Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

European Journal of Experimental Biology, 2015, 5(1):34-38

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Effects of organic and chemical fertilizers on cluster bean (*Cyamopsis tetragonolobus*)

Balbhim L. Chavan*, Mangesh M. Vedpathak*[1] and Bhimashankar R. Pirgonde[#]

**Department of Environmental Science, School of Earth Sciences, Solapur, MAH, India*
**[1]Shriram Institute of Engineering & Technology Center, Paniv,*
[#]Sangmeshwar College, Solapur Solapur University, Solapur, MAH, India

---

ABSTRACT

A field experiment was carried out to determine impact of organic fertilizers prepared from agriculture solid waste (FYM) with various composting methods on the growth and yield of Cluster bean (Cyamopsis tetragonolobus).The agricultural solid waste was used for preparation of different organic composts. The five treatments were taken as compost from vermicomposting (T-1), pit composting method (T-2), NADEP method of composting (T-3), complex chemical fertilizers (25:50:50) as T-4 and control (T-5). These organic fertilizers and chemical fertilizers were supplied to field for Cluster bean (Cyamopsis tetragonolobus) vegetable crop cultivation. Growth analysis of Cluster bean (Cyamopsis tetragonolobus) plant was carried out at various days. The number of pods per plant, pod yield (g/plant) and pod yield per plot were recorded after 60 days at various treatments of organic and chemical fertilizers and compared with control. The highest plant height was noticed with vermicomposting treatment on 7th day (4.1 (±0.120) cm, 30th day (8.9(±0.118) cm and 23.9(±0.112) cm over the c ontrol and other fertilizers. The fresh and dry biomass contents after 60 days were 8.43(±0.236) g/plant and 1.89 (±0.087) g/plant and the weight of pod yield was 106.78 g/100 pods in the set of vericompost treatment indicating drastic increase than the other sets studied. Morphological characters including plant height, number of leaves per plant were higher with the application of vermicompost. The results show significance increase in growth, yield pods in plants treated by vermicompost fertilizer, followed by chemical fertilizers and as compared with control field. Vermicomposting with agricultural solid waste by earthworms gave better results than other fertilizers.

Keywords: Organic fertilizer, chemical fertilizers, vermicompost, crop yield, *Cyamopsis tetragonolobus*, agricultural solid waste.

INTRODUCTION

The agricultural soil supports the crop growth better, if the growing crops are supplied with suitable fertilizersfor the growth of all vegetable crops[1].*Cyamopsis tetragonoloba* or cluster bean (Guar) belongs to the family Fabaceae (*Leguminaceae*). It is commercially grown for its seeds as a source of natural polysaccharide (galactomannan), commercially known as guar gum. Guar gum has a number of uses in food [2]. C. tetragonoloba acts as an appetizer, cooling agent, digestive aid, laxative, and is useful in dyspepsia and anorexia Anti-ulcer, anti-secretory, cytoprotective, hypoglycaemic, hypolipidemic and anti-hyperglycaemic effects [3]. In addition, Guar beans are potentially high sources of additional phytochemicals [4].Guar contains many important nutrients and phytochemicals such as saponin and flavonoids and is well-known traditional plant used in folklore medicine [3, 5]. Abundant use of chemical fertilizers in agriculture has resulted in poor soil fertility and health of consumers. The nitrogenous fertilizers and pesticide residues have created water pollution leading to carcinogenic effect on human

body and caused damage to the important organs. Application of chemical fertilizers leads to the loss of soil fertility due to imbalanced use of fertilizers which have adversely affected agricultural productivity and caused soil degradation [6]. There is need to investigate suitable method of composting for agricultural solid waste management for agricultural use. Composting and vermicomposting are the recycling technologies which improve the quality of products [7, 8]. Vermicomposting (T-1), pit composting (T-2) and NADEP method (T-3) are appropriate methods for biodegradable agricultural solid waste management [5]. Inthis paper compost was prepared by different methods including vermicomposting, pit method of composting, NADEP aerobic method. The present study was undertaken to convert agricultural solid waste into value added manures by different methods and observe its effect on growth and yield of Guar vegetable crop (Cluster bean).

MATERIALS AND METHODS

The effect of vermicompost in comparison with organic and chemical fertilizers was tested on Cluster bean (*Cyamopsis tetragonolobus*)vegetable crop. The plots of size 2.75mX2.75m in three replications were prepared in an agricultural plot in the nursery of Solapur University, Solapur. The soil was ploughed and prepared for experiments. The (pre-characterised) vermicompost was applied at the rate of 1.9 kg per plot (@ 0.245 kg/sqm). Rate of application of pit compost and compost from NADEP were 3.024 kg per plot (@ 0.399 kg/sqm) each and chemical fertilizer with NPK in the proportion of 25:50:50 was applied at the rate 150gm per plot (@ 19.84gm/sqm)according to recommended dose of fertilizers.[9].Total 200 seeds were sown in each plot. Irrigation system was by surface water. The rate of irrigation was done on 3 $^{rd.}$ and 6thday per week. A random sample of 10 plants from each plot was taken at various time intervals that viz. are 7, 30 and 60 days after sowing. The vegetative growth characters like Plant height, number of leaves and total fresh and dry weight of plant were measured with reference to standard method of agronomy [8]. At the time of harvest (after 60 days) total yield of pods of Guar per plot was recorded. Yield components like number of seeds/pod,dry seeds weight (g/100 seed), number of pods/plant, average fresh weight of pod/ plant, pods weight (g/100 pod) and total fresh weight of Pods/ plant were recorded after 60 days.

Prior to this experimental study, nutrient status of different fertilizers and soil characteristics of study site were estimated using standard methods[10, 11].

The samples were subjected to chemical analysis. pH of the samples was measured by pH meter and moisture was determined by loss on drying method. The electrical conductivity values of a soil samples were determined by using digital conductivity meter. Organic carbon of soil sample was determined by using Walkley and Black by rapid dichromate oxidation technique method. Total Nitrogen was determined by using Kjeldahl method. Estimation of available phosphorus was done by using method given for acidic soil by Bray and Kurfz method[12]. Potassium in the soils was estimated by flame photometer. Calcium and magnesium forms stable complexes and were determined by EDTA titrimetric method. Sodium was determined by the method of preparation of standard curve for sodium. Phosphorous by Olsen method and Cu, Zn, Fe, Mn was estimated with help of DTPA (diethylenetetraminepenta acetic acid) as an extractant method and the micronutrients in the extract are determined by using Atomic Absorption Spectrophotometer. Boron was determined by Spectrophotometric method. Sulphur content was determined by phosphate extractable SO4 method [13]. The literature suggested methods, capable to characterise MSW are useful for solid waste recycling studies [14], hence are preferred.

RESULTS AND DISCUSSION

The physic-chemical parameters of soil used in present investigation indicated that the soil was alkaline in nature with pH 8.01 having 8.8% initial moisture and 0.15(mS/cm) EC and 1% carbon content. The NPK contents were 0.21%, 0.19% and 0.08% respectively. The all other values of nutrients found are represented in Table 1 which indicate the suitability of soil for the crop growth.

Table 1. Initial physic-chemical characteristics of experimental soil:

Parameter	Soil characteristics	Parameter	Soil characteristics
pH	8.01	Mg (%)	0.43
Moisture(%)	8.8	Na(ppm)	310
EC(mS/cm)	0.15	B (ppm)	28
Org. carbon	1	Fe (ppm)	87
N(%)	0.21	Mn (ppm)	62
P(%)	0.19	Cu (ppm)	14
K(%)	0.08	Zn (ppm)	30
S(%)	0.16	Cl (ppm)	465
Ca (%)	1.07		

Nutrient contents of all composts used in experiment are given in Table 2.The initial soil test helped for the application of enough fertilizers to meet the requirement of crop while taking advantage of nutrients already present in soil.

Table 2.Nutrients contents of different organic fertilizers prepared from agricultural solid waste

SR. NO	PARAMETERS	T-1	T-2	T-3
1	pH	8.03	7.49	6.84
2	Moisture (%)	32.70	19.40	16.90
3	Org. Carbon (%)	19.50	12.10	9.56
5	N (%)	1.27	0.93	0.88
6	P (%)	1.64	1.05	0.93
7	K (%)	1.11	1.72	1.25

T1stands for nutrient status of FYM prepared from vermicompost method, T2 stands for nutrient status of FYM prepared from Pit composting method, T3stands for nutrient status of FYM prepared from NADEP method of composting.

The all nutrient contents were found more in agricultural waste of vermicompost as compared to pit composting and NADEP method of FYM. All values such as pH, Moisture, Organic Carbon, N, P were high in vermicomposts as compared to other composts. Vermicomposting of FYM showed highest nutrients whereas NADEP method of agricultural waste compost gave lowest nutrients. The range of all necessary parameters was in mature state of fertilizers as suggested by S. R. Maley viz. pH (07.00 to 8.2), organic carbon (16.0%), Nitrogen (1.50 to 2.00%), Total phosphorous (2.5 to 3.2%), available phosphorous (1.25%) and potassium (2.00%).

The properties of vermicomposts, pit composts and NADEP compost were compared (Table 2), it was observed that the vermicompost has alkaline pH (8.03) than pit compost (7.49) with slight alkaline and NADEP compost with slightly lower (6.84) pH. The N.P.K contents were 1.27%, 1.64% and 1.11% in vermicompost 0.93%, 1.05% and 1.72% in pit compost and 0.88%, 0.93% and 1.25% in NADEP compost.

The effect of application of compost and chemical fertilizers on cluster bean (*Cyamopsis tetragonoloba)*growth parameters are presented in Table no 3, 4, 5. The results show that there were different impacts of each compost application on the crop which differently favoured the plant growth parameters. Rate of application ofcompost however showed increase in the values of growth parameters measured from the control plant to those plants supplied with the desired rates of other fertilizers including chemical fertilizer.

Table3. Effect of different fertilizers treatments on average morphological characteristics of Cluster bean (*Cyamopsis tetragonolobus*) plant after 7 days

Treatments	Plant height (cm)	No. of leaves/ plant	Biomass	
			Fresh Weight (gm/plant)	Dry Weight (gm/plant)
T-1	4.1 (±0.120)	3	0.56 (±0.012)	0.17 (±0.140)
T-2	3.9Z (±0.120)	3	0.48 (±0.004)	0.13 (±0.053)
T-3	3.1 (±0.128)	3	0.42 (±0.018)	0.11(±0.056)
T-4	3.8 (±0.265)	3	0.38 (±0022)	0.06 (±0.040)
T-5	2.9 (±0.112)	2	0.38 (±0.033)	0.05 (±0.012)

T1 stands for Vermicomposting of FYM, T2 stands for pit composting of FYM, T3 stands for NADEP method of composting of FYM, T4 stands for Chemical complex fertilizers (25:50:50) and T5 stands for Control.

Table 4. Effect of different fertilizers treatments on average morphological characteristics of Cluster bean (*Cyamopsis tetragonolobus*) plant after 30 days

Treatments	Plant height (cm)	No. of leaves/ plant	Biomass	
			Fresh Weight (gm/plant)	Dry Weight (gm/plant)
T-1	8.9 (±0.118)	7	0.93 (±0.065)	0.28 (±0.075)
T-2	8.5(±0.094)	6	0.77 (±0.050)	0.21 (±0.049)
T-3	8.0 (±0.011)	6	0.61 (±0.087)	0.16 (±0.027)
T-4	9.1 (±0.127)	7	0.75(±0.075)	0.12 (±0.045)
T-5	6.3 (±0.103)	5	0.41 (±0.056)	0.09 (±0.053)

T1 stands for Vermicomposting of FYM, T2 stands for pit composting of FYM, T3 stands for NADEP method of composting of FYM, T4 stands for Chemical complex fertilizers (25:50:50) and T5 stands for Control.

Table 5. Effect of different fertilizers treatments on average morphological characteristics of Cluster bean (*Cyamopsis tetragonolobus*) plant after 60 days

Treatments	Plant height (cm)	No. of leaves/ plant	Biomass	
			Fresh Weight (gm/plant)	Dry Weight (gm/plant)
T-1	23.9(±0.112)	16	8.43(±0.236)	1.89(±0.087)
T-2	23.1(±0.096)	14	3.24(±0.260)	0.83(±0.087)
T-3	18.4(±0.072)	12	3.74(±0.155)	1.00(±0.111)
T-4	26.6(±0.141)	21	6.0(±0.231)	1.55(±0.081)
T-5	17.3 (±0.075)	9	2.6 (±0.168)	0.44(±0.051)

T1 stands for Vermicomposting of FYM, T2 stands for pit composting of FYM, T3 stands for NADEP method of composting of FYM, T4 stands for Chemical complex fertilizers (25:50:50) and T5 stands for Control.

Under the present study, plant height and no. of leaves per plant were significantly influenced by different composts and chemical fertilizer at different days of crop age. It was observed that that plant height was highest (26.6 cm) with application of chemical fertilizer. On the other hand, the lowest plant height (17.3 cm)was observed in control at harvesting stages (at 60 day). During the growth analysis (at 60 days) maximum numbers of leaves per plant were found in Cluster bean (*Cyamopsis tetragonolobus*) plant treated with chemical fertilizer followed by vermicompost of FYM. It is observed that the fresh weight (8.43gm) and dry weight (1.89gm) was maximum in treatment set of vermicompost of FYM, which was followed by the set of treatment with chemical fertilizer. All results were significant over the control.

Table: 6. Effect of different fertilizers treatments on morphological characteristics and yield of Cluster bean (*Cyamopsis tetragonolobus*) plant after 60 days (i.e. harvesting time)

Compost application	No. of seeds/ pod	Dry seed weight (g/100 seeds)	No. of pods/ plant	Average fresh Weight of Pods/plant	weight of pods (g/100 pods)	Total fresh Weight of Pods/ plant
T-1	7.5 (±0.130)	1.62	6	0.816 (±0.067)	106.78	4.2 (±0.045)
T-2	6.3 (±0.112)	1.37	4	0.723 (±0.035)	91.898	1.87 (±0.065)
T-3	6.10 (±0.078)	1.22	5	0.487 (±0.040)	74.808	1.55 (±0.050)
T-4	6.4 (±0.011)	1.56	7	0.571 (±0.035)	100.18	3.3 (±0.075)
T-5	6.2 (±0.098)	1.08	3	0.355 (±0.050)	59.12	1.02 (±0.030)

T1stands for Vermicomposting of FYM, T2stands for pit composting method of FYM,T3stands for NADEP method of composting of FYM, T4stands for Chemical complex fertilizers and T5stands for Control.

Total yield/plot of Cluster bean (*Cyamopsis tetragonolobus*) was achieved to be 1.880kg while it came out to be 0.620kg, 0.478kg, 1.320kg and 0.408kg in treatments T1, T2, T3, T4 and T5 respectively. The lowest yield was obtained in control field. A significant increase in 100 pods/gm of Guar plant was observed in five treatments and it was 106.8 g in T1, 91.898 g in T2, 74.808 g in T3, 100.18 g in T4 and as compared to control (59.12 g) as shown in table 6. All treatments produced significantly higher number of pods per plant over the control. Data presented in Table6 indicated that no. of seeds/ plant, dry seed weight (g/100), no. of pods/ plant, average fresh weight/ plant and total fresh of pod/plant were significantly increased after 60 days with treatment of vermicompost of FYM.

Table: 7. Effect of different fertilizers treatments on chemical contents of Cluster bean (*Cyamopsis tetragonolobus*) plant after 60 days (i.e. harvesting time).

Compost Application	Chemical Constituents						
	N (%)	P (%)	K (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
T-1	1.4	0.34	4.64	14.9	10.2	14.8	9.6
T-2	1.17	0.31	4.96	27.7	10.9	12.0	10.3
T-3	1.13	0.21	4.65	19.6	10.4	10.1	9.9
T-4	1.06	0.32	5.12	24.4	8.4	7.9	9.9
T-5	1.28	0.33	4.32	12.5	9.7	13.7	10.2

T1stands for Vermicomposting of FYM, T2stands forPit composting method of FYM, T3stands for NADEP method of composting of FYM, T4stands for Chemical complex fertilizers and T5stands for Control.

Results in Table 7reflect that, the effect of the different fertilizers application treatments on nutrient contents (N, P K, Fe, Mn, Zn and Cu). Concerning the effect of these treatments on chemical constituents, it was observed that that treatment T-1 gave the maximum value of chemical constituents. All treatments caused increase nutrient contents

compared with the control treatment. The lowest value of chemical constituents was resulted in the treatment T-5 and in comparison with treatments T2, T-3, T4 and T5.

CONCLUSION

Among all the fertilizer treatments for the growth, yield and chemical contents of Cluster bean (*Cyamopsis tetragonolobus*) crop recorded significantly highest with application of vermicompost of FYM as compared to remaining treatments and then followed by treatment with chemical fertilizer. Therefore it is concluded that vermicompost can be recommended for better growth and yield of Guar in agricultural practices.

REFERENCES

[1] Chavan B. L. GE-*International J of Management Res*, **2014**, 2(11): 407-429.
[2] Khalil, M.M.*Nahrung*,**2001**, 45(1): 21-24.
[3] Mukhtar, H.M., S.H. Ansari, Z.A. Bhat and T. Naved,*Pharm. Biol*.,**2006**,44(1):10-13.
[4] Wang, M.L., J.B. Morris. *Plant Genetic Resources: Characterization and Utilization*, **2007**,5(2):96–99.
[5] Chavan B.L., Vedpathak M.M., Pirgonde B.R.,AB of National Seminar on 'Environmental issues & Social exclusion' 11 & 12 Feb **2014**, Centre for the Study of Social Exclusion and Inclusive Policy, (Shivaji University, Kolhapur), 52.
[6] Wani S.P. and Lee K.K. Fertilizers, organic manures, recyclable wastes and biofertilisers (Tandon HLS, Ed.). New Delhi, **1992**.
[7] Jayasankar S, M.E. Thesis, Anna University,(Madras, India, **1994**).
[8] Selvi T, M. Sc. Dissertation, Bharathidasan University, Tiruchirappalli, **1996**.
[9] Krushidarshani (Bhimrao ulmek Ed.) Mahatma Phule Krushi Vidypith, (Rahuri, India, **2014**)
[10] Minakumari T and Shekhar M.,*World res.J. of agricultural biotechnology*. **2012,** 1 (1):14-16.
[11] H. Kochakinezhad, Gh Peyvast, A.K. Kashi, J. A. Olfati and A. Asadii. *J. of organic system*, **2012**, 7(2), 14-25.
[12] D.A.C.,Methods manual, Soil testing in India,Department of Agriculture & Cooperation, Ministry of Agriculture,(Government of India, New Delhi. January-**2011**).
[13] Wagh G. S.and Sayyad M.R.G. Uni. *J. of Env. Res. & Techn*, **2013,**3(1): 72-78.
[14] Seema Jilani.*Pac.J.Bot*, **2007**, 39(1): 271-277.

-

.