2014; 27(3):303-307.
6. Goswami S, Khan RA, Vyas KM, Dixit JP, Namdeo KN. Response of soybean (*Glycine max*) to levels, sources and methods of phosphorus application. Indian Journal of Agronomy. 1999; 44 (1):126-129.
7. Kurhade PP, Sethi HN, Zadode RS. Effect of different levels of potassium on yield, quality and available nutrients of black gram. International Journal of Soil Science. 2014; 6(2):152-154.
8. More SR, Mendhe SN, Kolte HS, Venprediwar MD, Choudhary RL. Growth and yield attributes of soybean as

influenced by nutrient management. Journal of Soil and Crops. 2008; 18(1):154-157.
9. Singh SR, Najar GR, Ummed Singh. Productivity and nutrient uptake of soybean (*Glycine max*) as influenced by bio-inoculants and farmyard manure under rainfed conditions. Indian Journal of Agronomy. 2007; 52(4):325-329.
10. Wandkhekar NV, Tambe AD, Pawar AD. Response of soybean to sowing dates and fertilizer management. Journal of Maharashtra Agricultural Universities. 2005; 30(3):355-357.