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Effect of INM practices on yield, quality and economics of Pigeonpea (*Cajanus cajan* L. Millsp.) under rainfeed conditions

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ABSTRACT

A field experiment was conducted during the *kharif* season of 2001-02 to study the response of pigeonpea (*Cajanus cajan* L. Millsp.) to integrated nutriment management in clayey soils of Gujarat. The results revealed that seed inoculation with biofertilizers significantly increased the growth, yield, protein content and monetary returns of pigeonpea crop. The crop responded favourably to application of FYM 5 t ha^{-1} and gave significantly higher grain yield, protein yield and net returns over no manuring. A significant increasing in yield, protein content and protein yield was noted with each increment of fertilizer dose up to 100 % recommended dose. Fertilizing the crop with 100 % RDF ha^{-1} gave the highest net realization of Rs. 14854 ha^{-1}, however the highest net ICBR of 1:3.2 was secured with 75 % RDF ha^{-1}.

Key words: Pigeonpea, INM, Yield,Quality,Economics

INTRODUCTION

Pigeonpea (*Cajanus cajan* L. Millsp.) is one of the major pulse crop of India but has poor productivity of 720 kg ha^{-1} against the potential of 3000 kg ha^{-1} as recorded in different parts of the country. The low yield of pigeonpea is not only due to its cultivation on sub marginal lands, but also due to poor level of nutrient management. To overcome this problem, soil has to be fortified with different sources of nutrients. In this context, use of biofertilizers occupy an important place as they help in making available plant nutrients by fixing nitrogen and solubilization of phosphate, thus providing a scope for reduction in costly chemical fertilizers. The use of organic material in crop production is receiving attention worldwide. Total reliance on such materials alone, however, is unrealistic and mineral fertilizers in conjunction with organic fertilizers should be applied to obtain desirable yields. Inorganic fertilizers though support plant growth and increase yield, but in long run, they affect the soil biota and make soil infertile due to leaching, change in pH etc. Keeping this view in mind, an experiment was conducted to find out level of substitution of inorganic fertilizers with and without organic and biofertilizers for maximizing yield, quality and monetary returns of pigeonpea crop.

MATERIALS AND METHODS

An experiment was conducted at Instructional Farm, Junagadh Agricultural University, Junagadh during the *kharif* season of 2001-02. The experimental soil was clayey in texture, medium in total nitrogen and available phosphorus and high in available potassium with pH 7.7. 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:Kha^{-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% P_2O_5 and 0.5 % K_2O 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 547.3 mm rainfall was received in 41 rainy days. Two supplementary irrigations were given during the crop period. The protein content in grain was calculated by multiplying n content of seed with the factor 6.25 (Gassi *et al*. 1973) . Modified Kjeldhal's method and vanodomolybdo-phosphoric acid yellow colour method was adopted to find out N and P content in grains respectively (Jackson 1967). The protein yield (kg ha^{-1}) was calculated from the protein content and the grain yield.

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RESULTS AND DISCUSSION

Effect of biofertilizers (Rhizobium + P. striata):

Significantly the highest grain (1279 kg ha^{-1}) and stover (2696 kg ha^{-1}) yields was recorded by seed inoculation with biofertilizers, which was 3.97 per cent and 15.04 per cent higher over, uninoculated control (Table 1). Shah (1993) and Singh *et al*. (1998) also reported similar results. Protein content (22.04 %) and protein yield (282.28 kg ha^{-1}) was significantly increased with biofertilizers inoculation. Similar trend was also noticed in nitrogen and phosphorus content in pigeonpea grains. Seed inoculation may be attributed to increase nitrogen content in grain, as nitrogen is an integral part of protein. It may also be attributed due to increase phosphorus content in grain (Table 1), which is structural element of certain co-enzymes involved in protein synthesis, while the increase in protein yield may be attributed due to increase in protein content in grain and grain yield. The results are in accordance with Solaiappan and Ramiah (1990) in respect of protein content and Singh *et al.* (1998) with respect to protein yield. Maximum net realization of Rs. 13457 ha^{-1} was recorded with biofertilizers inoculation with net ICBR of 1:6.7. This may be attributed to significant increase in grain and stover yields under biofertilizers inoculation treatment with smaller increase in cost of production.

Effect of farmyard manure (FYM)

The application of farmyard manure significantly increased the grain and stover yields of pigeonpea. (Table1). The mean grain and stover yield recorded with 5 t ha^{-1} was 4.26 per cent and 12 per cent higher respectively over no manuring. The higher yields owing to farmyard manure application may be due to additional nutrients supplied by it and improvement in soil physical health. The findings are in accordance with that of Sarkar *et al*. (1997). The significant increase in protein content (21.97%) and protein yield (284.81 kg ha^{-1}) due to application of FYM 5 t ha^{-1} was recorded as compared to no FYM application. Manuring the crop with FYM 5 t ha^{-1} recorded 8.60 per cent higher protein yield over no manuring. Increasing trend was also noticed with respect to nitrogen and phosphorus content in pigeonpea grains. Similar observations were made by Sharma and Misra (1997) in soybean crop. Crop manured with FYM 5 t ha^{-1} recorded the highest net realization of Rs. 13367 ha^{-1} with net ICBR of 1:6.3. Significant increase in grain and stover yields with application of FYM 5 t ha^{-1} might be

Table 1 : Yield, quality and economics as influenced by integrated nutrient management in pigeonpea

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Protein content (%)	Protein yield (kg ha^{-1})	Nitrogen content (%) in grain	Phosphorus content (%) in grain	Net realization (Rs.ha^{-1})	Net ICBR
Biofertilizers (*Rhizobium + P. striata*)								
B_0 No inoculation	1230	2344	21.16	264.78	3.385	0.483	12718	--
B_1 Inoculation	1279	2696	22.04	282.28	3.515	0.502	13457	1: 6.7
CD (P = 0.05)	36.09	47.78	0.57	12.99	0.09	0.012	--	
Farmyard manure (FYM)								
F_0 No FYM	1228	2378	21.23	262.25	3.397	0.485	12495	--
F_1 FYM 5 t ha^{-1}	1281	2663	21.97	284.81	3.504	0.500	13367	1: 6.3
CD (P = 0.05)	36.09	47.48	0.57	12.88	0.09	0.012	--	
Recommended dose of fertilizers (RDF)								
R_0 0% RDF ha^{-1}	1084	2373	20.09	222.75	3.193	0.456	11154	--
R_1 50% RDF ha^{-1}	1154	2485	21.69	250.31	3.469	0.495	11779	1: 0.8
R_2 75% RDF ha^{-1}	1375	2596	22.09	304.19	3.534	0.505	14663	1: 3.2
R_3 100% RDF ha^{-1}	1406	2627	22.53	316.88	3.604	0.515	14854	1: 2.7
CD (P = 0.05)	51.05	67.15	0.80	18.37	0.12	0.017	--	

Market rates: Grain Rs. 15.50/kg
Stover Rs .0.25/kg

the reason for increased net realization.

Effect of recommended dose of fertilizers

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}) was recorded under 100% RDF ha^{-1} but it was followed by 75% RDF ha^{-1}. This might be due to effective utilization of increasing levels of fertilizers by the crop. The results are in line with those of Thakur *et al.* (1998). The maximum protein content (22.53%) and protein yield (316.88 kg ha^{-1}) was recorded with 100% RDF ha^{-1} and found equally effective with 75% RDF ha^{-1} but significantly superior to control. Increase in nitrogen content in grain due to fertilizer application may be attributed to increase the protein content in grain whereas increased grain yield as well as protein content consequently increased the protein yield of pigeonpea. The findings are akin to report of Singh and Prasad (1976) and Motiwade and Sheelawantar (1995). Fertilizing the crop with 100 % RDF ha^{-1} gave the highest net realization of Rs. 14854 ha^{-1}, however the highest net ICBR of 1:3.2 was secured with 75 % RDF ha^{-1}. The probable reason for increased net ICBR with 75 % RDF ha^{-1} may be that fertilizing the crop with 75 or 100 % RDF ha^{-1}, found equally effective in securing the grain and stover yields, but comparatively lower cost of production with 75 % RDF ha^{-1} as compared to 100 % RDF ha^{-1}.

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