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Effect of integrated nutrient management on clusterbean [*Cyamopsis tetragonoloba* (L.) Taub] seed production cv. PUSA NAVBAHAR

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ABSTRACT

A field experiment was conducted during late *Kharif* season of 2006 at Anand to study the effect of integrated nutrient management on growth, seed yield and quality and economics of clusterbean cv. Pusa Navbahar under semi arid conditions of Middle Gujarat. The results revealed that integrated use of inorganic fertilizer, bio-fertilizer and organic manure enhanced the growth and seed yield of clusterbean. Higher yield and yield attributes as well as nutrient uptake and protein content were recorded in the treatment of 100% RDF (25 kg N + 50 kg P_2O_5 ha^{-1}) + FYM @ 10 t ha^{-1} + seed treatment with *Rhizobium* followed by 100% RDF + Vermicompost @ 2 t ha^{-1} + seed treatment with *Rhizobium*. Application of FYM @ 10 t ha^{-1} + *Rhizobium* inoculation integrated with chemical fertilizer (100% RDF) fetched maximum net returns (Rs. 1, 16, 640 ha^{-1}) and BCR (6.21).

Key words : Integrated nutrient management, Clusterbean, F.Y.M., Vermicompost, *Rhizobium*, Seed yield

INTRODUCTION

Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub] is an important vegetable crop locally known as 'Guar'. The green pods of clusterbean are used as vegetables. Clusterbean has a great export potential as it is used in dehydration, canning, pharmaceutical, mining, paper industry, textile, cosmetic and explosive industry. Production of the vegetable clusterbean often suffers a setback due to unavailability of high yielding good quality seeds. Poor soil fertility and lack of nutrients are considered the major reasons of this dismally low productivity. Therefore, augmenting of nutrient supply assumes prime significance to improve its productivity. Due to energy crisis, the use of chemical fertilizers are cost prohibitive, therefore, low cost nutrient sources such as bio-fertilizer along with chemical fertilizers in form of integrated plant nutrient – supply system may be a better option. Hence, the present study was undertaken to find out the best integrated nutrient management treatment for achieving maximum quality seed yield of clusterbean, cv. PUSA NAVBAHAR.

MATERIALS AND METHODS

An experiment was carried out during late *Kharif* season of 2006 at the Regional Research Station farm, Anand Agricultural University, Anand. The soil of the experimental plot was loamy sand, low in organic carbon (0.39%), medium in available P_2O_5 (40.3 kg ha^{-1}) and higher in available K_2O (289 kg ha^{-1}). The experiment was laid out in Randomized Block Design having four replications with fifteen nutrient management treatments *viz.*, T_1 - 75% RDF, T_2 - 100% RDF [25 kg N ha^{-1} + 50 kg P_2O_5 ha^{-1}], T_3 - 150% RDF, T_4 - FYM @ 10 t ha^{-1} + 75% RDF, T_5 - FYM @ 10 t ha^{-1} + 100% RDF, T_6 - FYM @ 10 t ha^{-1} + 150% RDF, T_7 - Vermicompost @ 2 t ha^{-1} + 75% RDF, T_8 - Vermicompost @ 2 t ha^{-1} + 100% RDF, T_9 - Vermicompost @ 2 t ha^{-1} + 150% RDF, T_{10} - T_4 + *Rhizobium*, T_{11} - T_5 + *Rhizobium*, T_{12} - T_6 + *Rhizobium*, T_{13} - T_7 + *Rhizobium*, T_{14} - T_8 + *Rhizobium*, T_{15} - T_9 + *Rhizobium*. The clusterbean variety Pusa Navbahar was sown at 45 x 20 cm spacing on September 5, 2006. The RDF was 25 kg N + 50 kg P_2O_5 ha^{-1}, applied basal through urea and single super phosphate as per treatments. Bio-fertilizer (*Rhizobium*) was applied as seed treatment just before sowing. The FYM @ 10 t ha^{-1} was incorporated into the soil 20-25 days before sowing as per the treatments. The dried matured pods were harvested and threshed manually and weighed (kg ha^{-1}). The growth attributes like plant height, dry matter production and yield attributes like length of dry pod, dry pods cluster^{-1}, dry pods plant^{-1}, weight of 1000 seeds, seeds pod^{-1}, seed and straw yields, harvest index, economics were assessed. The representative samples of seeds were analyzed for ascertaining the nutrient (N, P and K content). The N, P and K contents were analyzed by micro Kjeldahl, Vanado- molybdophosphoric acid yellow - colour and flame photometer methods, respectively.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Effect on growth attributes :

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Growth attributes showed significant improvement owing to application of nutrients through organic manures, chemical and bio-fertilizer. Significant variation in plant height and dry matter production were recorded at harvest stage. Maximum plant height (102.4 cm) and dry matter production (27.41 g plant^{-1}) were registered under treatment T_{11} (FYM @ 10 t ha^{-1} + 100% RDF + *Rhizobium*) which was significantly superior to all other nutrient management treatments expect application of 100 or 150% RDF in conjunction with Vermicompost and treatment of chemical fertilizer + Vermicompost or FYM coupled with *Rhizobium* seed treatment (Table 1). An increased availability of nutrients with application of chemical fertilizers and biological nitrogen fixation through *Rhizobium* and decomposition of organic manure increase the solubilization of native and applied phosphorus might have helped in increasing growth and dry matter production. Similar results were also reported by Singh and Tiwana (1995) and Kumpawat (2006).

Effect on yield attributes and yields :

Integrated nutrient management had significant and positive effect on yield attributes *viz*., length of dry pod (11.35 cm), dry pods cluster^{-1} (5.88), dry pods plant^{-1} (67.50), weight of 1000 seeds (49.07 g), seeds pod^{-1} (8.19) of clusterbean (Tables 1 and 2). Application of organic manures either FYM @ 10 t ha^{-1} or Vermicompost @ 2 t ha^{-1} alone or in conjunction with *Rhizobium* as a seed treatment at low fertility level (75% RDF) or 100% RDF gave significantly higher seed yield than at higher fertility level (150% RDF) or only chemical fertilizers. The treatment T_{11} (RDF 100% + FYM 10 t ha^{-1} + *Rhizobium* seed treatment) recorded significantly higher seed yield (1231 kg ha^{-1}) than rest of the treatments except $T_{14,}$ T_{10}, T_{13}, T_{12}, T_5 and T_8 which were found to be comparable with treatment $T_{11.}$ Similar trend was also observed in nutrient uptake and protein content. However, harvest index did not reveal significant variation due to any integrated nutrient management treatments. The increased growth in terms of plant height and dry matter production along with better expression of yield attributes might have led to increase seed yield under these treatment. These findings are in conformity with the results of Tarafdar and Rao (2001) and Kumar *et al.* (2004).

Economics :

Cost-benefit analysis given in Table 2 indicated that maximum net return (Rs. 1, 16, 640 ha^{-1}) and BCR (6.21) were accrued under treatment T_{11} (FYM @ 10 t ha^{-1} + 100% RDF+*Rhizobium*) closely followed by treatment T_{14} (Rs. 107430 ha^{-1} with 5.05 BCR value) and T_{10} (Rs. 104308 ha^{-1} with 5.65 BCR value).

Integrated nutrient management consisting of

Table 1: Effect of nutrient management on growth and yield attributes of clusterbean cv. PUSA NAVBAHAR

Treatment	Plant height (cm)	Dry matter production (g plant^{-1})	Dry pods cluster^{-1}	Dry pods plant^{-1}	Dry pod Length (cm)	Seeds pod^{-1}	Weight of 1000 seed (g)
T_1 = 75% RDF	82.74	19.15	4.08	42.75	8.85	6.16	37.33
T_2 = 100% RDF	85.46	23.94	4.14	47.75	9.85	6.63	39.41
T_3 = 150% RDF	89.71	20.44	4.50	53.25	10.02	7.18	41.92
T_4 = FYM @ 10 t ha^{-1} + 75% RDF	89.54	22.92	4.71	56.00	10.33	7.31	47.33
T_5 = FYM @ 10 t ha^{-1} + 100% RDF	91.49	24.33	5.34	59.00	10.20	7.70	48.40
T_6 = FYM @ 10 t ha^{-1} + 150% RDF	91.12	22.44	4.98	54.75	10.08	7.28	47.98
T_7 = VC @ 2 t ha^{-1} +75% RDF	89.84	21.76	4.80	54.75	10.25	7.38	44.69
T_8 = VC @ 2 t ha^{-1} + 100% RDF	93.48	22.85	5.01	58.00	10.40	7.44	48.76
T_9 = VC @ 2 t ha^{-1} + 150% RDF	93.20	20.92	4.98	51.25	10.33	7.28	42.59
T_{10} = FYM @ 10 t ha^{-1} + 75% RDF + Rhiz.	96.09	25.96	5.34	60.75	11.05	7.33	47.50
T_{11} = FYM @ 10 t ha^{-1} + 100% RDF + Rhiz.	102.40	27.41	5.88	67.50	11.35	8.19	49.07
T_{12} = FYM @ 10 t ha^{-1} + 150% RDF + Rhiz.	91.41	23.77	5.10	55.75	10.20	7.64	46.65
T_{13} = VC @ 2 t ha^{-1} + 75% RDF + Rhiz.	97.01	25.00	5.28	59.50	10.75	7.49	47.44
T_{14} = VC @ 2 t ha^{-1} + 100% RDF + Rhiz.	97.75	27.12	5.58	63.00	10.88	7.72	48.16
T_{15} = VC @ 2 t ha^{-1} + 150% RDF + Rhiz.	91.03	22.09	4.86	57.50	10.15	7.31	43.06
C. D. (P=0.05)	9.87	4.84	0.90	11.08	1.14	0.89	6.64

FYM : Farm yard manure VC : Vermicompost RDF : Recommended dose of fertilizer Rhiz. : *Rhizobium*

Input cost
FYM @ Rs. 350 tonne^{-1}
Vermicompost @ Rs. 3000 tonne^{-1}
Rhizobium @ Rs. 30 ha^{-1}
SSP @ Rs. 3.18 Kg^{-1}
Urea @ Rs. 5.12 kg^{-1}
NS = Non significant

Selling price
Seed @ Rs. 110 kg^{-1}

Table 2 : Effect of nutrient management on nutrient uptake, protein content, seed yield and economics of clusterbean CV. PUSA NAVBAHAR

Treatment	Nutrient uptake by seeds (kg ha^{-1})			Protein content of seeds (%)	Seed yield (kg ha^{-1})	Harvest index (%)	Net realization (Rs. ha^{-1})	BCR
	N	P	K					
T_1 = 75% RDF	29.53	3.73	7.62	22.10	847	30.50	78248	5.24
T_2 = 100% RDF	32.55	4.33	7.57	23.29	880	29.20	81560	5.35
T_3 = 150% RDF	38.19	4.68	7.61	26.86	898	29.65	82904	5.22
T_4 = FYM @ 10 t ha^{-1} + 75% RDF	39.49	4.41	8.02	25.99	944	30.50	85418	4.64
T_5 = FYM @ 10 t ha^{-1} + 100% RDF	42.97	5.35	8.92	25.55	1065	30.93	98410	5.25
T_6 = FYM @ 10 t ha^{-1} + 150% RDF	38.29	3.85	8.37	27.19	882	31.03	77644	4.01
T_7 = VC @ 2 t ha^{-1} +75% RDF	43.95	4.86	8.82	27.61	995	27.60	88528	4.23
T_8 = VC @ 2 t ha^{-1} + 100% RDF	45.92	5.13	9.13	28.35	1014	30.50	90300	4.25
T_9 = VC @ 2 t ha^{-1} + 150% RDF	43.54	5.02	9.02	27.35	993	30.10	87354	3.99
T_{10} = FYM @ 10 t ha^{-1} + 75% RDF + *Rhiz.*	48.01	5.5	10.01	27.06	1116	29.53	104308	5.65
T_{11} = FYM @ 10 t ha^{-1} + 100% RDF + *Rhiz.*	58.43	5.92	11.32	29.59	1231	29.55	116640	6.21
T_{12} = FYM @ 10 t ha^{-1} + 150% RDF + *Rhiz.*	47.17	5.67	9.62	27.29	1081	29.78	99504	5.13
T_{13} = VC @ 2 t ha^{-1} + 75% RDF + *Rhiz.*	43.91	5.78	9.82	25.25	1095	29.43	99498	4.75
T_{14} = VC @ 2 t ha^{-1} + 100% RDF + *Rhiz.*	51.63	5.88	10.65	27.52	1170	29.88	107430	5.05
T_{15} = VC @ 2 t ha^{-1} + 150% RDF + *Rhiz.*	42.62	4.93	9.47	26.57	1005	28.65	88644	4.05
C. D. (P=0.05)	9.74	1.07	1.93	3.60	221.81	NS	81560	5.35

FYM : Farm yard manure VC : Vermicompost RDF : Recommended dose of fertilizer Rhiz. : *Rhizobium*

Input cost
FYM @ Rs. 350 tonne^{-1}
Vermicompost @ Rs. 3000 tonne^{-1}
Rhizobium @ Rs. 30 ha^{-1}

SSP @ Rs. 3.18 Kg^{-1}
Urea @ Rs. 5.12 kg^{-1}
NS = Non significant

Selling price
Seed @ Rs. 110 kg^{-1}

chemical fertilizer @ 100 per cent RDF + FYM @ 10 t ha^{-1} + *Rhizobium* seed treatment in clusterbean can be used to achieve higher seed production and resource utilization with maximum returns in late *Kharif* season under semi arid condition of Middle Gujarat.

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