The Pharma Innovation Journal 2022; 11(3): 774-777

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 774-777

www.thepharmajournal.com
Received: 17-12-2021
Accepted: 20-01-2022

Anju Kanwar Khangarot
Scholar, Department of Agronomy, SKRAU, Bikaner, Rajasthan, India

SS Yadav
Professor and Dean, College of Agriculture, Lalsot, SKNAU, Jobner, Rajasthan, India

Rajendra Jakhar
Scholar, Department of Agronomy, SKNAU, Jobner, Rajasthan, India

Rajesh
Senior Technical Assistant, ICAR-IARI, New Delhi, India

Corresponding Author:
Anju Kanwar Khangarot
Scholar, Department of Agronomy, SKRAU, Bikaner, Rajasthan, India

Physiological parameters of mungbean [*Vigna radiata* (L.) Wilczek] as influenced by application of prom and microbial inoculants

Anju Kanwar Khangarot, SS Yadav, Rajendra Jakhar and Rajesh

Abstract
A field trial was conducted at agronomy farm, S.K.N. Agriculture University, Jobner during *kharif* season of 2019 to study the effect of PROM and microbial inoculants on Mungbean. The experiment comprised of 12 treatments involving control, PROM, PSB, VAM, *Pseudomonas fluorescens* (PF) and their respective combinations which was laid out in randomized block design with three replications. Results revealed that the magnitude of most of physiological parameters was increased under combined application of PROM + PSB + VAM + PF (T_{12}) as compared to other combinations and control, but it was at par with PROM + PSB + VAM (T_9). T_{12} treatment recorded higher CGR, RGR, Leaf area index and Chlorophyll content remained at par on treatment (T_9).

Keywords: Physiological parameters, CGR, RGR, LAI

Introduction

Mung bean (*Vigna radiata* L.) commonly known as green gram is an ancient and well-known pulse crop that belongs to family *Papilionoideae* and originated from South East Asia (Mogotsi, 2006) [8]. It is a short duration pulse crop of *kharif* season which can be grown as compensational crop between *rabi* and *kharif* seasons. According to Dainavizadeh and Mehranzadeh (2013) [2], the nutrient composition of the seed of mung bean contains 20–24% protein, 9.4% moisture, 2.1% oil, 2.05% fats, 6.4% fiber, 343.5 kcal per 100 gram energy, carbohydrates and a fair amount of vitamin A and B. In addition, the protein and carbohydrates of mung bean are more easily digestible than proteins derived from other legumes. In legumes nitrogen requirement is less as compared to phosphorus because major portion is supplied through nitrogen fixation. Therefore phosphorus is the key nutrient for increasing productivity of pulses in general and green gram in particular. Phosphorus is the major essential element required by the crop. Phosphorus stimulates early root development, enhances the availability of Rhizobia and increases the formation of root nodules thereby fixing more atmospheric nitrogen. Legumes as such have a relatively high phosphorus requirement being utilized by plant and bacteria. In order to meet this phosphorus requirement and to promote crop production, the use of high inputs of chemicals in the soil in the form of fertilizers along with intensive irrigation practices, helped to achieve the target to a certain stage. However, the decrease in crop yield took place despite the application of fertilizer. The toxic chemicals influence the life of beneficial soil microorganisms, which are indeed responsible for maintaining soil fertility. Phosphate Rich Organic Manure (PROM) is a type of fertilizer used as an alternative to diammonium phosphate and single super phosphate. It is produced by co-composting high-grade (32% P_2O_5 +/- 2%) rock phosphate in very fine size (say 80% finer than 54 microns). The finer the rock phosphate, the better is the agronomic efficiency of Phosphate rich organic manure. According to Nature Preceding PROM may be a more efficient way of adding phosphorus to soil than applying chemical fertilizers. Other benefits of phosphate rich organic manure are that it supplies phosphorus to the second crop planted in a treated area as efficiently as the first, and that it can be produced using acidic waste solids recovered from the discharge of biogas plants. Microorganisms are crucial in the natural phosphorus cycle. The use of phosphate solubilizing bacteria (PSB) as biofertilizers for agriculture enhancement has been a subject of study for years. PSBs apply various approaches to make phosphorus accessible for plants to absorb. These include lowering soil PH, chelation, and mineralization. The principal mechanism for solubilization of soil P is lowering of soil pH by microbial production of organic acids or the release of protons (Kumar *et al*., 2018) [6].

Strong positive correlation has been reported between solubilization index and organic acids produced (Alam *et al.*, 2002) [1].

Symbiotic relationship between plant roots and certain soil fungi *e.g.* Vesicular Arbuscular Mycorrhiza (VAM) contributes a significant role in P cycling and uptake of P by plants (Biswas *et al*., 2001). Through symbiotic linking with plant roots, VAM helps in mobilization of Phosphorus. These fungi can save P – fertilizer by 25 – 30 per cent (Somani *et al*., 1990).

Materials and Methods

An attempt was made to study the effect of PROM and Microbial Inoculants on growth and yield of mungbean. Field experiment was conducted during *kharif* season of 2019 at agronomy Farm, SKN Agriculture University, Jobner (Rajasthan). The soil was loamy sand with pH 8.2, available N 128.0 kg/ha (Subbiah and Asija, 1956), P 16.63 kg/ha (Olsen *et al.*, 1954), K 154.1 kg/ha (Jackson., 1967) and 0.15% organic carbon (Jackson, 1973). The twelve treatments comprised of control, PROM, PSB, VAM, *Pseudomonas fluorescens* (PF) and their respective combinations were laid out in Randomized Block Design with three replications. PROM (10.4% P_2O_5) applied as basal equivalent to 40 kg P_2O_5/ha and was incorporated well into the soil at the time of sowing as per treatments. Mungbean seed was inoculated with liquid PSB culture i.e. *Bacillus megatherium* @2 ml/kg seed and with PGPR *Pseudomonas fluorescens* (PF) @10 ml/kg seed as per routine procedure 2-3 hours before sowing as per treatments. The soil based VAM (*Trichoderma viride*) containing hyphae, spores and sporacarp was incorporated into soil in crop rows at the time of sowing @5 kg/ha VAM was mixed with 8-10 kg vermi-compost as per treatment and thoroughly mixed manually in the treated plots. Seeds of the mungbean variety, IPM-02-3 were sown on 10th July, 2019 in rows spaced at 30 cm apart at the depth of 4-5 cm with the help of '*kera*' method using a seed rate of 16 kg/ha. Prior to sowing, the seed was treated with *Rhizobium* culture, uniformly under all the treatments. CGR is calculated on the basis of following formula

CGR= (1/P) x (W2-W1) / (t2-t1)

LAI is calculated on the basis of following formula

LAI = leaf area / ground area

RGR is calculated on the basis of following formula

RGR= (1/W) (dW/dt)

The experimental data recorded for CGR, RGR, LAI and chlorophyll content were subjected to statistical analysis in accordance with the "Analysis of Variance" technique suggested by (Fisher, 1950). Appropriate standard error for each of the factor was worked out. Significance of differences among treatment effects was tested by "F" test. Critical difference (CD) was worked out, wherever the difference was found significant at 5.0 or 1.0 per cent level of significance.

Results and Discussion

Crop growth rate

It can be seen from the table 1 that CGR in mungbean increased progressively with the advancement of crop age. The values of CGR were lower during 0 - 25 DAS stage; highest during 25 – 50 DAS and then moderate during 50 DAS - harvest stage. A critical examination of data revealed that all the treatments of PROM and microbial inoculants either alone or in different combinations registered significantly higher CGR values than control during all the stages except T_4 and T_5 during 50 DAS – at harvest, stage. The maximum CGR (4.51, 7.38 and 6.71 g/m^2/day) during these three stages was recorded under application of PROM + PSB + VAM + PF which was closely followed by PROM + PSB + VAM (4.49, 7.37 and 6.70 g/m^2/day) and PROM + PSB + PF (4.27, 7.02 and 6.32 g/m^2/day).

Table 1: Effect of PROM and microbial inoculants on crop growth rate (CGR) in mungbean during different stages

Treatments	CGR (g/m^2/day)		
	0 – 25 DAS	25 – 50 DAS	50 DAS – at harvest
T_1 – Control	2.85	4.81	4.13
T_2 – PROM	3.55	5.94	5.21
T_3 – PSB	3.32	5.58	4.79
T_4 – VAM	3.09	5.22	4.49
T_5 – *Pseudomonas fluorescens* (PF)	3.08	5.21	4.52
T_6 – PROM + PSB	4.02	6.66	5.98
T_7 – PROM + VAM	3.79	6.30	5.63
T_8 – PROM + PF	3.78	6.30	5.55
T_9 – PROM + PSB + VAM	4.49	7.37	6.70
T_{10} – PROM + PSB + PF	4.27	7.02	6.32
T_{11} – PROM + VAM + PF	4.04	6.66	6.02
T_{12} – PROM + PSB + VAM + PF	4.51	7.38	6.71
S.Em+	0.11	0.19	0.23
CD (p = 0.05)	0.22	0.39	0.48

Relative growth rate: It is further evident from the data presented in table 1 that application of PROM and different microbial inoculants either alone or in combination could not bring variation in RGR of mungbean up to the level of significance during all the stages.

Leaf area index: It can be inferred from the data given in table 2 that leaf area index in mungbean at 50 DAS was significantly influenced due to application of PROM and microbial inoculation treatments in comparison to control. The highest LAI (5.74) was obtained under PROM + PSB + VA + PF (T_{12}) which was closely followed by PROM + PSB + VAM (5.72) and PROM + PSB + PF (5.52). The extent of increase in LAI rendered due to these three treatments was 59.0, 58.4 and 52.9 per cent over control, respectively. However, these were found at par among themselves. The treatments T_{11}, T_6 and T_7 also increased the LAI by margin of 42.7, 42.1 and 33.8 per cent over control and thus emerged as the next better and statistically similar treatments in improving this parameter.

Table 2: Effect of PROM and microbial inoculants on RGR, LAI and chlorophyll in mungbean

Treatments	RGR (mg/g/day)		LAI	Chlorophyll content (mg/g)
	25 – 50 DAS	50 DAS – at harvest		
T_1 – Control	39.49	17.52	3.61	1.76
T_2 – PROM	39.32	17.78	4.53	2.27
T_3 – PSB	39.43	17.50	4.24	2.08
T_4 – VAM	39.58	17.54	3.98	1.93
T_5 – *Pseudomonas fluorescens* (PF)	39.56	17.68	4.00	1.94
T_6 – PROM + PSB	39.02	18.10	5.13	2.77
T_7 – PROM + VAM	39.12	18.05	4.83	2.60
T_8 – PROM + PF	39.23	17.80	4.82	2.43
T_9 – PROM + PSB + VAM	38.91	18.12	5.72	3.10
T_{10} – PROM + PSB + PF	38.89	18.03	5.52	3.02
T_{11} – PROM + VAM + PF	39.01	18.09	5.15	2.86
T_{12} – PROM + PSB + VAM + PF	38.78	18.13	5.74	3.18
S.Em+	1.10	0.64	0.15	0.09
CD (p = 0.05)	NS	NS	0.30	0.19

Chlorophyll content

An examination of data presented in table 2 and fig 1 revealed that mungbean crop responded favorably to the application of PROM and microbial inoculants in regard of chlorophyll content. All the treatments attained significantly higher chlorophyll content than control except T_5 and T_4. Combined application of PROM + PSB + VAM + PF (T_{12}) observed the highest chlorophyll content (3.18 mg/g) indicating a significant increase of 80.7 per cent over control. However, it showed statistical equivalence with PROM + PSB + VAM (3.10 mg/g) and PROM + PSB + PF (3.02 mg/g), wherein, an increase of 76.1 and 71.6 per cent over control was recorded, respectively. These were followed by T_{11}, T_6, T_7 and T_8 indicating an increase of 62.5, 57.4, 47.7 and 38.1 per cent over control, respectively. The significant increase in above growth characters might be associated with the better nutritional environment in the root zone for growth and development of crop as well as in plant system under the influence of improved availability of different nutrients due to application of PROM and microbial inoculants. It is an established fact that phosphorus is an essential macro-element required for plant nutrition. Phosphorus plays an important role in an array of cellular processes, including maintenance of membrane structures, synthesis of biomolecules and formation of high-energy molecules (ADP and ATP). It also helps in cell division, enzyme activation/inactivation and carbohydrate metabolism (Razaq *et al.*, 2017) [9]. At whole plant level, it stimulates seed germination; development of roots, stalk and stem strength; flower and seed formation; crop yield and quality. In addition, availability of P increases the N-fixing capacity of leguminous plants by improving nodulation and supplying assimilates to the roots.

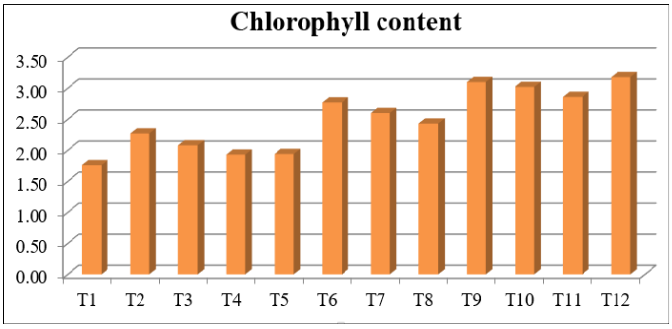

Fig 1: Effect of PROM and microbial inoculants on net returns in mungbean

Conclusion

Based on the results of one year experimentation, it may be concluded that application of PROM + PSB + VAM + PF was found the most superior treatment combination for obtaining higher values of CGR, RGR, Leaf area index and chlorophyll content in mungbean.

References

1. Alam S, Khalil S, Ayub N, Rashid M. *In vitro* solubilization of inorganic phosphate by phosphate solubilizing microorganism (PSM) from maize rhizosphere, International Journal of Agricultural Biology. 2002;4(12):454-458.
2. Dainavizadeh P, Mehranzade HM. Effect of seed rate on growth, yield components and yield of mung bean grown under irrigated conditions in the North of Khuzestan. International Journal of Agriculture and Crop Sciences (IJACS). 2013;5(20):2359-2365.
3. Gurjar BS, Yadav LR, Rathore BS, Yadav P, Singh K, Kumar R. Effect of foliar nutrition on growth and yield of hybrid pearl millet (*Pennisetum glaucum* (L). R. Br.). 2022.
4. Gurjar BS, Yadav LR, Rathore BS, Yadav P, Yadav M, Singh K, *et al*. Effect of foliar nutrition on nutrient content and uptake in hybrid pearl millet (*Pennisetum glaucum* (L). R. Br.). 2022.
5. Khatkar R, Abraham T, Joseph SA. Effect of biofertilizers and sulphur levels on growth and yield of blackgram (*Vigna mungo* L.). Legume Research. 2007;30(3):233-234.
6. Kumar A, Kumar, Patel H. Role of microbes in phosphorus availability and acquisition by plants, International Journal of Current Microbiology and Applied Sciences. 2018;7(5):1344-1347.
7. Kumar R, Ram H, Meena RK, Kumar D, Kumar R, Singh K. Productivity and Profitability of Fodder Cowpea Cultivars under Various Zinc Management Practices in IGP of India. Legume Research-An International Journal. 2021;44(10):1211-1218.
8. Mogotsi K. Mung bean (*Vigna radiata* L.). In M. Brink & G. Belay (Eds.), PROTA 1: Cereals and pulses/Cereals legumes, CD-Rom (pp. 23–29). PROTA. 2006.
9. Razaq M, Zhang P, Shen Hl, Salahuddin. Influence of nitrogen and phosphorus on the growth and root morphology of Acer mono. PLoS One. 2017;12:1-13.
10. Rekha K, Pavaya RP, Malav JK, Chaudhary N, Patel IM,

Patel JK. Effect of FYM, phosphorus and PSB on yield, nutrient content and uptake by green gram (*Vigna radiata* (L.) Wilckzek) on loamy sand. International Journal of Chemical Studies. 2018;6(2):1026-1029.
11. Singh K, Ram H, Kumar R, Meena RK, Kumar R. Fodder Quality and Yields of Mung Bean as Influenced by Different Weed Management Practices. Indian Journal of Animal Nutrition. 2021;38(3):233-239.