

Effect of integrated nutrient management on growth and yield of pigeonpea (*Cajanus cajan* L. Millsp.)

A.B. PATIL* AND D.R. PADMANI

Department of Agronomy, College of Agriculture, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA

ABSTRACT

An experiment was conducted during the rainy (*khariif*) season of 2001-02 at Junagadh (Gujarat) to study the influence of integrated nutrient management on growth, nodulation and dry matter yield of pigeonpea (*Cajanus cajan* L. Millsp.). Seed inoculation with biofertilizers (*Rhizobium* + *P. striata*) significantly increased the dry matter accumulation, nodules per plant, yield attributes and yield. Manuring the crop with FYM 5 t ha⁻¹ gave significantly 4.26 per cent higher grain yield of pigeonpea over no manuring. Fertilizing the crop with 75 and 100% RDF ha⁻¹ found equally effective and significantly superior to control in respect of growth parameters, yield attributes and yield of pigeonpea. The interaction effect between farmyard manure and recommended dose of fertilizers was found to be significant in respect of grain yield

Key words: Pigeonpea, INM, Growth, Nodulation, Yield

INTRODUCTION

Pigeonpea (*Cajanus cajan* L. Millsp.) is the fifth prominent pulse crop in the world and second in India after chickpea. Being a pulse, it plays an important role for improving the soil fertility and consequently the productivity of succeeding crops. To meet the demands of pulse crops of ever increasing population of our country, it is necessary to improve the production and productivity of pulse crops. In order to increase the production further there is no other option except to increase productivity by using available resources most efficiently. Fertilizers use continued to play a key role in augmenting higher crop productivity but reckless use of it deteriorates soil health, energy conserving ecosystem and economics. It has been realized that not only chemical fertilizers but also organic manures in conjunction with biofertilizers will sustain and maintain the productivity of soil. Therefore, it is needed to compare various organic as well as biological sources of nutrients with chemical fertilizers in order to find out most effective combination. Keeping this objective in view, the present investigation was conducted to study the effect of integrated nutrient management on growth, nodulation and dry matter yield of pigeonpea

MATERIALS AND METHODS

The investigation was carried out at Instructional Farm, Junagadh Agricultural University, Junagadh during the kharif season of 2001-02. The soil of the experimental plot was clayey in texture having pH 7.7, medium in total nitrogen and available phosphorus and high in available

potassium. The experiment was laid out in factorial randomized block design with sixteen treatment combinations involving two levels of Biofertilizers (with and without seed inoculation of *Rhizobium* plus *Pseudomonas striata*), two levels of FYM (with and without 5 ton FYMha⁻¹) and four levels of Recommended dose of fertilizers (0, 50, 75 and 100 % RDFha⁻¹) with four replications. Pigeonpea Cv. GT-1 was sown at 90cm x 20cm spacing with 15 kg seed/ha in first week of July. The recommended dose of fertilizers @ 25:50:0 kg N:P:K ha⁻¹ was considered as 100% RDF. The crop was fertilized as per treatments with application of urea and diammonium phosphate at the time of sowing, while well decomposed FYM containing 0.5 % N, 0.2% P₂O₅ and 0.5 % K₂O was applied 10 days prior to sowing as per treatments. Seed was inoculated with a culture of *Rhizobium* plus *Pseudomonas striata* as per treatments before sowing. Other cultural operations were done as per recommendation and crop requirements. During crop growth period about 547.6 mm rainfall was received in 41 rainy days. Finally the crop was harvested and produce were thrashed, cleaned, dried and weighed. The yield data was subjected to statistical analysis.

RESULTS AND DISCUSSION

Effect of biofertilizers (Rhizobium + P. striata)

Seed inoculation with biofertilizers significantly increased the growth parameters viz., plant height and number of branches per plant at harvest and number of root nodules at 30, 60 and 90 DAS as well as yield attributes viz., number of pods per plant, number of grains

* Author for correspondence, Present Address : Dept. of Agronomy, College of Horticulture, P.S.G.V.P. Mandal, Shahada (M.S.)

per pod, grain yield per plant and test weight of pigeonpea crop as compared to control (Table 1). Biofertilizers inoculation resulted in greater nodulation resulted in increased availability of fixed as well as applied nitrogen and phosphorus to the plants, which in turn encourage cell formation, division and multiplication. The beneficial effect of these inoculations on yield attributes seem to be due to better availability of nutrient and their translocation, which reflect in terms of increased yield attributes of pigeonpea. Significantly the highest grain and stover yields were also reported by seed inoculation with biofertilizers which was 3.97 per cent and 15.04 per cent higher over uninoculated control respectively as grain yield is chiefly a product of all yield attributing characters and increase in these characters (Table 1) with increased plant growth (Table 1) as a result of biofertilizers inoculation might

pod, grain weight per plant and test weight as compared to control (without FYM) (Table 1). This may be due to the fact that farmyard manure increase the adsorptive power of soil for cation and anion and these absorbed ions are released slowly for the entire crop growth period resulted in better nutrient availability at active crop growth. The increase in these attributes might have been on account of the overall improvement in vegetative growth of the plants due to application of farmyard manure, which favourably influenced flowering, fruiting and ultimately resulted into increased number of pods per plant and number of grains per pod. Manuring the crop with FYM 5 t ha⁻¹ recorded 4.26 per cent higher grain yield and 12 per cent higher stover yield over no manuring. FYM acts as a nutrient reservoir and releases major and minor nutrients, which might have favourably influenced the plant

Table 1 : Effect of biofertilizers, farmyard manure and recommended dose of fertilizers on growth, yield attributes and yield of pigeonpea

Treatments	Plant height (cm)	No. of branches / plant	Number of nodules / plant			No. of pods / plant	No. of grains / pod	Grain yield / plant (g)	Test weight (g)	Yield (kg ha ⁻¹)	
			30 DAS	60 DAS	90 DAS					Grain	Stover
Biofertilizers (<i>Rhizobium</i> + <i>P. striata</i>)											
B ₀ No inoculation	162.15	18.58	3.71	6.73	6.31	152.39	3.43	23.40	12.63	1230	2344
B ₁ Inoculation	167.96	19.64	3.90	8.26	7.87	162.25	3.97	26.85	12.92	1279	2696
CD (P = 0.05)	3.48	0.79	0.16	0.54	0.53	5.12	0.13	1.89	0.24	36.09	47.78
Farmyard manure (FYM)											
F ₀ No FYM	162.98	18.63	3.71	6.55	6.17	153.14	3.53	23.68	12.63	1228	2378
F ₁ FYM 5 t ha ⁻¹	167.13	19.59	3.90	8.43	8.02	161.51	3.87	26.53	12.92	1281	2663
CD (P = 0.05)	3.48	0.79	0.16	0.54	0.53	5.12	0.13	1.89	0.24	36.09	47.48
Recommended dose of fertilizers (RDF)											
R ₀ 0% RDF ha ⁻¹	160.86	16.63	3.13	6.23	5.83	133.03	3.25	22.32	12.11	1084	2373
R ₁ 50% RDF ha ⁻¹	163.84	17.84	3.54	7.16	6.80	150.69	3.56	24.33	12.61	1154	2485
R ₂ 75% RDF ha ⁻¹	166.56	20.14	3.99	7.98	7.55	166.61	3.86	26.25	13.09	1375	2596
R ₃ 100% RDF ha ⁻¹	168.96	21.83	4.30	8.59	8.19	178.96	4.13	27.52	13.29	1406	2627
CD (P = 0.05)	4.92	1.12	0.22	0.76	0.74	7.24	0.19	2.67	0.34	51.05	67.15

have been resulted in increased grain and stover yield (kg ha⁻¹) of pigeonpea crop. These findings are in agreement with those obtained by Shah (1993) and Singh *et al.* (1998).

Effect of farmyard manure (FYM)

Pigeonpea crop manured with FYM 5 t ha⁻¹ significantly increased the growth parameters viz., plant height, number of branches per plant at harvest and number of root nodules at 30, 60 and 90 DAS as well as yield attributes like number of pods per plant, grains per

growth leading to increased yield attributes and finally higher yield of the crop. The results are in close conformity with the findings of Sarkar *et al.* (1997).

Effect of recommended dose of fertilizers (RDF)

Fertilizing the crop with 75 and 100% RDF ha⁻¹ found equally effective and significantly superior to control in respect of growth parameters and yield attributes of pigeonpea. The overall improvement in growth parameters of pigeonpea with the addition of fertilizers could be ascribed due to their pivotal role in several

physiological and biochemical processes viz., root development, photosynthesis and energy transfer reactions (Lakkineni and Abrol, 1994). The favourably effect of higher level of fertilization on the number of pods per plant and grains per pod may be due to the fact that formation of floral parts takes place at the expense of foods translocated to the floral meristem. Therefore, increase in these parameters with increasing levels of fertilizers could be ascribed to the overall improvement in plant growth, vigour, production and translocation of photosynthates and nutrients to developing reproductive structure which reflected into greater grain yield per plant test weight and finally the grain and stover yields per ha. Each incremental level of recommended dose of fertilizers significantly increased the grain and stover yields of pigeonpea crop (Table 1). The maximum grain yield (1406 kg ha⁻¹) and stover yield (2627 kg ha⁻¹) were recorded under 100% RDF ha⁻¹ but it was followed by 75% RDF ha⁻¹. Appreciable increase in number of pods per plant and grains per pod (Table 1) as a result of fertilizer application might have reflected in increased grain yield whereas, improvement in growth parameters viz., plant height and number of branches per plant (Table 1) due to fertilizer application might have resulted in higher stover yield. The results are substantiated with the studies conducted by Rao *et al.* (1983) and Thakur *et al.* (1988).

Interaction effect

The interaction effect between farmyard manure and recommended dose of fertilizers was found to be significant in respect of grain yield (kg ha⁻¹) (Table 2).

Table 2 : Interaction effect of farmyard manure and recommended dose of fertilizers on yield (kg ha⁻¹) of pigeonpea

Recommended dose of fertilizers (RDF)	Farmyard manure (FYM)	
	F ₀ (No FYM)	F ₁ (FYM 5 t ha ⁻¹)
R ₀ 0% RDF ha ⁻¹	1016	1151
R ₁ 50% RDF ha ⁻¹	1158	1150
R ₂ 75% RDF ha ⁻¹	1365	1385
R ₃ 100% RDF ha ⁻¹	1375	1436
C.D. (P = 0.05)	51.05	

Application of 100% RDF ha⁻¹ along with FYM 5 t ha⁻¹ gave significantly the highest grain yield (1436 kg ha⁻¹) but found equally effective with 75 % RDF ha⁻¹ along with FYM 5 t ha⁻¹ and significantly superior to rest of treatment combinations. The increase in grain yield may be attributed to the reason that chemical fertilizers along with FYM possibly increased the concentrations of N, P and K ions of soil solution and ultimately affected the formation of more nodules, vigourous root development, better N fixation and better development of plant growth leading to higher photosynthetic activity and translocation of photosynthates to the sink which in turn resulted in better development of yield attributes and finally in higher grain yield.

REFERENCES

- Lakkineni, K.C. and Abrol, Y.P. (1994). Sulphur requirements of crop plants: Physiological analysis. *Fert. News.*, **39(3)**: 11-18.
- Rao, Y.Y., Reddy, G., Ramasubba, C. and Ramaseshaish, K. (1983). Response of *rabi* red gram to different levels of fertility. *Andhra Agric. J.*, **30** : 196-199.
- Sarkar, R.K., Shit, D. and Chakraborty, A. (1997). Effect of levels and sources of phosphorus with and without farmyard manure on pigeonpea under rainfed condition. *Indian J. Agric.*, **42(1)**: 120-123.
- Shah, M.J. (1993). Effect of N,P, *Rhizobium* and P-solubilizing biofertilizers in growth yield and quality of pigeonpea. M.Sc. (Agri), A thesis submitted to G.A.U., Sardar Krishinagar
- Singh, G.V., Rana, N.S. and Ahlawat, I.P.S. (1998). Effect of nitrogen, *Rhizobium* inoculation and phosphorus on growth and yield of pigeonpea (*Cajanus cajan*). *Indian J. Agron.*, **42(3)**: 358-361.
- Thakur, H.S., Raghuvanshi, R.K.S., Verma, R.S. and Verma, G.P. (1988). Effect of fertilizer doses and plant density on yield of pigeonpea. *Advancement of crops and monitoring of environment process in ecology.*, **10**:373-377.

Received : October, 2006; Accepted : January, 2007