Plant Archives Vol. 14 No. 1, 2014 pp. 267-270 *ISSN 0972-5210*

EFFECT OF DIFFERENT COMBINATIONS OF VERMICOMPOST, BIOFERTILIZERS AND CHEMICAL FERTILIZERS ON GROWTH, PRODUCTIVITY AND PROFITABILITY IN CHICKPEA (*CICER ARIETINUM* L.)

Sandeep Kumar, Ripudaman Singh*, M. Saquib, Dharmendra Singh[1] and Awadhesh Kumar[2]

Department of Agronomy, C. S. Azad University of Agriculture & Technology, Kanpur - 208 002 (U. P.), India.
[2]Department of Soil Science and Agricultural Chemistry, C. S. Azad University of Agriculture & Technology, Kanpur - 208 002 (U. P.), India.
[3]Department of Soil Conservation and Water Management, C. S. Azad University of Agriculture & Technology, Kanpur - 208 002 (U. P.), India.

Abstract

A field experiment was conducted at Students' Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.), India during *rabi* season of 2011-12 to find out the effect of different combinations of vermicompost, biofertilizers and chemical fertilizers on growth, productivity and economics in chickpea. The experiment was laid out in a randomized block design with three replications. The treatments consisted of twelve combinations of different doses of vermicompost (vc) and biofertilizers with recommended doses of chemical fertilizers (20 kg N & 46 kg P_2O_5 ha^{-1}). For biofertilizers *Rhizobium* and phosphorus solubilising bacteria (PSB) were used. Application of RDF + @ 5.0 ton/ha VC + Rhizobium + PSB significantly increased growth and yield attributes of chickpea over control. The significantly maximum net profit (Rs. 40086) and benefit cost ratio (2.12) was recorded by application of RDF + @ 3.0 ton/ha VC + *Rhizobium* + PSB on control.

Key words : Chickpea, vermicompost, biofertilizers, PSB, chemical fertilizers, productivity and economics.

Introduction

Chickpea (*Cicer arietinum* L.) is an important grain legume crop in the world, which was globally grown on 11.55 million ha area with total production with 10.46 million tonnes. In India, it is grown an area about 8.56 million ha and total production of about 7.35 million tones with productivity 858 kg ha^{-1} (Anonymous, 2010). Major chickpea producing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat, Andhra Pradesh and Karnataka which sharing over 95% area and 85% production.

In India, it grown on marginal soil and the good soil is used for growing other more fovour crops. With the results, the productivity of chickpea is very low. Chickpea productivity is influenced by many factors including sowing time, *Rhizobium* inoculation, phosphorus solubilizing bacteria, plant population, moisture stress, seed priming etc. For obtaining high grain yield proper management of crop is a must and proper nutrient management is one of the important factors contributing towards high productivity. Vermicompost, enriches soil in most natural organic manner and also increases the soil fertility, soil micro-organisms and organic fertilizer is completely harmless and provide macro and micro-nutrients that is best to crop growth (Asewar *et al.*, 2003). Biofertilizer are recognized as an important component of sustainable agriculture. Rhizobium culture and phosphorus solubilizing bacteria (PSB) can be used to inoculate pulse crops for enhancing the crop productivity and profitability (Bajracharya and Rai, 2009). Nitrogen is an essential component of several amino acids, enzymes nucleic acids etc is required in comparatively less amount due to biological fixation by pulses. *Rhizobia* are agriculturally important soil bacteria capable of forming root nodules and in some cases, stem nodules on leguminous plant, where they can fix atmospheric nitrogen. Hence, the present investigation was conducted to study the Effect of different combination of vermicompost, biofertilizers and chemical fertilizers on growth, productivity and profitability in chickpea.

***Author for correspondence :** E-mail : rsycsa@gmail.com

Table 1 : Mean plant height, branches plant^{-1}, pod plant^{-1}, 100 grain weight, grain yield and straw yield as influenced by different treatments.

Treatment	Plant height (cm)	Branches plant^{-1}	Number of pod plant^{-1}	Weight of 100 seeds (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
T_1 - Control	28.16	6.00	30.62	16.04	13.82	21.00
T_2 - RDF (20kg N & 46kg P_2O_5 ha^{-1})	28.50	6.31	32.49	16.32	18.57	22.00
T_3 - 125% RDF	30.16	6.91	34.25	16.83	19.97	22.66
T_4 - RDF + @ 3.0 ton ha^{-1} vermicompost (VC)	30.66	7.12	35.80	17.21	21.53	25.22
T_5 - RDF + @ 5.0 ton ha^{-1} vermicompost (VC)	31.16	7.91	37.58	17.47	22.47	25.12
T_6 - RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium*	32.16	8.12	39.63	17.62	22.93	28.59
T_7 - RDF + @ 3.0 ton ha^{-1} VC + PSB	32.50	8.56	42.49	17.92	23.61	27.99
T_8 - RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium*	32.83	8.98	44.53	18.20	24.57	30.30
T_9 - RDF + @ 5.0 ton ha^{-1} VC+ PSB	33.00	9.12	48.75	18.49	24.93	30.72
T_{10} - RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium*	34.16	9.66	51.60	18.92	25.41	31.15
T_{11} - RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB	35.00	10.21	54.57	19.90	26.49	31.97
T_{12} - RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma	34.83	10.12	53.54	19.48	25.89	31.73
CD (P = 0.05)	**2.31**	**0.97**	**1.72**	**1.36**	**2.18**	**2.55**

Table 2 : Mean cost of cultivation, gross and net monetary returns and benefit cost ratio as influenced by different treatments.

Treatment	Cost of cultivation (Rs. ha^{-1})	Gross monetary returns (Rs. ha^{-1})	Net monetary returns (Rs. ha^{-1})	Benefit cost ratio
T_1 - Control	27500.00	40805.33	13305.3	1.48
T_2 - RDF (20kg N & 46kg P_2O_5 ha^{-1})	30089.74	54121.67	24031.9	1.79
T_3 - 125% RDF	30212.17	61515.33	31302.8	2.03
T_4 - RDF + @ 3.0 ton ha^{-1} vermicompost (VC)	35089.24	62806.33	27717.1	1.78
T_5 - RDF + @ 5.0 ton ha^{-1} VC	37839.00	65537.66	27697.9	1.73
T_6 - RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium*	35439.00	67083.00	31634.0	1.89
T_7 - RDF + @ 3.0 ton ha^{-1} VC + PSB	35339.00	65692.66	30353.6	1.85
T_8 - RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium*	38189.00	71836.00	33647.0	1.88
T_9 - RDF + @ 5.0 ton ha^{-1} VC+ PSB	38089.00	72895.00	34806.0	1.91
T_{10} - RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium*	35689.00	74282.34	38593.3	2.08
T_{11} - RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB	38439.00	77388.34	38949.3	2.01
T_{12} - RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma	35589.00	75665.00	40086.0	2.12
CD (P = 0.05)		20129.38	6886.13	0.37

Materials and Methods

The field experiment was conducted at Students' Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.), India during *rabi* season ($25^0$56' N to $28^0$58' N latitude and $79^0$31' E to $80^0$34' E longitude). The soil of experimental field was sandy loam in texture and initial soil sample had 7.8 pH, 0.5% organic corbon, 150 kg available nitrogen, 18.5 kg available phosphorus, 164 kg available potassium and 2.4 kg available Zn ha^{-1}. The experiment was laid out in Randomized Block Design with three replication and consisted twelve treatments *viz*. $\mathbf{T_1}$ Control, $\mathbf{T_2}$ RDF (20 kg N & 46 kg P_2O_5 ha^{-1}), $\mathbf{T_3}$ 125% RDF, $\mathbf{T_4}$ RDF + @ 3.0 ton ha^{-1} vermicompost (VC), $\mathbf{T_5}$ RDF + @ 5.0 ton ha^{-1} VC, $\mathbf{T_6}$ RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium*, $\mathbf{T_7}$ RDF + @ 3.0 ton ha^{-1} VC + PSB, $\mathbf{T_8}$ RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium*, $\mathbf{T_9}$ RDF + @ 5.0 ton ha^{-1} VC + PSB, $\mathbf{T_{10}}$ RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium*, $\mathbf{T_{11}}$ RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB and $\mathbf{T_{12}}$ RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB. Chickpea variety Udai (KPG-59) was sown 100 kg ha^{-1} seed at row spacing of 45 cm apart with country plough on 10th November, 2011. The statistical analysis of data was carried out by "Analysis of Variance" method (Panse and Sukhatme, 1967).

Results and Discussion

Differences in growth and yield attributes differed significantly due different combination of vermicompost, biofertilizers and chemical fertilizers in chickpea. The data from table 1 revealed that application of RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB produced significantly higher plant height (35.00 cm), number of branches $plant^{-1}$ (10.21), number of pod $plant^{-1}$ (54.57), grain (26.49) and straw yield (31.97) over rest of the treatments except treatment $\mathbf{T_{10}}$ and $\mathbf{T_{12}}$ (RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma) which having at par each others. The minimum values of all growth and yield attributes were significantly recorded on $\mathbf{T_1}$ (control). The higher values of yields with $\mathbf{T_{11}}$ (RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB) followed by application of $\mathbf{T_{12}}$ (RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma) might be ascribed due to higher doses of vermicompost, inoculation of *Rhizobium* and PSB, which increased in growth and yield attributing characters (mean plant height, branches $plant^{-1}$, pod $plant^{-1}$, 100 grain weight) by enhancing availability of nutrients, thereby given positive impact on productivity of chickpea. It has been observed that *Rhizobium* culture and phosphorus solubilising bacteria (PSB) both given beneficial effect on growth yield of chickpea. Devi *et al.* (2005) reported the application organic sources significantly enhanced the yield and yield components, vermicompost @10 ton ha^{-1} gave the highest number of pods per plant (50.77), number of grains per pod (1.30), and grain (23.22 g) and biological (46.69 g) yields per plant and per hectare (32.09 and 74.58 quantal, respectively). Similar findings were reported by Asewar *et al.* (2003), Singh and Yadav (2004).

The data from table 2 revealed that application of RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB ($\mathbf{T_{11}}$) recorded maximum cost of cultivation (Rs. 38,439.00 ha^{-1}) and maximum gross monetary return (Rs. 77,388.34 ha^{-1}) amongst other treatments. It was revealed that (table 2) net monetary returns (Rs. 40,086.0 ha^{-1}) and benefit cost ratio (2.12) were registered maximum under $\mathbf{T_{12}}$ (RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma), which was significantly more than rest of the treatments except $\mathbf{T_9}$, $\mathbf{T_{10}}$ and $\mathbf{T_{10}}$, whereas at par each others. The application of RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma ($\mathbf{T_{11}}$) was significantly resulted in the higher values of net monetary returns and benefit cost ratio, which might be due to lower cost of cultivation and higher grain and straw yields. Similar findings were reported by Asewar *et al.* (2003), Singh and Yadav (2004) and Bajracharya and Rai (2009).

Conclusion

A field experiment was conducted during *Rabi* season of 2010-11 at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.), India to study the Effect of different combination of vermicompost, biofertilizers and chemical fertilizers on growth, productivity and profitability in chickpea on sandy loam soil of central Uttar Pradesh under irrigated condition. The growth, yield attributes and yield of chickpea in terms of plant height, branches $plant^{-1}$, number of pod $plant^{-1}$, 100-grain weight and grain and straw yield were significantly maximum achieved in RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB (26.49 q ha^{-1}) followed by RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB (25.89 q ha^{-1}), RDF + @ 3.0 ton ha^{-1} VC + *Rhizobium* (25.41 q ha^{-1}), RDF + @ 5.0 ton ha^{-1} VC + PSB. (24.93 qha^{-1}) and RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* (24.57 q ha^{-1}). The highest net profit and B : C ratio was found in R.D.F + @ 3.0 ton ha^{-1} VC + *Rhizobium* + PSB + Trichoderma (Rs. 40076.0 ha^{-1}) followed by significantly at par with RDF + @ 5.0 ton ha^{-1} VC + *Rhizobium* + PSB (Rs. 38949.3 ha^{-1}). However, the minimum net profit was obtained in control (Rs. 13305.33 ha^{-1}).

References

Anonymous (2010). All India coordinate Research project on chickpea. Chickpea Research Highlights, 2010.

Asewar, B. V., S. S. Bainade, O. D. Kohire and P. S. Bainade (2003). Integrated use of vermicompost and inorganic fertilizer in chickpea. *Annals of Plant Physio.*, **17(2)** : 205-206.

Bajracharya, S. K. and S. K. Rai (2009). Study on the effects of vermicompost on the nodulation and the yield of chickpea. *Nepal Agriculture Res. Journal*, **9** : 132-138.

Devi, Uma and K. P. Singh (2005). Integrated nutrient management in chickpea (*Cicer arietinum* L.). *Haryana J. Agron.*, **21(1)** : 74.

Panse, V. G. and P. V. Sukhatme (1967). Statistical methods for agricultural workers. ICAR publication, New Delhi.

Singh, R. K. and B. S. Yadav (2004). Effect of vermicopost and fertilizers on productivity of gram (*Cicer arietinum*) and soil fertility. *Indian J. Agril. Sci.*, **74(11)** : 613-615.