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### Effect of organic fertilizers on yield and yield attributes of cluster bean (*Cyamopsis tetragonoloba* L.) Cv. Pusa Navbahar

**Hardik Patel, Vijay Parmar, Priyanka Patel, Vipul Mavdiya**

#### Abstract

The present investigation entitled “Effect of organic fertilizers on growth and yield of cluster bean (*Cyamopsis tetragonoloba* L.) Cv. Pusa Navbahar” was conducted during year 2017 at Fruit Research Station Jambuvadi, Junagadh Agricultural University, Junagadh. The experiment was laid out in Randomized Block Design (RBD) with three replication. In all, there were eight different treatments T<sub>1</sub>: control without any treatment, T<sub>2</sub>: RDF 20:40:00 NPK kg/ha, T<sub>3</sub>: FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed, T<sub>4</sub>: FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed, T<sub>5</sub>: FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed + KSB @ 20 ml kg<sup>-1</sup> seed, T<sub>6</sub>: Vermicompost @ 2.5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed, T<sub>7</sub>: Vermicompost @ 2.5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed, T<sub>8</sub>: Vermicompost @ 2.5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed + KSB @ 20 ml kg<sup>-1</sup> seed. Different treatments were significantly affected by number of cluster per plant, number of pod per cluster, length of green pod (cm), green pod kg/ plant, green pod kg/ha, dry pod kg/ha.

**Keywords:** Cluster bean, bio fertilizer, yield, farm yard manure, vermicompost

#### Introduction

Vegetable growing is one of the major branch of Horticulture. Different vegetables have played an important role in the economy of the country and have played a pivotal role in the food and nutritional securities of growing population of our country. They are in great demand in a country like India where a majority of the population in vegetarian.

Vegetables are rich source of nourishment and are considered as protective supplementary food as they contain large quantities of minerals, vitamins and essential amino acids. The important minerals like calcium, phosphorous and iron, which are generally lacking in cereals while they are available in abundant quantities in vegetables. Leguminous vegetables are the richest source of protein.

Cluster bean (*Cyamopsis tetragonoloba* L.) belongs to the family Fabaceae (Leguminaceae) is a coarse, upright, bushy, a drought-tolerant summer annual legume and it is cultivated as a feed crop for human and livestock consumption. Cluster bean (Guvar) is usually grown kitchen garden as a summer vegetable but at present it is also being grown as commercial crop near the urban area. It is a native plant of India and Pakistan (Rahman and Shafivr, 1967) [13]. It is grown in tropical Asia, Africa and America. The major world suppliers are India, Pakistan and the United States, with smaller acreages in Australia and Africa.

In India, green and tender pods of cluster bean are used as a favorite vegetable in many parts of the country. It is also grown as a forage crop. When it grown as a green manure crop. It enriches the soil by fixing atmospheric nitrogen almost 50-150 kg per hectare (Lal, 1985) [8]. Sometimes it is used in reclamation of saline and alkaline soils (Kay, 1979) [5]. In recent years, this crop has assumed a great significance due to the presence of good quality gum in the endosperm of its seed. Due to diversified uses of cluster bean gum in textile, paper, explosive and mining industries, pharmaceuticals, cosmetic goods and food stuffs, it has ever increasing demand in the international market.

In India, it is cultivated mainly in Rajasthan, Gujarat, Punjab, Haryana, Uttar Pradesh and Maharashtra. The cultivated area under cluster bean in Gujarat during 2016 was 3.0 lakh ha with the production of 2.8 lakh tonnes. The average production of guar in Gujarat is 766 kg ha<sup>-1</sup> (Anon., 2016) [1]. Guar is mainly cultivated in Banaskantha, Mehsana, Ahmadabad, Gandhinagar, Kheda and Kachchh district of Gujarat.

Cluster bean is an erect annual growing plant; grow to a height of 2 m with stiff erect branches stems are angled, leaves trifoliate, ovate and serrate. The white or pink colored flowers are small and borne on auxiliary raceme. Pods are compressed, linear, erect and clustered, double ridge on dorsal side, single ridge below, length 4-10 cm, 5-12 seeds per pod with white to grey or black in colour with an average weight of 0.06 g. Green pods contain moisture 81.0 %, carbohydrates 10.8 g, protein 3.2 g, fat 0.49 g, vitamin C-47 mg, vitamin A-316 IU per 100 g of pod (Parthasarathy, 2003) [11].

Organic farming strategy is growing rapidly all over the world to conserve human health and the environment. Bio-fertilizers are formulations of beneficial microorganisms, which upon application can increase the availability of nutrients by their biological activity and help to improve the soil health for increasing soil fertility with objective of increasing the number of such micro organisms and to accelerate certain microbial processes. Bio fertilizers are low cost, effective and renewable source of plant nutrients to supplement chemical fertilizers (Boraste *et al.* 2009) [2] In addition to their role in enhancing the growth of the plants, bio fertilizers can act as bio control agents in the Rhizosphere at the same time. This synergistic effect, when present, increases the role of application of bio fertilizers in the sustainable agriculture. To meet the demand of quality vegetables, some chemical fertilizers are repeatedly used during all the seasons of cropping system. Bio fertilizer is a substance which contains living micro organism when applied to seed, plant surface, or soil, colonize the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. These are low cost, effective and renewable source of plant nutrients to supplement chemical fertilizers. Therefore, use of biological fertilizers especially in cluster bean as it is a leguminous crop will definitely give significant results. Bio fertilizers have the ability to mobilize the nutritionally important elements from non-usable to usable form through biological processes and known to increase yield in several vegetables (Kumar *et al.* 2002) [7]. Bio fertilizers play a vital role in maintaining long term soil fertility and sustainability. It may increase yield of crops by 10-30 percent (khandelwala *et. al.*, 2012) [6]. In recent years, several strains of Phosphate Solubilizing Bacteria and fungi are isolated. The mechanism action of these micro organisms involves secretion of organic acids which lower the pH and increase the availability of sparingly soluble phosphorus sources. Phosphate solubilizing bacteria change the unavailable phosphorus of soil in available form for crop. Inoculation of seeds with PSB and KSB culture increases nodulation, crop growth, nutrient uptake and crop yield (Srivastava and Ahlawat, 1993) [18]. A combination of chemical and biological sources of nitrogen seems to be a cheap and effective way of increasing production under limited resources.

### Materials and Methods

An experiment was conducted at Fruit Research Station, Jambuwadi, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, during summer seasons of 2017. The experiment site is situated in South Saurashtra Agro-climatic region of Gujarat. The soil was medium clayey in texture and slightly alkaline in reaction with pH (7.63) and EC (0.62 dSm<sup>-1</sup>), low in available N was carried out with Alkaline KMnO<sub>4</sub> method by Subbaiah and Asija, 1956 (239.32 kg ha<sup>-1</sup>), medium in available P (41.07 kg ha<sup>-1</sup>) and available K (234.75 kg ha<sup>-1</sup>). The available P and K

were carried out with Olsen's method and Flame Photometric method by Olsen *et al.*, 1954 [10] and Jackson, 1974. The available heat soluble sulphur (10.60 ppm) carried out with Turbidimetric method (Chaudhary and Cornfield, 1966). The available micronutrients Fe, Mn, Zn and Cu (5.70, 8.74, 0.27 and 0.71 mg kg<sup>-1</sup>) carried out with DTPA extract method (AAS). The experiment were laid out in Randomized Block Design with three replications and consisting of 8 treatment combinations, comprising control: without any treatment (T<sub>1</sub>), RDF 20:40:00 NPK kg/ha (T<sub>2</sub>), FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed (T<sub>3</sub>), FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed (T<sub>4</sub>), FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed + KSB @ 20 ml kg<sup>-1</sup> seed (T<sub>5</sub>), Vermicompost @ 2.5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed (T<sub>6</sub>), Vermicompost @ 2.5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed (T<sub>7</sub>), Vermicompost @ 2.5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed + KSB @ 20 ml kg<sup>-1</sup> seed (T<sub>8</sub>). Seeds will be treated before sowing. Manure will be applied in soil before sowing of seed. The cluster bean variety 'Pusa Navbahar' was sown at 45 cm row to row and 20 cm plant to plant spacing. The crop was raised as per the recommended package of practices.

### Results and Discussion

#### Effect on yield and yield attributes parameter

An assessment of data (Table 1) indicated that application of FYM @ 5 t/ha + *Rhizobium* culture @ 20 ml kg<sup>-1</sup> seed + PSB @ 20 ml kg<sup>-1</sup> seed + KSB @ 20 ml kg<sup>-1</sup> seed (T<sub>5</sub>) recorded significantly the highest number of cluster per plant (13.67), number of pod per cluster (8.33), length of green pod (11.68 cm), green pod kg / plant (0.250 kg/plant), green pod kg/ha (17880.00) and dry pod kg/ha (4133.33) which was at par with different treatments following the different yield parameters over the control (T<sub>1</sub>).

This might be due to promotive impact of bio-organic treatments could be attributed to the nitrogen fixing capacity of *Rhizobium*. It enhanced the plant growth and resulted in higher number of cluster per plant. Addition of organic matters with other source of nutrients was reflected in yield parameters. Increased availability of nutrients along with bio-fertilizers and other micro nutrients to plants cause more energy source to plant. It may be influenced in yield parameters. In presence of moisture and organic substance, *Rhizobium*, PSB and KSB enhanced their activity in favorable condition. Similar findings were obtained by Sammauria *et al.* (2009) [16] in cluster bean.

This might be due to maximum use of FYM increase plant growth and yield of plant. Good moisture condition and higher efficiency of PSB influence the nutrient availability of phosphorus and influence on test weight. This condition reflected in significant improvements in pod length. Similar results were also reported by Rathore *et al.* (2007) [14] in cluster bean.

This might be due to the facts that combined effect of *Rhizobium*, PSB and KSB with organic fertilizer. It may be increased the availability of nutrients to the plant from different organic sources. It plays important role in increase the solubility micro nutrients in root rhizosphere, essentially required for the formation and development of the pods. Thus, it increased the number of pods per plant, Green pod kg per plant, Green pod kg per hectare. It influenced the rate of photosynthesis, protein synthesis and more absorbance capacity of nutrients from root zone. It may be mentioned that

no single source of nutrient supply. It bio-fertilizer is in position to meet the increasing nutrient demand and yield. Similar results were also supported by Rawat *et al.* (2008)<sup>[15]</sup> in cluster bean, Meena *et al.* (2005)<sup>[9]</sup> in chickpea, in pigeon pea and Sharma *et al.* (2009)<sup>[17]</sup> in soyabean.

The amount of total dry pod produced is an indication of the overall efficiency of resources utilization. Increase in plant height, number of leaves, higher leaf area, clusters plant<sup>-1</sup> and

pod yield plant<sup>-1</sup> have contributed to higher dry matter production. The increase in dry weight may also be attributed to higher uptake of essential nutrients and better utilization of these nutrients. The beneficial role of organic manures in improving soil physical, chemical and biological role is well known, which in turn helps in better nutrient absorption by plants (Prabhu *et al.* 2002)<sup>[12]</sup>.

**Table 1:** Effect of different organic fertilizers on yield and yield attributes parameter

Treat. No.	Number of cluster per plant.	Number of pod per cluster	Length of green pod (cm)	Green pod kg per plant	Green pod kg per hectare	Dry pod kg/ha
T <sub>1</sub>	9.67	6.00	9.78	0.160	11333	3206.67
T <sub>2</sub>	10.67	6.40	9.78	0.210	12070	3400.00
T <sub>3</sub>	13.27	7.28	10.35	0.210	14746	3833.33
T <sub>4</sub>	13.33	7.47	10.53	0.240	16000	3943.33
T <sub>5</sub>	13.67	8.33	11.68	0.250	17880	4133.33
T <sub>6</sub>	11.00	6.67	10.01	0.180	12070	3500.00
T <sub>7</sub>	11.00	6.80	10.76	0.190	14000	3666.67
T <sub>8</sub>	11.73	7.23	11.02	0.230	14910	3733.33
SEm ±	0.43	0.37	0.38	0.01	1148.71	139.58
CD at 5%	1.32	1.12	1.16	0.03	3483.73	423.30
CV (%)	6.38	9.13	6.33	8.51	14.08	6.57

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