

Original Research Article

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Integrated Nutrient Management Practices to Enhance Yield and Quality of Cowpea (*Vigna unguiculata* L.)

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ABSTRACT

Keywords

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A field experiment was conducted during *kharif* 2014-15 at College farm, College of Agriculture, Latur, VNMKV, Parbhani (Maharashtra) to evaluate the effect of 10 treatments *i.e.*, various sources of nutrient on yield and quality of cowpea (*Vigna unguiculata* L.) with variety 'Konkan Sadhabahar'. The experiment was conducted in a randomized block design (RBD) and replicated thrice. As regards the seed yield (1066 kg ha⁻¹) and straw yield (2707 kg ha⁻¹) were considerably higher with the application of 75 per cent RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹. The application of RDF (25:50:00 NPK kg ha⁻¹) (T₁) recorded the higher protein content (23.26) and application of 75 per cent RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹ (T₆) gave highest protein yield (246 kg ha⁻¹) due to increased yield. The obtained results might be due to the improvement of physical, chemical and biological properties of soil, improvement in the water holding capacity of soil and induced solubilisation of phosphate and helped in nitrogen fixation. This collectively resulted in increased yield of cowpea under rainfed conditions.

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp) is one of the important *kharif* pulse crop and grown in India for green vegetable pods, grain, forage and green manure purpose. The largest producer was Africa, Brazil, Haiti, India, Myanmar, Srilanka, Australia, Bosnia and Herzegovina also have significant production. Worldwide cowpea was cultivated in 8 m ha approximately. The total world production was estimated about 3.3 M T of dry grain. In India area under cowpea was 3.9 m ha with a production of 2.21 M T with the national productivity of 683 kg ha⁻¹ (Singh *et al.*,

2012). Major states growing cowpea in India were Maharashtra, Karnataka, Tamilnadu, Madhya Pradesh, Rajasthan and Andhra Pradesh. In Maharashtra cowpea occupies an area of 11, 800 ha with an average productivity of 400 kg ha⁻¹ (Anonymous, 2012). Cowpea is highly nutritious constitution with protein (23.4 %), fat (1.8 %) and carbohydrates (60.3 %), also rich source of Ca and Fe. Cowpea is grown as catch crop, mulch crop, intercrop and mixed crop. It has ability to fix atmospheric nitrogen in soil at the rate of 80-85 kg ha⁻¹ in association with symbiotic bacteria under favourable conditions.

Of the various factors known to augment the crop production, fertilizers added with suitable agronomic practices play a pivotal role to boost up the crop yield. Currently, 40 to 50 per cent (%) increase in agricultural production can be credited to fertilizers alone (Tondon, 1994). Integrated Nutrient Management (INM) is basically the complementary use of organic, inorganic and biological sources of plant nutrients to maintain and sustain soil fertility and enhance crop productivity in a framework of an ecologically compatible, socially acceptable and economically viable situation.

The organic manures add nutrients and organic compounds to the soil while going under decomposition. Biologically organic manures provide food for the beneficial soil microorganisms. Keeping these in view, the present investigation entitled "Effect of Integrated nutrient management on growth, yield and quality of cowpea (*Vigna unguiculata* L.)" was undertaken at Agronomical Experimental Farm, College of Agriculture, Latur with the objective to study the effect of inorganic, organic and bio-fertilizers on yield and quality of cowpea.

Materials and Methods

A field experiment was conducted during *kharif* 2014-15 at College farm, College of Agriculture, Latur, VNMKV, Parbhani (Maharashtra). The experiment was conducted in a randomized block design (RBD) and replicated thrice. The experiment comprise of 10 treatments *viz.*, RDF (25:50:00 NPK kg ha⁻¹) (T₁), 75 % RDF + Bio-fertilizers (*Rhizobium* + PSB) (T₂), 75 % RDF + FYM @ 2.5 t ha⁻¹ (T₃), 75 % RDF + vermicompost @ 1.25 t ha⁻¹ (T₄), 75 % RDF + Bio-fertilizers + FYM @ 2.5 t ha⁻¹ (T₅), 75 % RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹ (T₆), 50 % RDF + Bio-fertilizers + FYM @ 5 t ha⁻¹ (T₇), 50 % RDF + Bio-fertilizers +

vermicompost @ 2.5 t ha⁻¹ (T₈), 50 % RDF + FYM @ 5 t ha⁻¹ (T₉) and 50 % RDF + vermicompost @ 2.5 t ha⁻¹ (T₁₀). Sowing of seed was done in *Kharif* season with variety 'Konkan Sadhabahar'. Quantity of organic and inorganic fertilizers to be applied to the cowpea was calculated as per the treatments.

Quantity of nitrogen was added through urea, phosphorus added through single super phosphate. Farm Yard Manure (FYM) and vermicompost were applied as per the treatments. *Rhizobium* and PSB were given as per the treatments. Five plants randomly selected per treatment to record observations.

Results and Discussion

Effect of integrated nutrient management on yield attributes and yield of cowpea

Data pertaining to Table 1 revealed that the application of 75 % RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹ (T₆) recorded significantly maximum number of pods per plant (6.60) which was at par with the application of RDF (25:50:0 NPK kg ha⁻¹) (T₁), 75 % RDF + vermicompost @ 1.25 t ha⁻¹ (T₄) and 75 % RDF + Bio-fertilizers + FYM @ 2.5 t ha⁻¹ (T₅) and minimum number of pods per plant (4.67) was recorded with the application of 50% RDF + FYM @ 5 t ha⁻¹ (T₉). Similar results reported by Singh *et al.*, (2011) that phosphorus is essential for nodulation in cowpea resulted in higher nodulation which resulted more photosynthesis, pod development and eventually more number of pods per plant. Higher pod yield plant⁻¹ (7.68 g) was achieved with the application of 75 % RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹ (T₆) followed by RDF (25:50:00 NPK kg ha⁻¹), (7.56 g plant⁻¹). Similarly higher number of seeds plant⁻¹ (58.20) with treatment T₆ and lower number of seeds plant⁻¹ (42.74) was found in treatment T₉.

Table.1 Yield and quality of cowpea as influenced by different treatments

Treatment	Pods plant ⁻¹	Pod yield plant ⁻¹ (g)	Number of seeds plant ⁻¹	Seed yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Biological yield (kg ha ⁻¹)	Harvest index (%)	Protein content (%)	Protein yield (kg ha ⁻¹)
T ₁ : RDF (25:50:0 NPK kg ha ⁻¹)	6.13	7.56	57.70	1002	2603	3605	27.79	23.26	233
T ₂ : 75% RDF + Bio-fertilizers (<i>Rhizobium</i> +PSB)	5.38	6.14	51.57	879	2322	3201	27.46	22.97	202
T ₃ : 75% RDF + FYM @ 2.5 t ha ⁻¹	5.21	5.89	48.63	829	2210	3039	27.28	22.85	190
T ₄ : 75% RDF + vermicompost @ 1.25 t ha ⁻¹	5.80	6.43	54.30	938	2460	3398	27.60	23.12	217
T ₅ : 75% RDF + Bio-fertilizers + FYM @ 2.5 t ha ⁻¹	5.93	6.98	57.17	992	2593	3585	27.67	23.21	230
T ₆ : 75% RDF + Bio-fertilizers + vermicompost @ 1.25 t ha ⁻¹	6.60	7.68	58.20	1066	2707	3773	28.25	23.22	246
T ₇ : 50% RDF + Bio-fertilizers + FYM @ 5 t ha ⁻¹	4.95	5.19	44.47	704	1920	2624	26.83	22.71	160
T ₈ : 50% RDF + Bio-fertilizers + vermicompost @ 2.5 t ha ⁻¹	5.06	5.33	45.83	725	1967	2692	26.93	22.84	166
T ₉ : 50% RDF + FYM @ 5 t ha ⁻¹	4.67	4.73	42.74	626	1737	2363	26.49	22.64	142
T ₁₀ : 50% RDF + vermicompost @ 2.5 t ha ⁻¹	4.88	5.08	43.33	665	1842	2507	26.52	22.65	151
S. Em+	0.31	0.31	2.80	47	109	156	-	0.29	10
C.D. at 5%	0.93	0.94	8.31	140	325	465	-	NS	32
General Mean	5.45	6.10	50.39	842	2236	3078	27.28	22.94	194

NS = Non-significant

This might be due to higher vegetative growth in crop means higher interception of light and therefore more assimilated production that thereby increased pod yield. These results are in conformity with the results of Babaji *et al.*, (2011). The seed yield of cowpea was differed significantly due to different treatments. Maximum seed yield (1066 kg ha⁻¹) was observed with the application of 75 % RDF + Biofertilizers + vermicompost @ 1.25 t ha⁻¹ treatment (T₆) and followed by application of RDF (25:50:0 NPK kg ha⁻¹) (T₁), 75 % RDF + Bio-fertilizers + FYM @ 2.5 t ha⁻¹ (T₅), and 75 % RDF + vermicompost @ 1.25 t ha⁻¹ (T₄) and minimum seed yield was achieved with the application of 50% RDF + FYM @ 5 t ha⁻¹ (T₉). Similarly higher straw yield (2707 kg ha⁻¹) with the treatment (T₆) and lower straw yield (1737 kg ha⁻¹) was found in 50% RDF + FYM @ 5 t ha⁻¹(T₉). The maximum biological yield was (3773 kg ha⁻¹) in 75 % RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹ treatment (T₆). Harvest index achieved maximum (28.25 %) with treatment (T₆) and minimum (26.49 %) was observed in treatment (T₉). The enhanced microbial activity in vermicompost resulted in an increase in the concentration of nutrients in vermicompost. Beneficial microbes like phosphorous solubilisers and nitrogen fixers vermicompost induced solubilisation of phosphate and helped in nitrogen fixation.

Same results were reported by SailajaKumari and Ushakumari (2002). Compost application might have played a major role in improvement of physical, chemical and biological properties of soil, improvement in the water holding capacity of soil (Venkateswarlu, 1987) and improved soil health by reducing the soil hardening. This collectively resulted in increased yield of cowpea under rainfed conditions. These results are in conformity with the results of Ramesh and Devasenapathy (2008).

Effect of Integrated Nutrient Management on quality of cowpea

A reference to data in (Table 1), revealed that the effect of different treatments on protein content was found to be non-significant. The application of RDF (25:50:00 NPK kg ha⁻¹) recorded maximum protein content (23.26%) and minimum (22.64%) was observed in 50% RDF + FYM @ 5 t ha⁻¹ (T₆). Similarly maximum protein yield (246 kg ha⁻¹) was observed with the application of 75 % RDF + Bio-fertilizers + vermicompost @ 1.25 t ha⁻¹ (T₆) and followed by application of RDF (25:50:0 NPK kg ha⁻¹) (T₁), 75 % RDF + Bio-fertilizers + FYM @ 2.5 t ha⁻¹ (T₅) and 75 % RDF + vermicompost @ 1.25 t ha⁻¹ (T₄) and minimum protein yield (142 kg ha⁻¹) was achieved with the application of 50% RDF + FYM @ 5 t ha⁻¹ (T₉). It might be due to higher leghaemoglobin content resulted with the application of nitrogen. Leghaemoglobin is a heme containing protein, which is produced in the symbiotic association of both partners, the heme moiety comes from bacteria while host contributed protein component. Similar findings were also reported by Singh *et al.*, (2006).

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