



Effect of Fertilizer, Organic Manure and Bio-fertilizer on Summer Grown Cowpea (*Vigna unguiculata* L. Walp)

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In India, pulses are grown in an area of 25.21 million ha with a total production of 19.78 million tones with a productivity of 763 kg ha⁻¹. In Gujarat, it is cultivated in an area of 6.54 lakh ha with an annual production of 5.99 lakh tonnes and average productivity of 916 kg ha⁻¹ (Anonymous 2016). About a dozen of pulse crops *viz.*, chickpea, pigeonpea, green gram, black gram, lentil, field pea, lathyrus, cowpea, common bean, moth bean, horse gram and rice bean are cultivated under varied agro-ecological conditions. Among the pulses, cowpea serves as a dual purpose food at both green shell and dry stage but its productivity is low owing to different reasons. In general pulses respond well to phosphorous application and seed inoculation with *Rhizobium* (Prasad and Sanoria 1984) but response could be larger if organic manure is supplemented. As such information for enhancing the productivity of cowpea is limited and hence the present investigation was carried out.

A field experiment was conducted at B.A College of Agriculture, Anand Agricultural University, Anand during summer 2018 with cowpea (var. GC4) as test crop. The experimental soil was loamy sand with low organic carbon and available nitrogen (124.85 kg ha⁻¹), medium available P₂O₅ (29.23 kg ha⁻¹) and high available K₂O (286.76 kg ha⁻¹). There were 12 treatment namely, T₁-no fertilizer (control); T₂-RDF 20-40-00 kg ha⁻¹ (NPK); T₃-castor cake @ 0.5 t ha⁻¹; T₄-vermicompost @ 1 t ha⁻¹; T₅-FYM @ 4 t ha⁻¹; T₆-castor cake @ 0.5 t ha⁻¹ + PSB @ 5 ml kg⁻¹ seed; T₇-vermicompost @ 1 t ha⁻¹ + PSB @ 5 ml kg⁻¹ seed; T₈-FYM @ 4 t ha⁻¹ + PSB @ 5 ml kg⁻¹ seed; T₉-*Rhizobium* @

5 ml kg⁻¹ seed + PSB @ 5 ml kg⁻¹ seed; T₁₀- castor cake @ 0.25 t ha⁻¹ + *Rhizobium* @ 5 ml kg⁻¹ seed + PSB @ 5 ml kg⁻¹ seed; T₁₁-vermicompost @ 0.5 t ha⁻¹ + *Rhizobium* @ 5 ml kg⁻¹ seed + PSB @ 5 ml kg⁻¹ seed and T₁₂- FYM @ 2 t ha⁻¹ + *Rhizobium* @ 5 ml kg⁻¹ seed + PSB @ 5 ml kg⁻¹ seed in a Randomized Block Design with four replications. Chemical fertilizers were applied through urea and DAP but organic manures *viz.* castor cake and FYM were applied well in advance for proper decomposition whereas vermicompost was applied on the day of sowing. As per the seed rate (25 kg ha⁻¹), the required seed/plot (3.60 m x 5.0 m) were inoculated with respective strains of *Rhizobium* (broth) and PSB (broth) and sown on 21st February. Crop was harvested in second week of May. The cowpea raised under recommended agro-practices and the data generated during experiment was statistically analyzed (Panse and Sukhatme 1967).

Data (Table 1) indicated that different treatments had a significant influence on plant height, number of branches plant⁻¹ and number of root nodules plant⁻¹. Application of RDF (20-40-00 kg NPK ha⁻¹) recorded significantly higher plant height (43.83 cm) and higher number of branches per plant (6.10) being at par with treatment FYM 4 t ha⁻¹ + PSB 5 ml kg⁻¹ seed, might be due to the availability of nutrients from chemical fertilizer and subsequent uptake of nutrients by the crop.

Among different treatments, significantly higher number of root nodule plant⁻¹ (26.60) was recorded under the treatment FYM @ 2 t ha⁻¹ + *Rhizobium* @ 5 ml kg⁻¹ seed + PSB @ 5 ml kg⁻¹ seed and it remained at par with treatment having vermicompost @

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Table 1. Effect of chemical fertilizer, organic manure and bio-fertilizers on growth and yield attributes and yield of cowpea

Treatments	Plant height (cm)	Number of branches plant ⁻¹	Number of root nodules plant ⁻¹	Number of pods plant ⁻¹	Number of seeds of pod ⁻¹	Seed yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Seed index (g)	Harvest index (%)
T ₁ Control	32.40	3.80	18.50	17.00	9.25	747	922	15.58	44.69
T ₂ RDF (20-40-00 NPK kg ha ⁻¹)	43.83	6.10	21.30	21.70	11.70	972	1362	16.39	41.65
T ₃ Castor cake @ 0.5 t ha ⁻¹	35.85	4.95	20.65	17.98	10.05	825	1052	16.00	47.38
T ₄ Vermicompost @ 1 t ha ⁻¹	35.80	4.40	21.00	17.88	10.05	824	1034	15.98	45.16
T ₅ FYM @ 4 t ha ⁻¹	36.90	5.03	20.75	18.20	10.15	825	1078	16.06	44.03
T ₆ Castor cake @ 0.5 t ha ⁻¹ + PSB @ 5 mL kg ⁻¹ seed	37.65	5.10	21.75	18.45	10.40	848	1096	16.12	43.02
T ₇ Vermicompost @ 1 t ha ⁻¹ + PSB @ 5 mL kg ⁻¹ seed	37.20	5.05	20.00	18.28	10.40	842	1081	16.06	43.07
T ₈ FYM @ 4 t ha ⁻¹ + PSB @ 5 mL kg ⁻¹ seed	39.88	6.10	21.25	20.30	10.90	942	1201	16.20	39.68
T ₉ <i>Rhizobium</i> @ 5 ml kg ⁻¹ seed + PSB @ 5 ml kg ⁻¹ seed	33.50	3.80	21.83	17.55	9.55	784	979	15.79	44.24
T ₁₀ Castor cake @ 0.25 t ha ⁻¹ + <i>Rhizobium</i> @ 5 ml kg ⁻¹ seed + PSB @ 5 ml kg ⁻¹ seed	34.80	4.25	21.85	17.82	9.83	812	997	15.92	45.81
T ₁₁ Vermicompost @ 0.5 t ha ⁻¹ + <i>Rhizobium</i> @ 5 ml kg ⁻¹ seed + PSB @ 5 ml kg ⁻¹ seed	34.50	3.83	24.85	17.75	9.75	800	994	15.92	45.33
T ₁₂ FYM @ 2 t ha ⁻¹ + <i>Rhizobium</i> @ 5 mL kg ⁻¹ seed + PSB @ 5 ml kg ⁻¹ seed	34.90	4.30	26.60	17.85	9.95	818	1000	15.96	45.23
S.E.m. ±	1.85	0.24	0.73	0.89	0.37	42	56	0.33	1.97
C.D. at 5 %	5.33	0.69	2.11	2.56	1.07	121	163	NS	NS
C.V. %	10.16	10.08	6.76	9.69	7.36	10.06	10.59	4.19	8.92

0.5 t ha⁻¹ + *Rhizobium* @ 5 ml kg⁻¹ seed + PSB @ 5 ml kg⁻¹ seed. Increase in root nodules might be ascribed to better availability of nutrients through FYM at critical growth stages. PSB might also have enhanced the availability of phosphorus to plants which must have been utilized in greater root development and nodulation. The results are in close agreement with the findings of Prasad *et al.* (1984), Hajare *et al.* (1994), Meena *et al.* (2015) and Pargi *et al.* (2018).

Application of RDF (20-40-00 NPK kg ha⁻¹) recorded significantly higher number of pods plant⁻¹, number of seeds pod⁻¹, higher seed and haulm yield which remained at par with treatment FYM @ 4 t ha⁻¹ + PSB @ 5 ml kg⁻¹ seed. More number of pods plant⁻¹ might be due to more survival of flowers with high supply of photosynthates under treatment RDF as compared to other treatments. The higher number of seeds pod⁻¹ was obtained probably due to supplying of nutrients in the form of chemical fertilizer. The higher number of seed pod⁻¹ and haulm yields were also associated with recommended dose of fertilizer than other treatments. These results are in conformity with the results of Yadav and Malik (2005), Meena *et al.* (2015), Joshi *et al.* (2018), Pargi *et al.* (2018) and Singh *et al.* (2018).

References

- Anonymous (2016). Prospects of Pulses-2016. Publication No.: DPD/Pub, 1(2).
- Hajare, T. N., Jagdish Prasad and Naga Bhushana, S. R. (1994). Response of soybean (*Glycine max*) to phosphorus with and without nitrogen and *Rhizobium* inoculation in cracking clay soils. *Indian Journal of Agricultural Sciences* 64, 492-494.
- Joshi, J. R., Patel, V. M., Barad, H. L., Macwan, S. M. and Javid, E. (2018). Effect of land configuration and fertilizer management practices on growth, yield and yield attributes and economics of summer cowpea (*Vigna unguiculata* L.) under south Gujarat condition. *International Journal of Current Microbiology and Applied Science* 7, 1148-1155.
- Meena, J. S., Verma, H. P. and Pancholi, P. (2015). Effect of fertility levels and bio-fertilizers on the growth and yield of cowpea (*Vigna unguiculata* L. Walp) on sandy loam soil of Rajasthan. *An Asian Journal of Soil Science* 10, 55-58.
- Panse, V. G. and Sukhatme, P. V. (1967). Statistical methods for agricultural workers, ICAR Pub. New Delhi, p, 361.
- Jagdish Prasad and Sanoria, C. L. (1984). Associative effect of *Rhizobium* and *Azotobacter* at different levels of phosphorus on yields and nutrients content of bengal gram (*Cicer arietinum*). *Legume Research* 7, 13-16.
- Pargi, K. L., Leva, R. L., Vaghasiya, H. Y. and Patel, H. A. (2018). Integrated nutrient management in summer cowpea (*Vigna unguiculata* L.) under south Gujarat conditions. *International Journal of Current Microbiology and Applied Sciences* 7, 1513-1522.
- Singh, R., Singh, V., Singh, P. and Yadav, R. A. (2018). Effect of phosphorus and PSB on yield attributes, economics of summer greengram (*Vigna radiata* L.). *Journal of Pharmacognosy and Phytochemistry* 7, 404-408.
- Yadav, R. D. and Malik, C. V. S. (2005). Effect of *Rhizobium* inoculation and various sources of nitrogen on growth and yield of cowpea (*Vigna unguiculata* L. Walp.). *Legume Research* 28, 38-41.