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Response of garden bean to organic manures and biofertilizers on growth, yield and quality attributes

■ **J.P. SAJITHA AND K. HARIPRIYA[1]**

Members of the Research Forum

Associated Authors:
[1]Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, CHIDAMBARAM (T.N.) INDIA

Author for correspondence :
J.P. SAJITHA
Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

ABSTRACT : The response of garden bean variety Konkan Bushan to organic manures along with biofertilisers as a substitute to chemical fertilizers was studied at olericulture unit, Department of Horticulture, Faculty of Agriculture, Annamali University. Among the treatments tested inoculation of *Rhizobium* and Vesicular arbuscular mycorrihae (VAM) along with vermicompost and vermiwash yielded better than uninoculated and controlled treatments. As a result of increased nutrient uptake, nodulation and biological nitrogen fixation of *Rhizobium*, colonization of VAM and supplementation of nutrients through vermiwash and vermicompost derived from vegetable waste was found to be superior. Earliness in flowering was observed in the treatment Pressmud based vermicompost, VAM, *Rhizobium* along with vermiwash. The treatment supplied with *Rhizobium* and VAM along with flower waste vermicompost and spraying of vermiwash reigstered highest protein content. The treatment which received with pressmud based vermicompost, biofertilizer and vermiwash recorded highest fibre content. These result indicate that the garden bean being responds very well for inoculation of *Rhizobium*, VAM and vermicompost and its wash for providing all necessary nutrients in available form.

KEY WORDS : Garden bean, *Rhizobium*, VAM, Vermiwash, Pressmud, Vegetable waste based vermicompost

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The global scenario currently directs the scientists of agriculture to produce residue free farm produce. In India, though self sufficiency in food production is realized, the cultivable land has been polluted due to heavy use of high analysis fertilizers. This had resulted in multinutrient deficiencies in soil-plant system. Long term fertilizer experiments conducted all over the India for the past 25 years have clearly demonstrated that combined use of organic manures and biofertilizers have maintained the higher levels of productivity and are being increasingly used in vegetable production today. On the other hand, biofertilizers are cost effective and renewable source of plant nutrients to supplement a part of chemical fertilizers. They are also agriculturally important elements from non- usable to usable form through biological processes and known to increase yield in several vegetables, besides considerable saving of inorganic fertilizers (Kumar *et al*., 2001).Organic manures like vermicompost, FYM, pressmud and neem cake are available in plenty in and around the area of experimentation and could be efficiently utilized for vegetable production. Hence, this investigation was undertaken to study the response of garden bean "Konkan Bushan" to organic manures and biofertilizers on growth, yield and quality attributes.

RESEARCH METHODS

A field experiment was carried out at olericulture unit, Department of Horticulture Faculty of agriculture ,Annamali unversity (sandy loam soil with pH 7.2, EC 0.75 d S/m). The treatments were fixed with four kinds of vermicompost derived from Fym, pressmud, vegetable waste and flower waste and its respective vermiwash. Bioinoculants like *Rhizobium* and VAM were used. Thus, a total of ten treatments including normal practice (recommended N&P) were replicated thrice in Randomized Block Design. Thery were T_1- pressmud based vermicompost+ vermiwash, T_2 – FYM based vermicompost + vermiwash, T_3 – vegetable waste based vermicompost + vermiwash,T_4 – flower waste vermicompost + vermiwash, T_5– pressmud based vermicompost+ *Rhizobium* + VAM+ vermiwash, T_6– FYM based vermicompost + *Rhizobium* + VAM+ vermiwash, T_7– vegetable waste based vermicompost + rhizobium + VAM+ vermiwash, T_8– flower waste vermicompost + *Rhizobium* + VAM+ vermiwash T_9 – control, T_{10}- normal practice (36:72 kg NP/ ha).

All kinds of vermicompost and vermiwash were prepared in field laboratory using *Eudrilus eugeniae*. Biofertilizers were procured from department of microbiology, Faculty of Agriculture, Annamalai University. Basal dose of vermicompost @ 12.5 t/ha was incorporated during the land preparation and in normal practice FYM was added. Along with this N and P_2O_5 was added, K_2 was rich in soil, so it was not applied. *Rhizobium* was applied as seed treatment and VAM (*Glomus fasiculatum*) culture @ 5g/ hole was placed beneath the surface of the soil at a depth of 5cm in the field. The foliar spray of vermiwash was first given at 20th day after sowing and was repeated five times at an interval of 15 days .

The seeds were sown at the rate of 2/ hill spaced at 60x15cm. The recommended agronomic practices were followed for maintenance of the crop. Neem cake extracts was used to ward off pest at initial stages of crop establishment. The data on crop growth and yield were recorded and analyzed following the standard statistical packages.

RESEARCH FINDINGS AND DISCUSSION

Growth is one of the essential parameters for the attribution of yield, vegetable waste based vermicompost in combination with vermiwash and biofertilizers (T_7) recorded the highest value for, plant height, number of branches per plant (Table 1). High level of nutrients and growth stimulating substances excreted by earthworms into the casts. Vermicast is known to contain humic acid (Alves *et al*., 2001) which influences the plant growth. Foliar application of vermiwash at 1:5 dilution also boosted the, plant height and number of branches due to the presence of growth promoter like substances (Grappelli *et al*., 1985). A combination of legume with *Rhizobium* and VAM has brought out a significant improvement in plant growth due to increased availability of phosphorus content together, with higher nitrogen – fixation in the soil. Inoculation of leguminous seeds with *Rhizobium* culture is considered as one of the important way of getting atmospheric nitrogen to the plants and soils and the inoculated plants are greener and taller (Nutman, 1956). Earliness in flowering is an important economic character which reducing the duration of the crop and lends to the production of better quality produce (Kanika, 1999). Pressmud based vermicompost, VAM, *Rhizobium* along with vermiwash (T_5) resulted in first flowering. Phosphorus plays a major role in inducing earliness in flowering. The desirable results might be due to the favourable effect of organic phosphorus supplied by vermicompost and vermiwash at an optimum concentration to the plants

The highest number of pods / plant, yield of pods/ plant, single pod weight and yield was recorded in the treatment T_7 followed by T_6 in both the seasons of experimentation (Table 2). Vermiwash application at 1:5 dilution has promoted to yield statistics due to sulphur, iron and ammonia. All these salts being in soluble form would have diffused into the plant system, through the stomatal opening and might have influenced the partitioning capacity of crop plants (Pramoth, 1995 and Morselli *et al*., 1999). In the present study, the highest protein content (8.1 and 8.5) was recorded in T_8 where flower waste based vermicompost was used. The next best was observed in T_5 with the application of pressmud based vermicompost (Table 3). From the above results it is evident that different kinds of organics play an important role in improving the protein content. *Rhizobium* significantly increase in protein content in cowpea pods (Singh *et al*., 1989) and increased level of P, increased in protein and phosphorus content. Fibre content was observed to be highest (4.5 and 4.7 %) in the treatment T_5 supplied with pressmud based vermicompost, biofertilizer and vermiwash. Next to this, FYM based vermicompost, biofertilizers with vermiwash

Table 1 : Effects of organic manures and biofertilizers on growth attributes of garden bean

Treatments	Plant height (cm)		Number of branches per plant		Number of days taken for first flowering	
	Crop I	Crop II	Crop I	Crop II	Crop I	Crop II
T_1	47.74	51.70	4.10	4.60	29.45	28.60
T_2	49.86	53.60	4.70	5.00	29.82	28.80
T_3	51.75	54.80	5.06	5.95	29.68	28.72
T_4	45.38	50.40	3.70	4.20	29.55	28.66
T_5	58.36	65.60	6.72	7.00	28.94	28.14
T_6	62.06	69.40	7.58	7.93	29.28	28.47
T_7	65.25	82.40	7.93	8.40	29.16	28.40
T_8	55.73	57.60	5.94	6.20	29.04	28.30
T_9	40.12	46.80	2.80	3.40	30.04	28.88
T_{10}	52.15	55.40	5.08	6.00	29.41	28.55

Table 2 : Effects of organic manures and biofertilizers on yield attributes of garden bean

Treatments	No. of pods / plant		Pod weight (g)		Pods yield / plant (g)		Yield / ha (t)	
	Crop I	Crop II	Crop I	Crop II	Crop I	Crop II	Crop I	Crop II
T_1	21.5	23.7	3.2	3.5	70.3	82.6	3.3	4.1
T_2	22.9	24.7	3.3	3.6	78.9	88.9	3.4	4.4
T_3	24.3	26.9	3.3	3.7	84.1	99.5	4.1	4.9
T_4	18.9	21.9	3.2	3.4	65.2	75.2	3.1	3.7
T_5	27.9	30.0	3.5	3.9	108.2	117.0	4.3	5.8
T_6	29.4	32.5	3.7	4.0	121.7	130.1	4.5	6.5
T_7	30.3	33.7	4.0	4.1	134.4	137.3	5.5	6.9
T_8	27.1	28.4	3.4	3.8	99.7	108.7	4.3	5.4
T_9	17.0	19.0	3.1	3.3	60.0	62.7	2.9	3.1
T_{10}	24.5	27.2	3.4	3.7	84.7	101.4	4.1	5.0

Table 3 : Influence of oranic manures and biofertilizers on quality of garden bean

Treatments	Protein content		Fibre content	
	Crop I	Crop II	Crop I	Crop II
T_1	6.6	6.7	3.7	4.1
T_2	6.2	6.0	3.6	3.8
T_3	6.4	6.4	3.2	3.3
T_4	6.9	7.1	3.4	3.6
T_5	7.7	8.1	4.5	4.7
T_6	7.3	7.5	4.3	4.5
T_7	7.5	7.8	3.9	4.2
T_8	8.1	8.5	4.1	4.4
T_9	5.2	5.7	3.1	3.1
T_{10}	7.1	7.2	3.8	4.1

(T_6) showed the best result. These results indicate that the garden bean being a leguminous vegetable crop responds very well for inoculation of *Rhizobium*, VAM and vermicompost and its wash for providing all necessary nutrients in their available form.

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