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Effect of organic inputs and inorganic nutrients on growth and yield of Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub

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Abstract
An experiment was conducted during winter 2012 at Department of Horticulture, Faculty of Agriculture, Annamalai University, Tamil Nadu. The Experiment was conducted in Randomized Block Design (RBD) with 12 treatments and 3 replications in the inorganic (NPK) and organic (vermicompost) were allotted to 7 different combinations of biofertilzers (Rhizobium + Pseudomonas fluorescence) and micronutrients (Zn and Fe). Results showed super imposition of 25% N organic (recommended dose of N through vermicompost) to 100% NPK (recommended dose of NPK through fertilizers), being at par with 100% NPK + 50% N organic resulted in significant improvement in growth character, plant height, branches plant^{-1}, and yield attributes (pod length, pods plant $^{-1}$ and grains pod^{-1}) and nutrient (N, P, K, S, Zn and Fe) uptake was higher under 100% NPK + 25% N organic level. The combined effect of biofertilizers and micronutrients (biofertilizer + Zn + Fe treatment) was significantly better than their individual effects as this treatment significantly improved growth characters, yield attributes and integration of 100% NPK +25% N organic and biofertilizer + Zn + Fe was conducive for getting significantly optimum yield.

Keywords: organic inputs, cluster bean, agriculture

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 set back 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 greater 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 the form of integrated plant nutrient – supply system may be a better option. Hence, the present study was under taken to find out the best integrated nutrient management treatment for achieving maximum quality seed yield of clusterbean, cv. pusa navbahar.

Materials and Methods
The Experiment was conducted in Randomized Block Design (RBD) with 12 treatments and 3 replications in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Tamil Nadu. The soil of the experimental plot was sandy loamy, low in organic carbon (0.39%), medium in available P_2O_5 (36.83 kg ha^{-1}) and higher in available K_2O (296 kg ha^{-1}). The experiment was laid out in Randomized Block Design having three replications with 12 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 @ 20 t ha^{-1} + 75% RDF, T_5 - FYM @ 20 t ha^{-1} + 100% RDF, T_6 - FYM @ 20 t ha^{-1} + 150% RDF, T_7 - Vermicompost @ 5 t ha^{-1} + 75% RDF, T_8 - Vermicompost @ 5 t ha^{-1} + 100% RDF, T_9 - Vermicompost @ 5 t ha^{-1} + 150% RDF, T_{10} - T_4 + *Rhizobium*, T_{11} -T_5 + *Rhizobium*, T_{12} - T_6 + *Rhizobium*. The clusterbean variety Pusa Navbahar was sown at 45 x 20 cm spacing The RDF was 25 kg N + 50 kg P_2O_5 ha^{-1} and potash (kg 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 @ 20 t ha^{-1} was incorporated into the soil 10-15 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, number of branches plant^{-1}, Days to 50% flowering, Number of cluster per plant, number of pods per cluster, number of pods per plant, pod weight, pod yield per plant, pod

yield per hectare. The representative samples of seeds were analyzed for ascertaining the nutrient (N, P and K content).

Results and Discussion

The results obtained from the present investigation are summarized below. Growth attributes showed significant improvement owing to application of nutrients through organic manures, chemical and bio-fertilizer. Significant variation in plant height were recorded at harvest stage. Maximum plant height (86.63 cm) and number of branches (13.30 plant^{-1}) were registered under treatment T_8 (Vermicompost @ 5 t ha^{-1} + 100% RDF) 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 applied phosphorus might have helped in increasing growth. Similar results were also reported by Singh and Tiwana (1995) [4] and Gupta (2006) [1].

Integrated nutrient management had significant and positive effect on yield attributes *viz.*, number of pod per cluster (7.83), pods plant^{-1} (278.92), (Tables 1). Application of organic manures either FYM @ 20 t ha^{-1} or Vermicompost @ 5 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_8 (Vermicompost @ 5 t ha^{-1} + 100% RDF) recorded significantly higher pod yield (450.17 g plant^{-1}) than rest of the treatments except T_{11}, T_5 which were found to be comparable with treatment T_8. 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 along with better expression of yield attributes pod yield per hectare (38.15 t ha^{-1}) might have led to increase pod yield under these treatment. These findings are in conformity with the results of Jat and Ahlawat (2004) [2] and Kumar *et al.* (2004) [3].

Table 1: Effect of Organic inputs and Inorganic Nutrients on Growth and Yield of Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub

Treatments	Plant height (cm)	Number of Branches	Days to 50 % flowering	No of cluster per plant	No of pods per cluster	No of pods per plant	Pod weight (g)	Pod yield per plant (g)	Pod yield per ha
T_1 - 75% RDF	81.12	4.83	35.61	41.32	5.31	258.29	3.82	402.17	30.15
T_2 - 100% RDF 25 kg N ha^{-1} + 50 kg P_2O_5 ha^{-1}	71.56	6.22	33.68	29.32	5.01	180.32	1.52	248.36	18.44
T_3 - 150% RDF	79.49	8.66	35.94	31.60	7.25	139.92	2.58	340.13	25.38
T_4 - FYM @ 20 t ha^{-1} + 75% RDF	82.92	11.80	33.3	21.54	7.43	137.23	2.88	343.70	25.64
T_5 - FYM @ 20 t ha^{-1} + 100% RDF	83.22	12.20	35.32	42.27	7.73	261.11	3.87	422.20	35.55
T_6 - FYM @ 20 t ha^{-1} + 150% RDF	71.37	4.58	35.28	31.81	7.70	111.12	3.50	351.90	26.26
T_7 - Vermicompost @ 5 t ha^{-1} + 75% RDF	65.46	1.28	31.34	23.56	6.78	143.54	2.66	338.72	25.14
T_8 - Vermicompost @ 5 t ha^{-1} + 100% RDF	86.63	13.30	31.34	45.66	7.83	278.92	3.94	450.17	38.15
T_9 - Vermicompost @ 5 t ha^{-1} + 150% RDF	80.86	7.25	31.86	24.90	5.20	223.78	1.94	299.11	22.26
T_{10} - FYM @ 20 t ha^{-1} + 75% RDF + *Rhizobium*	82.81	9.82	31.64	41.12	5.29	233.34	1.84	313.67	23.40
T_{11} - - FYM @ 20 t ha^{-1} + 100% RDF + *Rhizobium*	84.58	12.49	32.65	43.32	7.78	269.43	3.90	431.79	36.23
T_{12} - FYM @ 20 t ha^{-1} + 150% RDF + *Rhizobium*	58.80	3.66	41.76	18.34	5.27	154.94	1.92	253.57	18.96
SE.d	0.17	0.01	0.30	0.05	0.02	0.20	0.003	0.39	0.07
CD= 0.5	0.49	0.03	0.89	0.14	0.07	0.80	0.011	1.13	0.22

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