

## Response of Cowpea (*Vigna unguiculata*) to Inorganic and Biofertilizers

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### Article History

Article ID: IJEP0265

Received in 25<sup>th</sup> July, 2018

Received in revised form 13<sup>th</sup> September, 2018

Accepted in final form 28<sup>th</sup> September, 2018

### Abstract

A field experiment was conducted to study the Effect of inorganic and biofertilizers on growth and yield of cowpea at Agronomy section, College of Agriculture, VNMKV, Latur, India. The experimental field was levelled and well drained. The soil was clayey in texture, moderate in nitrogen (216 kg ha<sup>-1</sup>), medium in phosphorous (16.54 kg ha<sup>-1</sup>), high in potash (465 kg ha<sup>-1</sup>) and moderate alkaline in nature (8.02 pH). The experiment was laid out in a factorial randomised block design. Each experimental unit was replicated three times. The gross and net plot size of each experimental unit was 5.4×4.2 and 4.8×3.6 m<sup>2</sup> respectively. There were nine treatment combinations of levels each of RDF and bio fertilizer viz. 75% RDF, 100% RDF, per cent RDF and Seed inoculation of PSB, Seed inoculation of rhizobium, dual seed inoculation of PSB+Rhizobium. Application of 125% RDF was recorded significantly higher growth and yield contributing characters viz. plant height (92.8 cm), no. of branches plant<sup>-1</sup> (8.7) no. of functional leaves plant<sup>-1</sup> (29.6), dry matter plant<sup>-1</sup> (23.6 g) and no. of seeds plant<sup>-1</sup> (66.1), no of pods plant<sup>-1</sup> (8.6) pod yield plant<sup>-1</sup> (7.98 g), seed yield kg ha<sup>-1</sup> (1564), straw yield (3881 kg ha<sup>-1</sup>) and seed index (8.7 g) respectively over the application of 75% RDF. Dual inoculation of PSB+Rhizobium culture was found superior than alone PSB treatment in respect of growth and yield parameters

**Keywords:** Bio fertilizer, RDF, PSB, rhizobium, pH, phosphorous, fertilizer

### 1. Introduction

Cowpea (*Vigna unguiculata* L.) is of immense importance multipurpose grain legume. The green pods of cowpea are used as vegetables. In addition to grain, it is also grown for its nutritious fodder under favourable conditions. It contains protein 23.4%, 1.8% fat and 60.3% CHO also rich in source of Ca and Fe. It is grown as green manure crop for soil improvement. Cowpea is called as vegetable meat due to high amount of protein with better biological value on dry weight basis. Increasing fertilizer prices and high requirement of nutrients differ the farmers from using the recommended doses of inorganic fertilizers. However pulses can harvest more than synthetically produced nitrogen from atmosphere saving huge quantity costlier energy. The bacterial culture inoculated to seeds for increasing pulse crop yield nowadays is becoming standard practice. Seed inoculation has assumed greater importance in the improvement of crop production, specially of pulse crops. Special attention must be given to the bacterial inoculation. It is generally, done by inoculation seeds to be sown with effective strain of rhizobia for increasing the yield of crop and nitrogen content of the soil. India is the largest producer and consumer of pulses in the world accounting for about 29% of the world area and 19% of the world production. At present the total area under pulses is 21.64 mha with

production of 11.93 mt. Among grain legumes, the green pods of cowpea are used as vegetables. In addition to grain, it is also grown for its also grown for its nutritious fodder. Cowpea is grown as catch crop, mulch crop, intercrop, mixed crop, and green crop. It has ability to fix atmospheric nitrogen in soil at the rate of 56 kg ha<sup>-1</sup> in association with symbiotic bacteria under favourable condition.

### 2. Materials and Methods

The field experiment was conducted during *kharif* season of 2011 at the Experimental Farm, Agronomy Section, College of Agriculture VNMKV, Latur. (M.S), India to study the effect of inorganic and biofertilizers on growth, yield and quality of cowpea (konkan sadabhar). The experiment was laid in Fractional Randomized Block Design (FRBD) with nine treatment combinations of three levels RDF and bio fertilizer and replicated thrice. To find out the suitable combination of N and P with biofertilizers and to assess the effect of inorganic and biofertilizers on protein content of cowpea. The gross and net plot size of each experimental unit was 5.4×4.2 m<sup>2</sup> and 4.8×3.6 m<sup>2</sup> respectively. The soil of the experimental plot was deep black in colour with good drainage and levelled topography with clayey in texture, moderate in nitrogen (216 kg ha<sup>-1</sup>), medium in phosphorous (16.54 kg ha<sup>-1</sup>), high



in potash (465 kg ha<sup>-1</sup>) and moderate alkaline in nature (8.02 pH). The crop was sown by dibbling with 2-3 seeds hill<sup>-1</sup> at a distance of 300 cm<sup>2</sup> at about 2.5 cm depth. Sowing of seeds was done on 9<sup>th</sup> July, 2011. The recommended dose of fertilizer (25:50:00 NPK kg ha<sup>-1</sup>) was applied through DAP and Urea. The three fertilizer levels were 75, 100 and 125% RDF and three biofertilizers treatments were PSB, Rhizobium and PSB+Rhizobium.

### 3. Results and Discussion

#### 3.1. Effect of different levels of RDF on Growth and Yield of cowpea

The growth and yield parameters of cowpea were significantly influenced by different levels of fertilizers and bio fertilizers

(Table 1). The maximum plant height (92.8 cm), no. of functional leaves plant<sup>-1</sup> (29.6), no. of pods plant<sup>-1</sup> (8.6), seed yield (1564 kg ha<sup>-1</sup>), straw yield (3881 kg ha<sup>-1</sup>) were recorded due to the application of fertilizer levels 125% RDF (F<sub>3</sub>) and significantly superior than 75% RDF (F<sub>1</sub>) but satisfactory at par with the application of 100 per cent RDF (F<sub>2</sub>). The higherno. of branches plant<sup>-1</sup> (8.7), no. of seeds plant<sup>-1</sup> (66.1) and pod yield plant<sup>-1</sup> (7.98 g) was recorded due to the application of fertilizer levels 125% RDF (F<sub>3</sub>) and significantly superior over the treatments 100 per cent RDF (F<sub>2</sub>) and 75% RDF (F<sub>1</sub>). The higher dry matter production plant<sup>-1</sup> (23.6 g) and seed index (8.7) was recorded due to the application of 125% RDF (F<sub>3</sub>) but did not found significantly superior over the treatments 100% RDF (F<sub>2</sub>) and 75% RDF (F<sub>1</sub>).

Table 1: Growth and yield of cowpea as influenced by different treatments

Treatments	Plant height (cm)	No. of branches plant <sup>-1</sup>	No. of functional leaves plant <sup>-1</sup>	Dry matter plant <sup>-1</sup> (g)	No. of seeds plant <sup>-1</sup>	No. of pods plant <sup>-1</sup>	Pod yield plant <sup>-1</sup> (g)	Seed yield kg ha <sup>-1</sup>	Straw yield kg ha <sup>-1</sup>	Seed index (g)
<b>Fertilizer levels (F)</b>										
F <sub>1</sub> : 75% RDF	79.3	6.3	24.5	21.1	47.2	7.7	5.96	1222	3306	8.6
F <sub>2</sub> : 100% RDF	85.3	7.7	27.2	22.4	58.3	7.9	6.96	1456	3641	8.7
F <sub>3</sub> : 125% RDF	92.8	8.7	29.6	23.6	66.1	8.6	7.98	1564	3881	8.7
SEm±	2.78	0.26	0.8	0.80	1.7	0.24	0.27	53	160	0.13
CD (p=0.05)	8.34	0.79	2.5	NS	5.3	0.72	0.81	158	480	NS
<b>Biofertilizers (B)</b>										
B <sub>1</sub> : PSB	78.6	7.1	25.6	21.7	50.1	7.4	6.33	1305	3468	8.6
B <sub>2</sub> : Rhizobium	85.5	7.1	26.5	22.5	53.1	8.3	7.06	1355	3634	8.7
B <sub>3</sub> : PSB+Rhizobium	93.4	8.5	29.3	24.8	59.9	8.4	7.51	1581	3725	8.7
SEm±	2.78	0.26	0.8	0.80	1.7	0.24	0.27	53	160	0.13
CD (p=0.05)	8.34	0.79	2.5	NS	5.3	0.72	0.81	158	480	NS
<b>Interaction F×B</b>										
SEm±	8.34	0.45	1.44	1.32	3.00	0.41	0.47	91	88.06	0.22
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

#### 3.2. Effect of different levels of Biofertilizers on growth and yield of cowpea

The maximum plant height (93.4 cm), no of pods plant<sup>-1</sup> (8.4) and pod yield plant<sup>-1</sup> (7.5 g) was recorded due to the application of PSB+Rhizobium (B<sub>3</sub>) and satisfactory at par with the application of rhizobium (B<sub>2</sub>) and found significantly superior over the treatment PSB (B<sub>1</sub>). The higher straw yield (3725 kg ha<sup>-1</sup>) was recorded due to the application of PSB+Rhizobium (B<sub>3</sub>) and significantly at par with the treatments rhizobium (B<sub>2</sub>) and PSB (B<sub>1</sub>). The maximum no. branches plant<sup>-1</sup> (8.5), no. of functional leaves plant<sup>-1</sup> (29.3), no. of seeds plant<sup>-1</sup> (59.9) and seed yield (1581kg ha<sup>-1</sup>) was recorded due to the application of PSB + Rhizobium (B<sub>3</sub>) and significantly

superior over the treatments rhizobium (B<sub>2</sub>) and PSB (B<sub>1</sub>). The maximum dry matter plant<sup>-1</sup> (24.8 g) and seed index (8.7 g) was recorded due to the application of PSB + Rhizobium (B<sub>3</sub>) but did not found significantly superior over the treatments rhizobium (B<sub>2</sub>) and PSB (B<sub>1</sub>). The interaction fertilizer levels and biofertilizers was did not found significant in case of all growth and yield attributing characters. The combined effect of PSB and rhizobium culture increased phosphorous availability and rhizobium provides the availability of atmospheric N for better growth of the crop.

#### 3.3. Economics of cowpea influenced by different treatments

Data presented in Table 2. Revealed that the highest gross monetary returns (₹ 50801 ha<sup>-1</sup>) and net monetary returns



Table 2: Economics of cowpea as influenced by different treatments

Fertilizer levels (F)	GMR (₹ ha <sup>-1</sup> )	NMR (₹ ha <sup>-1</sup> )	B:C Ratio
<b>Fertilizer levels (F)</b>			
F <sub>1</sub> : 75% RDF	39966	22125	2.2
F <sub>2</sub> : 100% RDF	47321	28836	2.6
F <sub>3</sub> : 125% RDF	50801	31672	2.6
SEm±	1717	1717	—
CD (p=0.05)	5151	5151	—
<b>Biofertilizers (B)</b>			
B <sub>1</sub> : PSB	42618	24108	2.3
B <sub>2</sub> : Rhizobium	44284	25709	2.4
B <sub>3</sub> : PSB+Rhizobium	51155	32555	2.7
SEm±	1717	1717	—
CD (p=0.05)	5151	5151	—
<b>Interaction F×B</b>			
SEm±	3312	3312	—
CD (p=0.05)	NS	NS	—

(₹ 28836 ha<sup>-1</sup>) was obtained due to the application of fertilizer levels 125% RDF (F<sub>3</sub>) and significantly superior than 75% RDF (F<sub>1</sub>) but satisfactory at par with the application of 100 per cent RDF (F<sub>2</sub>). The highest B:C ratio (2.6) was recorded due to the application of fertilizer levels 125% RDF (F<sub>3</sub>). The application of biofertilizers PSB+Rhizobium (B<sub>3</sub>) recorded highest gross monetary returns (₹ 51155 ha<sup>-1</sup>) and which is at par with the application of rhizobium (B<sub>2</sub>) and PSB (B<sub>1</sub>). The highest net monetary returns (₹ 18600 ha<sup>-1</sup>) and benefit cost ratio was recorded due to the application of biofertilizers PSB+Rhizobium (B<sub>3</sub>).

#### 4. Conclusion

Application of 125% RDF recorded higher growth and yield as well as economic returns but it was found at par with 100 per cent RDF. The Application of 100% RDF (25:50:00 NPK ha<sup>-1</sup>) along with combined seed treatment of PSB and rhizobium was found beneficial than alone seed treatment of PSB.

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