INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

Volume: 2: Issue-2: April-June -2011 IJABPT *ISSN 0976-4550*

INTEGRATED NUTRIENT MANAGEMENT IN PIGEONPEA (*CAJANUS CAJANA*)

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ABSTRACT : A field experiment was conducted during kharif 2005 and 2006 to study the effect of fertilizer, farmyard manure and biofertilizers on growth and yield of pigeonpea. The result revealed that 50%RDF + seed treatment with Rhizobium@200 g/kg seed recorded significantly more number of branches (16.3/Pl.), pods (151.3/Pl.), higher grain yield (1358 kg/ha) and net returns (Rs. 15541/-) followed by RDF+FYM and Rhizobium inoculation (14/Pl., 142/Pl.,1325 kg/ha and Rs. 13304/-) and 50%RDF+ dual inoculation with Rhizobium and PSB (14/Pl, 133/Pl., 1305 kg/ha and Rs. 14462/-) respectively.

Key words: Nutrient, PIGEONPEA, Management

INTRODUCTION

Pigeonpea (*Cajanus cajana Millsp.*) is an important crop amongst pulses and ranked second after chickpea in India interms of area and production. It provides protein rich food, firewood and income for resource poor small farmers. In India area sown under crop was 34.02 lakh hectares during 2005-06 with production of 2.47 million tons (http://aaqua.persistent.) Andhra Pradesh is one among the important states in the country cultivating pigeonpea When pigeonpea is grown as a sole crop, it is relatively inefficient because of its slow initial growth rate and low harvest index therefore it is grown as intercrop, which helps in efficient utilization of available resources for enhancing the productivity and profit. Several factors are responsible for low productivity, among them imbalance fertilization and terminal stress are important ones. To enhance the productivity of this crop, use of balanced fertilization by application of organic manures, NPK along with biofertilizers viz., Rhizobium and PSB is of great importance. Inoculation of pulses with PGPR and Rhizobium causes growth stimulation of plant and enhances crop yields (Sharma *et al.,* 2007). The synergism has also been reported between Rhizobium spp. and PSB in soybean (Dubey 1997) and urdbean (Prasad *et al.,* 2002)

Modern agriculture depends on the application of fossil fuel based inputs like chemical fertilizers, pesticides and herbicides. There is growing awareness and concern over their adverse effects on soil productivity and environmental quality. The high cost of chemical fertilizers, the low purchasing power of small and marginal farmers and their adverse effect on environment has led to look for some alternative strategies (Tilak, 2007). One such approach is the use of different integrated nutrient management systems, which can save the soil, environment and farmers limited resources. In Andhra Pradesh, redgram is often grown on marginal lands and is generally supplied with suboptimal doses of fertilizers in local varieties leading to low productivity of the crop. Balanced and efficient fertilizer application, combining inorganic and organic and biofertilizers are essential in realizing the higher yield and reducing cost of production. Therefore the present investigation was taken up to assess the influence of organic and inorganic fertilizers and biofertilizers on growth and yield parameters of redgram.

MATERIAL AND METHODS

A field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur, ANGRAU, during *kharif* seasons of 2005 & 2006 in black cotton soils having pH 8.3, organic carbon 0.32 , P medium (25) and medium K(127.5). The experiment comprising of 17 treatments consisted of all combinations of fertilizers: RDF and 50% RDF, FYM: no FYM and FYM @ 5t/ha, PSB: no PSB and PSB, Rhizobium: no inoculation and Rhizobium inoculation.

T1- Absolute control
T2- RDF
T3-50% RDF
T4- T2+FYM
T5- T2+ PSB
T6- T2+ RHIZOBIUM
T7- T3+FYM
T8- T3+PSB
T9- T3+ RHIZOBIUM
T10-T2+FYM+RHIZOBIUM
T11- T2+FYM+PSB
T12- T3+FYM+PSB
T13- T3+FYM+RHIZOBIUM
T14- T2+PSB+ RHIZOBIUM
T15-T3+ PSB+ RHIZOBIUM
T16-T2+FYM+ PSB+ RHIZOBIUM
T17-T3+ FYM+ PSB+ RHIZOBIUM

All the treatments were replicated thrice in factorial RBD. The recommended dose of fertilizer i.e 20 kg N and 50 kg P205/ha were applied as basal as per the treatment at sowing. Well decomposed FYM (5 t/ha) was applied as per the treatment and incorporated in to soil. Pigeonpea variety LRG-41 was sown in rows 210 cm apart during first week of July. The gross and net plot sizes were 36 and 14.4m^2, respectively. The seeds were treated with Rhizobium and PSB cultures@200g/ kg seed just before sowing. Recommended plant protection measures and other management practices were followed. Cost of cultivation, net returns as well as BC ratio were also worked out.

RESULTS AND DISCUSSION

Growth and yield attributes: All the treatment applications had no significant effect on plant height. Where as the other yield attributes like number of branches and pods per plant have shown significant differences. Performance of redgram was better with combined application of inorganic fertilizers and biofertilizers. Application of 50%RDF through inorganic fertilizer + Rhizobium @200g/kg seed at the time of sowing recorded significantly more number of branches (16.3/pl) and pods (151.3/pl) followed by RDF+FYM+Rhizobium (14 and 142.6/pl) and 50%RDF+Rhizobium+PSB (14 & 133.8/pl) respectively.

Yield: All the treatments had shown significantly higher yields than control. Among the treatments performance of redgram was better with combined application of inorganic and biofertilizers. Application of 50% RDF through inorganic fertilizer+ Rhizobium @200g/kg seed at the time of sowing recorded higher grain yield 1358.4 kg/ha followed by RDF+FYM+Rhizobium (1325.233 kg/ha) and 50%RDF+Rhizobium+PSB (1304.5). How ever the differences found non significant in these three treatments. Application of FYM, Rhizobium and PSB combination treatments recorded higher yields than only RDF treatment.

The increase in yield with the addition of Rhizobium is possibly due to higher nitrogen availability as it improves growth, quality and yield of field crops. Jat and Ahlawat (2004) also reported that combined application of various organic and inorganic sources is capable of sustaining higher production by improving soil physical conditions and soil productivity.

Application of FYM improves soil physical conditions and NPK content of soil there by increases yield and yield attributes. Mathan *et al* (1994) and Namdev and Gupta (1999) also reported favourable effect of FYM on seed yield of redgram.Seed inoculation with biofertilizer treatments influencd the grain yield significantly over no inoculation. Thus dual inoculation of *Rhizobium* and PSB improves nutrient status of soil and ultimately increase the nutrient uptake which enhanced the yield of crop. A similar result was also recorded by Devanand *etal.,* (2002). In the present investigation improvement in growth and yield parameters like plant height, no. of branches and pods per plant may be the result of enhanced photosynthetic activity, followed by efficient transfer of these metabolites in the seed. This improvement may not be solely due to the inoculation of seed with biofertilizers but because of several other factors such as release of growth promoting substances, suppression of plant pathogens and proliferation of beneficial microbes in the rhizosphere (Kundu and Guar 1980, Goud and Kale, 2010)

Table1 :Growth parameters of pigeonpea as influenced by different INM treatments

Treatments	Plant height	Branches	Pods	Yield
T 1(Absolute control)	181.0	6.7	**77.03**	813.6
T 2(RDF)	199.7	8.9	**104.4**	920.1
T 3(50% RDF)	196.7	8.1	**101.7**	874.2
T 4(T2+FYM)	196.3	7.0	**87.13**	826.0
T 5(T2+PSB)	210.0	14.0	**129.2**	1256.1
T6(T2+Rhizobium)	207.3	11.0	**119.7**	1103.6
T 7(T3+FYM)	204.3	10.3	**115.7**	1084.2
T 8(T3+PSB)	203.7	10.2	**113.2**	1083.9
T 9(T3+Rhizobium)	235.0	16.3	**151.3**	1358.4
T10(T2+FYM+PSB)	206.7	11.0	**119.6**	1102.9
T 11(T2+FYM+ Rhizobium)	219.7	14.0	**142.6**	1325.2
T 12(T3+FYM+PSB)	201.3	9.3	**104.4**	1002.8
T 13(T3+FYM+ Rhizobium)	207.3	12.0	**128.9**	1168.2
T 14(T2+PSB+ Rhizobium)	202.3	9.3	**112.2**	1006.6
T 15(T3+PSB+ Rhizobium)	214.0	14.0	**133.8**	1304.5
T16(T2+FYM+PSB+ Rhizobium)	205.0	10.3	**116.7**	1087.3
T17(T3+FYM+PSB+ Rhizobium)	207.3	11.1	**128.8**	1142.6
SEm	**8.1**	**0.38**	**9.8**	**38.5**
CD	**NS**	**1.111**	**28.1**	**110.5**
CV	**6.9**	**6.2**	**14.2**	**14.2**

Table -2.Yield of pigeonpea as influenced by different INM treatments

Treatments	Grain Yield(Kg/ha)	Cost of cultivation (Rs.)	Net returns (Rs)	BC ratio
T 1(Absolute control)	813.590	8880	6795	0.65
T 2(RDF)	920.087	9500	7062	0.74
T 3(50% RDF)	874.233	8860	6876	0.78
T 4(T2+FYM)	826.000	10500	4368	0.42
T 5(T2+PSB)	1256.100	9600	13008	1.36
T 6(T2+Rhizobium)	1103.553	9550	10314	1.08
T 7(T3+FYM)	1084.167	9860	9655	0.98
T 8(T3+PSB)	1083.900	8960	10550	1.18
T 9(T3+Rhizobium)	1358.400	8910	15541	1.74
T 10(T2+FYM+PSB)	1102.933	10600	9253	0.87
T 11(T2+FYM+ Rhizobium)	1325.233	10550	13304	1.26
T 12(T3+FYM+PSB)	1002.767	9960	8090	0.81
T 13(T3+FYM+ Rhizobium)	1168.200	9910	11117	1.12
T 14(T2+PSB+ Rhizobium)	1006.633	9650	8469	0.88
T 15(T3+PSB+ Rhizobium)	1304.5	9010	14462	1.61
T16(T2+FYM+PSB+ Rhizobium)	1087.300	10650	8921	0.84
T17(T3+FYM+PSB+ Rhizobium)	1142.567	10010	10557	1.05
SEM	38.513			
CD	110.548			
CV	6.1%			

Maximum benefit cost ratio (1.74) was recorded with 50% RDF through inorganic fertilizer+ Rhizobium followed by 50%RDF+ dual inoculation with Rhizobium and PSB (1.61).
Thus it could be concluded that 50%RDF+Rhizobium was the best combination for getting higher productivity with maximum net returns.

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