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A study on the effect of kitchen waste vermicompost on the yield of French bean (*Phaseolus vulgaris*)

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Abstract: Organic farming is an emerging area in vegetable production. There is a great demand for organically grown vegetables both in local and global markets. Hence growing vegetables organically by using cost-free and low cost inputs is gaining importance especially in regular legume vegetable crops like French beans which are grown both for their pods and seeds (Rajmas). An experiment to study the role of kitchen waste vermicompost, farm yard manure and neem cake on growth and yield of French beans (*Phaseolus vulgaris*) as a test crop without using any chemical fertilizer was conducted in the field of Department of Sericulture, SPMVV, Tirupati. House hold kitchen waste was converted to vermicompost by employing *Eisenia foetida* variety of earthworms. Different combinations of vermicompost, farm yard manure and neem cake were applied to French bean crop and tested for results. In comparison to other treatments T-7 using 33%VC, 33%FYM and 33%NC showed highest effective nodule percentage (56.84%), maximum pod yield (192gms/plant), and highest pod set percentage (33.05%) per plant with a gross return of 35,000 Rs / hec, net return of 25,867/hect and a highest cost-benefit ratio of 1:3.06. T-5 using 50% NC and 50% VC showed maximum values for mean height of the plant (48.6cms) and highest pod length (13.56cms). Both T-5 and T-7 showed highest protein percentage in the pods (2.54gms protein / 100 Gms edible pod).

Key words: Farmyard manure, Neem cake, *Phaseolus vulgaris*, Vermicopost

As vegetables form a part of regular diet in all parts of the world there is a need to increase production of vegetables both for the local and global markets in view of the growing population. French bean, *Phaseolus vulgaris* is a legume crop grown for both its pods as well as seeds used as Rajmas. French beans both fresh and frozen have good demand in global market. Also it is a best source of nutrients and roughage to our population better if grown organically. Further organically produced French beans fetch nearly 20-30% higher prices in city markets.

As the French bean is mainly grown for its pod yield rather than Rajmas in Southern parts of India including Andhra Pradesh, the yield parameters pertaining to pod yield were taken into consideration in this experiment. The role of KWVC (kitchen waste vermicompost) in increasing the yield was studied in relation to other organic manures like Farm yard manure and Neem cake. The effect of kitchen waste vermicompost in increasing the growth and yield of French beans, its relative effect on the quantitative and qualitative parameters in combination with neem cake and farm yard manure were studied in this experiment.

METHODS AND MATERIALS:

The experiment with Anupama variety of French beans (*Phaseolus vulgaris*) was carried out in the field of Department of Sericulture, SPMVV, Tirupati. The soil was a light red loamy soil with pH of 7.2. Kitchen wastes were converted into vermicompost by using cowdung slurry and *Eisenia foetida* variety of earthworms. The complete nutritional requirement of the crop was met through kitchen waste vermicompost @ 10 tons / hec, neem cake @ 3.3 tons / hec and farm yard manure@ 10 tons / hec. Prophylactic applications of natural plant extracts were used to prevent attack of diseases. The manures were applied to the crop as per the following treatments:

1. Control - Soil only
2. T-1 - FYM
3. T-2 - NC
4. T-3 - VC
5. T-4 - FYM + NC (1:1)
6. T-5 - NC + VC (1:1)
7. T-6 - VC + FYM (1:1)
8. T-7 - FFYM + NC + VC (1:1:1)

The treatments were tested in a randomized split plot design with 4 replications. The manures were given in three doses one week before sowing, 15 days after sowing and 30 days after sowing. The experiment was conducted between August and October during 2008 and 2009. Observations on qualitative and quantitative parameters regarding growth and yield were recorded and analyzed statistically.

TABLE – 1 – GROWTH PARAMETERS
(Average values over replications / seasons)

Treatments	Height of the plant (cms)	Mean leaf area(sq.cms)	No.of days to 50% flowering	No. of nodules/plant	No. of effective nodules / plant	Effective nodule %
Control	34.7	280.25	28	20.14	7.21	35.35
T-1	36.3	442.68	24	57.33	21.42	35.74
T-2	33.3	324.45	24.5	16.62	3.50	24.26
T-3	47.2	545.52	20	80.10	35.23	48.51
T-4	38.5	454.50	25	51.34	20.72	39.14
T-5	48.6	412.32	23.5	50.80	18.43	33.99
T-6	35.5	480.00	22	58.91	26.80	44.45
T-7	40.4	478.44	22	47.72	27.67	56.84

TABLE – 2 YIELD PARAMETERS
(Average values over replications / seasons)

Treatments	Pod length (cms)	Pod yield /plant	No. of flowers/plant	No. of pods/plant	Pod set %	Biomass yield (kgs / hec)	Pod yield (kgs / hec)	Harvest index	Total costs/hect in Rs.	Gross returns /hec in Rs.	Net returns/hect in Rs.	Cost-benefit ratio
Control	11.73	48	71.6	17.14	23.9	5,700	960	16.77	10600	8,980	-1310	1 : 0.8
T-1	11.97	123	82.75	22.27	26.85	9,426	3,600	26.05	12200	24600	12400	1 : 2.01
T-2	12.50	180	57.25	18.35	31.95	9510	2,460	38.06	12800	36000	23200	1 : 2.80
T-3	13.40	184	80.15	24.51	30.50	9,546	3,680	38.54	12200	36,800	24,600	1 : 3.01
T-4	11.80	160	63.85	18.70	29.20	6,202	3,600	51.49	12700	32000	19,300	1 : 2.51
T-5	13.56	180	62.6	19.66	31.38	6,916	3,200	52.31	12500	36,000	23,500	1 : 2.87
T-6	13.13	190	65.5	20.32	30.95	6,810	3,800	56.34	12400	38,000	25,600	1 : 3.02
T-7	13.40	192	67.85	22.48	33.05	9,176	3,840	41.74	12533	38,400	25,867	1 : 3.06

TABLE – 3 QUALITATIVE PARAMETERS
(Average values over replications / seasons)

Treatments	Fresh Wt. of the plant (gms)	Dry Wt. of the plant (gms)	Moisture content of the plant (%)	Fresh Wt. of the pod (gms)	Dry Wt of the pod (gms)	Moisture content of the pod (%)	Carbohydrate %	Protein %
Control	75.1	28.5	62.02	4.46	0.34	92.37	0.60	2.00
T-1	165.5	47.13	71.54	5.80	0.25	95.70	0.68	2.26
T-2	112.7	47.55	57.95	4.65	0.39	91.60	0.65	2.50
T-3	155.7	47.73	69.35	5.04	0.26	94.83	0.70	2.52
T-4	80.3	31.00	59.38	4.10	0.29	92.94	0.68	2.40
T-5	110.6	34.58	68.77	4.85	0.20	95.91	0.75	2.54
T-6	105.5	34.05	67.87	5.26	0.32	93.91	0.78	2.46
T-7	120.8	45.73	63.49	4.73	0.33	93.02	0.77	2.54

RESULTS AND DISCUSSION:

It is evident from table – 1 that regarding the quantitative growth parameters the effect of 100% kitchen waste vermicompost was more significant and highest in terms of mean leaf area, (545.52 sq.cms), mean number of nodules per plant (80.1 per plant) and mean number of effective nodules per plant (35.23 per plant). **T-5 with 50% vermicompost and 50 % neem cake** showed a maximum value of 48.6 cms for mean height of the plant as well as highest pod length (13.56cms) indicating that linear growth is influenced by this combination of VC and NC. However the effective nodule percentage which is an important parameter regarding the increase of nitrogen uptake, fixation, protein synthesis and pod yield was greatest with **T-7 using 33% vermicompost, 33% farmyard manure and 33% neem cake**.

Regarding yield parameters **T-1 using 100% farm yard manure** showed a maximum number of flowers (82.75 flowers / plant). **T-3 using 100% vermicompost** recorded a maximum number of 24.51 pods per plant. **T-5 using 50% neem cake and 50 % vermicompost** showed highest pod length of 13.56 cms. **T-7 where 33% vermicompost, 33% neem cake and 33% farm yard manure** were used together showed maximum pod yield of 192gms per plant and highest pod set percentage of 33.05% per plant and also showed highest pod yield of 3849 kgs / hectare. An analysis of gross returns, net returns and cost-benefit ratio reveals that **T-7 using 33% vermicompost, 33% farm yard manure and 33% neem cake** showed highest values of 38,400 rupees / hec, 25,867 rupees / hec and 1:3.06 for gross returns, net returns and cost-benefit ratio respectively.

Hence T-7 with equal proportion of vermicompost, neem cake and farm yard manure is found to be a good combination for increasing the plant yield, economic yield in terms of gross returns and net returns, cost-benefit ratio and so may be recommended to achieve high pod set percentage and high pod yield per plant.

Bio-chemical analysis of the pods reveals that **T-6 using 50% vermicompost and 50% farm yard manure** showed best results with high carbohydrate percentage of 0.78 Gms / 100 gms of edible pod. Both **T-5 using 50% neem cake and 50% vermicompost** and **T-7 using 33% vermicompost, 33% neem cake and 33% farm yard manure** could show an increased percentage of protein 2.54 Gms of protein / 100 gms of edible pod.

These results prove that though neem cake could not influence carbohydrate percentage significantly it was found to be significantly influencing the protein percentage both in T-5 and T-7.

SUMMARY:

The present study shows that **T-7, a combination of kitchen waste vermicompost with neem cake and farm yard in equal proportion** was able to increase the growth parameters like nodulation, yield parameters pod set percentage and mean pod yield per plant, highest gross returns, highest net returns and high cost-benefit ratio. It also shows highest protein percentage when compared to the control and all other treatments. Hence it may be recommended for use of this combination to improve not only the quantity and quality of French bean yield but also for maximum economic benefits.

The present study also recommends preparation and utilization of vermicompost with food wastes, kitchen wastes and cattle wastes both in small scale from house-holds, and in large scale from hotels and hostels from proper utilization of wet wastes and its enrichment with farm yard manure and neem cake for better use as a manure. Achievement of healthy yields along with high yields is the target of vegetable farming combining traditional knowledge with technology for the benefit of the farmer as well as the consumer.

Abbreviations used: VC-vermicompost, NC- Neem cake, FYM-Farm Yard Manure, KWVC-Kitchen waste vermicompost

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