J Krishi Vigyan 2018, 6(2) : 71-74 DOI : 10.5958/2349-4433.2018.00087.9

Effect of Nutrient Sources Particularly of Phosphorus on Growth and Productivity of Summer Blackgram Under Lateritic Soil

Subrata Mandal* and SouravMondal

Rathindra KrishiVigyan Kendra,
Institute of Agriculture, Visva-Bharati, Sriniketan, Birbhum 731 236 (West Bengal)

ABSTRACT

An experiment was conducted at the Instructional Farm of Rathindra KrishiVigyan Kendra, Visva-Bharati, Sriniketan, Birbhum during the summer season 2014-15, to study the different nutrient management practices with special emphasis on effect of phosphorus on growth, productivity, soil fertility and economics of summer black gram. The treatments were T1= Control (No source of nutrient), T2= Vermicompost (V.C) @ 2.5 t/ha, T3= V.C + Biofertiliser (B.F) (*Rhizobium* and Phosphorus Solubilising Bacteria), T4= V.C + BF+ Sea weed extract (10%), T5= DAP @100 kg/ha, T6= DAP +BF , T7= DAP + BF + Sea weed extract (10%), T8=Urea (20kg/ha)+SSP (40 kg/ha), T9= Urea+SSP +BF, T10= Urea+SSP +BF +Sea weed extract (10%). The experiment was conducted in randomised block design with 3 replications. The soil was acidic (pH- 6.18) in reaction, sandy loam in texture with low organic carbon, availablephosphorus and medium in potassium content. The maximum increase in growth attributes was found with the application of T10 i.e.Urea+SSP+Biofertiliser+Sea weed extract treatment followed by T4 and T7.The significantly higher grain yield (9.45 q/ha) and yield attributes were obtained under treatment of T10 than those of other treatments. The maximum net return (Rs. 24,050/-ha) and BC ratio (1:2.04) was obtained from the treatment T10.

Key Words: Blackgram, Vermicompost, Biofertiliser, Sea weed extract, SSP, DAP, Yield.

INTRODUCTION

In West Bengal, the crop productivity levels are usually low, owing to various soil related constraints such as low pH, organic matter, and nutrient availability. However, inclusion of a short duration pulse crop holds promise for increasing and sustaining productivity of these soils through biological N fixation(Bhattacharya *et al,* 2004). Integrating chemical fertilizers with organic manures will not only maintain higher productivity but also provide greater stability in crop production. Combined application of biofertiliser and neem oil cake have been reported to increase the yield of blackgram and residual soil fertility (Murugan *et al,* 2011). The physical properties such as water holding capacity, moisture content and porosity in soil amended with vermicompost were improved and maximised the plant parameter's like number of leaves (33.1± 0.21), leaf length (4.1±0.03 cm), height of the plants (9.5±0.42cm) and root length of plant (7.1±0.10cm) in black gram.(Tharmaraj *et al,* 2010). Seaweed extracts have been marked for several years as fertiliser additives, in which the importance is being given to be the source of microelements and as a soil conditioner. (Zodape, 2001).Phosphorus is the key nutrient for pulse cultivation. Integrated nutrient management using all the sources played significant role to increase yield of blackgram (Abraham and Lal, 2014).In rainy season the yield of blackgram is very poor in lateritic soil of West Bengal due to several reasons. Summer blackgram cultivation with little irrigation has a great potentiality. Little use of chemical fertiliser is only the nutrient management practice in blackgram cultivation. In this context, different nutrient management practices with special emphasis on phosphorus was studied in summer blackgram.

Corresponding Author's Email: smkvkvb@gmail.com

MATERIALS AND METHODS

This experiment was carried out at the Instructional Farm of Rathindra KrishiVigyan Kendra, PSB, Visva-Bharati, Sriniketan during the summer season, 2014-15. The seed rate of 25 kg/ha was used in 25cmX10cm spacing of variety WBU109 (Sulata). The treatments were T1= Control (No source of nutrient), T2= Vermicompost (V.C) @ 2.5 t/ha, T3= V.C + Biofertiliser (B.F) (*Rhizobium* and PSB), T4= T3 + Sea weed extract (10%), T5= Di ammonium phosphate (DAP) @100 kg/ha, T6= DAP +BF , T7= T6 + Sea weed extract (10%), T8=Urea (20kg/ha)+Single super phosphate (SSP) (40 kg/ha), T9= T8 +BF, T10= T9 +Sea weed extract (10%). All the nutrient sources except sea weed extract were applied as basal according to the treatments. The sea weed extract was sprayed in the standing crop at 25 days after sowing (DAS) in the specific plots as per treatment. Vermicompost was applied @ 2.5 t/ha and incorporated into the soil as basal as per treatments. Biofertilisers (Mixture of *Rhizobium* and PSB) were applied @ 1.5 kg/ha as seed inoculation according to the treatments. The experiment was conducted in randomised block design with 3 replications. The lateritic soil was acidic (pH 6.18) in reaction, sandy loam in texture with low organic carbon (038%), availablephosphorus (12.4 kg/ha) and medium in potassium content (122.4 kg/ha). All the data on growth attributes were collected at peak growing stage i.e at 45 DAS. Yield attributes were collected at maturity stage (85 DAS). The data were analysed using statistical tools (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect on growth attributes

The perusal of the data (Table1) indicated that the maximum increase in growth attributes like number of branches/plant, nodules/plant, dry weight of shoots (g/m^2) of summer blackgram were found statistically significant due to application of differential nutrient sources. The application of T10 i.e.Urea+SSP+Biofertiliser+Sea weed extract treatment produced maximum growth. However, it was found statistically at parwith the treatments T4 and T7. The balanced fertilization along with biofertilizer *Rhizobium* and PSB helped for supply of appropriate quantity of phosphorus nutrients

Table 1. Effect of different nutrient sources on growth, yield component and yield of summer blackgram.

Treatment	No. of branches / plant	No. of nodules / plant	Dry weight of shoots (g/m^2)	No. of pods /m^2	No. of seeds /pod	Test Weight (1000 seed weight in) (g)	Seed Yield (q/ha)
T1	9.4	14.5	309.7	167.5	5.55	27.25	5.75
T2	13.3	22.3	406.8	218.7	6.55	32.00	8.25
T3	14.1	24.0	421.5	242.7	7.03	32.29	9.02
T4	14.4	25.8	481.6	259.5	7.12	32.55	9.33
T5	12.2	20.7	395.2	212.7	6.70	32.25	8.26
T6	13.1	21.5	434.6	231.3	6.95	32.35	9.06
T7	14.1	23.5	444.7	250.6	7.05	32.50	9.30
T8	12.8	21.1	384.9	220.5	6.71	32.24	8.27
T9	13.6	23.1	434.2	238.4	7.00	32.33	9.10
T10	14.9	24.9	496.3	265.4	7.25	32.50	9.45
SEM +	0.28	0.42	9.49	4.41	0.35	0.33	0.05
CD at 5 %	0.72	1.08	27.05	11.35	0.14	0.85	0.13

for better root ramification and higher nodulation which is more important in pulse productivity.

Effect on yield attributes and yield

I t was observed that different yield components of blackgram like no. of pods/m2 (14.9), test weight (496.3) were found significantly higher with the application of T10i.e.Urea+SSP+Biofertiliser+Sea weed extract treatment than those of other treatments. However, maximum No. of seeds/pod (25.8) was found in T4treatment i.e. Vermicompost+ Biofertiliser + Sea weed extract. However, these treatments along with T3treatmenti.eVermicompost + Biofertiliser were found statistically at par. It indicated that the key nutrient for pulse phosphorous were available to the plants in same pattern from all the treatments for influencing the yield attributes. Similar type of results were obtained by Joshi *et al*(2016) in summer cowpea.

Similarly, the significantly highest grain yield was obtained by application of nutrient sources in the treatment T10 followed by T4 and T7. It was,thus, evident that sea weed extract was common treatment in all the three cases. Beside that phosphorous nutrient along with other nutrients were applied in balanced form in those treatments. The result may be due to the appropriate supply of key nutrient phosphorus for increasing pod formation, seed formation, seed size and ultimately seed yield. Nutrient supply through organic sources like T4 and integrated sources like T7, T10 produced almost similar yield. Alabadan *et al*(2009) also observed that use of organic manures alone or in combination with chemical fertilizers, helps in improving physico-chemical properties of the soil and improves the efficient utilization of applied fertilizers resulted in higher seed yield and quality. Further,it stimulates the activity of micro organisms that makes the plant to get the macro and micro-nutrients through enhanced biological processes, increase nutrient solubility.

Effect on residual soil status

The soil samples collected from all the plots treatment wise after harvesting the crops were analysed (Table2). The residual soil fertility status like pH , O.C , avail. P andavail. K were well maintained by the treatment T3= Vermi-compost + Bio-fertiliser (*Rhizobium* and PSB) closely followed by T4 and T2.This might be due to purely organic nature of the nutrient sources. Soil pH was found lower in the treatments where chemical fertilisers were included. Higher organic carbon was found where vermi-compost and bio-fertilisers were included. However, the treatment T10 performed lower in maintaining soil fertility than those of other treatments but played satisfactory role in maintaining soil fertility. Kannan *et al* (2005) reported that though, organic sources of nutrients contain relatively low concentrations of nutrients and handling them is labour intensive, there has been large increase in their use over inorganic fertilizers as nutrient source.

Table 2.Effect of different nutrient sources on soil fertility status after harvest of summer black gram.

Treatment	pH	O.C (%)	Available P (Kg/ ha)	Available K (Kg/ha)
T1	6.11	0.37	9.5	118.6
T2	6.70	0.80	27.1	152.4
T3	6.64	0.83	29.4	164.9
T4	6.59	0.79	28.8	161.2
T5	6.31	0.41	18.2	131.4
T6	6.42	0.71	25.1	140.3
T7	6.54	0.67	24.2	141.7
T8	6.44	0.54	19.5	134.2
T9	6.51	0.62	22.3	146.3
T10	6.49	0.62	20.5	145.4
SEM +	0.05	0.02	0.40	4.09
CD at 5 %	0.10	0.05	1.03	10.51

Economics of cultivation

The selling price of black gram of Rs. 65/- per kg (local market rate) was considered while calculating the economics. It was observed (Table 3) that maximum net return (38225/ha) and BC ratio (2.65) was obtained from the treatment T10.

This might be due to supply of all the nutrients specially phosphorus towards the balancing way in treatment T10 within the lower cost of cultivation. Gross cost were found higher in the treatments like T2, T3,T4 due to higher cost of vermi-compost. For this reason, the benefit was less in those treatment although yield was satisfactory.

Table3. Effect of different nutrient sources on economics of cultivation of summer blackgram.

Treatment	Gross cost (Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	B/C Ratio
T1	19500	37375	17875	1.91
T2	25700	53625	27925	2.09
T3	26100	58630	32530	2.25
T4	26700	60645	33945	2.27
T5	21800	53690	31890	2.46
T6	23400	58890	35490	2.52
T7	23700	60450	36750	2.55
T8	21200	53755	32555	2.54
T9	22900	59150	36250	2.58
T10	23200	61425	38225	2.65

CONCLUSION

Among the different nutrient management practices with special emphasis to phosphorus, the application of T10i.e.Urea+SSP+Bio-fertiliser+Sea weed extract treatment produced higher yield and benefits in summer blackgram cultivation and also maintained soil fertility satisfactorily under lateritic soil of Birbhum district of West Bengal. However, the best soil fertility was maintained with the application treatment T3 i.e. Vermi-compost + Bio-fertiliser (*Rhizobium* and PSB) but with slight reduction in yield.

ACKNOWLEDGEMENTS

Authors are thankful to the Agricultural Technology Management Agency (ATMA), Birbhum district for supporting the study. Beside that all the staff members of RKVK, Birbhum are also duly acknowledged for their help time to time.

REFERENCES

Abraham T and LalRB (2014). Performance of Blackgram (*Vigna mungo* L.) under Integrated Nutrient Management (INM) in a legume based cropping system for the inceptisols of NEPZ. *Indian J Dryland Agric Res & Dev* **19** (1), pp.81-87.

Alabadan B A, Adeoye P A and Folorunso E A (2009). Effects of different poultry wastes on physical, chemical and biological properties of soil. *Caspian J Environ Sci* **7**: 31-35.

Bhattacharya S S, Mandal D, Chattopadhyay G N and Majumdar K (2004). Effect of Balanced Fertilization on Pulse Crop Production in Red and Lateritic Soils. *Better Crops* **88** (4). pp.25-27.

Gomez KA and Gomez AA(1984). *Statistical Procedure for Agricultural Research*. Second Ed..An International Rice Research Institute Book. Willey, New York.pp.684.

Joshi D, Gediya KM, Patil JS, Birarai MM and Gupta S (2016). Effect of Organic manures on growth and yield of summer cowpea [*Vigna unguiculata* (L.) Walp.] under middle Gujrat condition. *Agric Sci Digest* **36** (2): 134-137.

Kannan P A, Saravanan S,Krishnakumar and S K Natrajan (2005). Biological properties of soil as influenced bydifferent organic manure. *Res J Agric Biol Sci* **1**: 181-183.

Murugan R, Chiraputhirapillai S, Nimesdroff P, and NanjappanK(2011). Effects of Combined Application of Biofertiliser with Neem Oil Cake on Soil Fertility and Grain Yield of Black gram. *World J Agric Sciences* **7** (5). Pp. 583-590.

Nambiar KK M and Abrol IP (1992). Long term fertilizer experiments in India – An overview. *Fertiliser News* **34** (4) : 11-26.

Tharmaraj K,Kolanjinathan K,Kumar S and Anandam A(2010).Influence of vermicompost and vermiwash on physico chemical properties of black gram cultivated soil. *Int J Recent Sci Res* **2**. Pp.234-237.

Zodape ST (2001). Sea Weeds as a biofertilisers. *J Scientific and Indust Res* **60**. Pp 378-382.

Received on 13/8/2017 *Accepted on 01/10/2017*