ADVNACE RESEARCH JOURNAL OF CROP IMPROVEMENT
Volume 2 Issue 1 (June, 2011) Page : 31-34

Received : *February, 2011;* ***Accepted :*** *March, 2011*

Research Paper

Yield and yield attributing characters of cowpea as influenced by biofertilizers and fertility levels var. GC-4

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ABSTRACT

A field experiment was conducted on medium black calcareous soil of the Instructional Farm, Junagadh Agricultural University, Junagadh (Gujarat) during the *Kharif* 2008. The results of the experiment indicate that cowpea seeds inoculated with *Rhizobium* significantly increased the growth parameters *viz.,* plant height, number of branches per plant as well as yield attributes like number of pods per plant, grain yield per plant, stover yield per plant and test weight. Significantly the highest grain (1441 kg ha^{-1}) and stover (1716 kg ha^{-1}) yields were also recorded by seed inoculation with *Rhizobium*. Fertilizing the crop with 50, 75 and 100 % RDF were found effective and significantly superior to control in respect of growth parameters and yield attributes *viz.,* the highest grain (1439 kg ha^{-1}) and stover (1678 kg ha^{-1}) yields were reported with 100 % RDF but was found statistically at par with 75 % RDF.

Dekhane, S.S. and Chavan, A.S. (2011). Yield and yield attributing characters of cowpea as influenced by biofertilizers and fertility levels cv. GC-4. *Adv. Res. J. Crop Improv.,* **2** (1) : 31-34.

Key words : Cowpea, Biofertilizer, Fertility levels

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp, synonym, *Vigna sinensis* (L.) savi ex Hassk] is one of the important *Kharif* pulses grown in the India for grain, forage and green manure purpose. It is called as vegetable meat due to highly nutritious constitutions with high protein 23-24 % (average 23.4 %), carbohydrate 60.3 %, minerals and vitamins and also rich source of iron and calcium. It belongs to the family *Fabaceae* and probably a native of Central Africa.

The seeds treated with bacterial culture of *Rhizobium* increase nodulation and influence seed yield as well as economize the input cost of fertilizer to some extent. It also renders protection against soil deterioration and environmental pollution caused by heavy use of chemical fertilizers. The efficient strain of *Rhizobium* can fix about 90 kg of nitrogen per hectare in one season and enrich soil nitrogen.

Phosphorus is the key element in the process of conservation of solar energy. The optimum supply of phosphorus to the plant stimulates root development and growth, thereby helps to establish seedlings quickly and also hastens maturity as well as improves the quality of crop yield. It also reduces the harmful effect of excess nitrogen in plants.

MATERIALS AND METHODS

A field experiment was conducted during the *Kharif* season 2008 at Instructional farm, Junagadh Agricultural University, Junagadh (Gujarat) to study the sixteen treatments comprised of all possible combinations of four levels of biofertilizers (B_1- without inoculation, B_2- with PSB inoculation, B_3- with liquid PSB inoculation and B_4- with *Rhizobium* inoculation) and four levels of fertilizer *viz.,* recommended dose of fertilizers (R_0 – 0 %RDF, R_1 – 50 % RDF, R_2 – 75 % RDF and R_3 – 100 % RDF), were tried in factorial randomized block design with four replications on medium black calcareous soil with pH of 7.9 which was free from any kind of salinity or sodicity hazards. The gross and net plot sizes were 5.00 m x 2.70

m and 4.00 m x 2.4 m, respectively. The crop was fertilized with 20 kg nitrogen and 40 kg phosphorus per hectare in the form of urea and single super phosphate. The entire quantity of fertilizers was applied as basal in furrows at 5-6 cm depth by country seed drill before sowing.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1, 2 and 3:

Effect of biofertilizer:

Seed inoculation with biofertilizers significantly increased the growth parameters *viz*., number of branches per plant, number of pods per plant, number of grains per pod and plant height (Table 1) and test weight (Table 2) were significantly influenced by application of B_4 (*Rhizobium*) over B_2 (PSB) and B_3 (Liquid PSB) than control B_1 (uninoculated). *Rhizobium* inoculation resulted in greater nodulation and higher atmospheric nitrogen fixation as well as solublization of fixed soil phosphorus. These findings are in agreement with Baboo and Mishra (2001) with respect to plant height and number of branches per plant and Mishra (1999) in respect of number of pods per plant.

Rhizobium inoculation significantly increased the Grain and stover yield (1716 kg ha^{-1}) of cowpea (Table 2). The increase in stover yield might be the consequence of increased growth parameters. The findings are in close vicinity with the findings of Shah (1993) with respect to stover yield.

Effect of fertility levels:

The results presented in (Table 1) revealed that application of F_3 (100% RDF) produced significantly higher plant height of cowpea at harvest in comparison to F_2 (75% RDF), F_1 (50% RDF) and F_0 (0% RDF). Significantly highest plant height of 47.69 cm was recorded with application of F_3 (100% RDF) at harvest. Increasing trend of yield attributes was observed under this treatment. Significantly higher number of branches per plant (8.44), number of pods per plant (9.67), number of grains per pod (10.82) (Table 1) and test weight (10.14 g) were recorded with application of F_3 (100% RDF) (Table 2). The findings are in close vicinity with the findings of Cheng *et al.* (1999), Okpara (2000) and Kishan *et al.* (2001) with respect to plant height and number of branches per plant, Sharma (1990) with respect to pods per plants and test weight.

The maximum grain yield (1439 kg ha^{-1}) and stover yield (1678 kg ha^{-1}) were recorded under F_3 (100% RDF), over other levels of RDF. The results are substantiated with the studies conducted by Amin *et al.* (1990), Sharma (1990), Okpara (2000) with respect to grain yield and stover yield.

Interaction effect :

Data regarding interaction effect between biofertilizers and recommended dose of fertilizers on test

Table 1: Plant height at harvest, number of branches per plant, number of pods per plant and number of grains per pod as influenced by various treatments

Treatments	Plant height (cm) At harvest	No. of branches /plant	No. of pods / plant	No. of grains /pod
Biofertilizers				
B_1 = without inoculation	42.50	7.55	8.84	9.83
B_2 = with PSB inoculation	46.06	8.21	9.35	10.39
B_3 = with liquid PSB inoculation	44.81	8.07	9.18	9.94
B_4 = with *Rhizobium* inoculation	47.38	8.44	9.96	11.06
S. E. ±	1.03	0.20	0.23	0.27
C.D. (P=0.05)	2.95	0.56	0.66	0.78
Recommended dose of fertilizers (RDF)				
F_0 = 0% RDF (kg/ha)	43.13	7.62	8.83	9.63
F_1 = 50% RDF (kg/ha)	44.00	7.99	9.22	10.09
F_2 = 75% RDF (kg/ha)	45.94	8.22	9.61	10.68
F_3 = 100% RDF (kg/ha)	47.69	8.44	9.67	10.82
S. E. ±	1.03	0.20	0.23	0.27
C.D. (P=0.05)	2.95	0.56	0.66	0.78
Interactions	NS	NS	NS	NS
C.V. %	9.15	9.77	9.97	10.57

Table 2: Test weight, grain yield and stover yield as influenced by various treatments

Treatments	Test weight (g)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
Biofertilizers			
B_1 = without inoculation	9.08	1131	1398
B_2 = with PSB inoculation	9.66	1343	1598
B_3 = with liquid PSB inoculation	9.44	1235	1447
B_4 = with *Rhizobium* inoculation	10.08	1441	1716
S.E. ±	0.24	35.49	42.79
C.D. (P=0.05)	0.69	101.17	121.98
Recommended dose of fertilizers (RDF)			
F_0 = 0% RDF (kg/ha)	9.06	1128	1397
F_1 = 50% RDF (kg/ha)	9.26	1256	1502
F_2 = 75% RDF (kg/ha)	9.80	1326	1580
F_3 = 100% RDF (kg/ha)	10.14	1439	1678
S.E. ±	0.24	35.49	42.79
C.D. (P=0.05)	0.69	101.17	121.98
Interactions	Sig.	Sig.	NS
C.V. %	10.10	11.03	11.12

Table 3: Interaction effect of biofertilizers and recommended dose of fertilizers on test weight (g) of cowpea

Biofertilizers	Recommended dose of fertilizers			
	F_0 = 0% RDF (kg/ha)	F_1 = 50% RDF (kg/ha)	F_2 = 75% RDF (kg/ha)	F_3 = 100% RDF (kg/ha)
B_1 = without inoculation	9.50	9.03	8.45	9.35
B_2 = with PSB inoculation	9.47	9.18	10.23	9.77
B_3 = with liquid PSB inoculation	8.23	9.53	10.19	9.82
B_4 = with *Rhizobium* inoculation	9.06	9.31	10.33	11.63
S. E. ±		0.48		
C.D. (P=0.05)		1.38		
C.V. %		10.10		

weight of cowpea are presented in Table 3. Results reveal that application of *Rhizobium* along with 100 % RDF recorded significantly the highest test weight (11.63) but it was statistically at par with *Rhizobium* with 75 % RDF, and significantly superior to rest of the treatment combinations.

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