Environment & Ecology 27 (4) : 1608—1611, 2009
 ISSN 0970-0420

Effect of Enriched Sugarcane Trash Compost on Green Chilli Yield

D. H. ROOPASHREE[1], MUKUND JOSHI[1], T. BHAGYA LAKSHMI[2], S. KAMALA BAI[1], Y. M. RAMESHA[1] AND D. KRISHNAMURTHY[1]

[1]*Department of Agronomy,* [2]*Department of Soil Science & Agricultural Chemistry, University of Agricultural Sciences Bangalore 560065, India*
E-mail : roopa229@rediffmail.com

Abstract

An experiment was conducted in *kharif* season at farmer's field to explore the possibilities of hastening the process of decomposition of sugarcane trash by using various additives. Four different combinations were tried using trash with green manure, poultry manure, yeast sludge and rock phosphate along with common application of cow dung, microbial culture and matured starter compost. After 120 days of composting in heaps, sugarcane trash layered with various additives resulted in nutrient rich trash manure. Different combinations resulted in composts of various nutrient composition. The combination of 44% trash + 50% sludge by weight made up by 5% cow dung and 1% matured compost yielded manure with N (3.10%), P (0.28%) and K (0.95%), while a combination of 44% trash + 25% green manure + 25% poultry manure made up by 5% cow dung and 1% matured compost on weight basis resulted in a nutrient rich manure with N (2.96%), P (0.42%) and K (1.16%). The compost receiving no additives could not achieve nutrient composition beyond 0.70% N, 0.15% P and 0.41% K after 120 days of composting time. The enriched trash compost was also evaluated for its superiority under field conditions using chilli as test crop. The results indicated that combining trash compost with chemical fertilizers on 50% basis was more helpful in improving the growth and yield of green chillies as compared to combining FYM in similar proportion or applying the trash trash compost alone. The integrated treatments with trash compost resulted in highest green chilli yield (107.57 to 126.27 q/ha) as compared to applying it alone (84.44 to 102.39 q/ha).
Key words : Sugarcane, Enriched compost, Green chilli, Yield.

One of the major reasons for burning of trash, so commonly resorted to by sugarcane farmers, is its poor decomposability making it unsuitable for farm yard manure preparation. The sugar cane trash is not easily decomposed due to wide C : N ratio and also due its shape and size. The high C : N ratio of sugar cane trash does not allow the faster microbial activities, resulting into slow degradation of cellulose and lignin, the main constituents of the trash. The long body sugar cane leaves does not favor the faster decomposition. If these twin problems are solved, then vast quantity of sugar cane trash i.e., 28 million tonnes per year, generated in India could be successfully recycled for improved crop production. Besides harnessing the vast quantity of nutrients available in trash, the utilization of trash in manure preparation automatically curbs trash burning practice, which has resulted in loss of soil micro flora, poor emergence of sprouts in ratoons.

Methods

Preparation of Enriched Sugarcane Trash Compost

Four different types of composts were prepared in the study using different combinations viz., sugarcane trash (94%)–C_1, sugarcane trash (44%) + green manure (25%) + poultry manure (25%) – C_2, sugarcane trash (44%) + yeast sludge (50%) – C_3 and sugarcane trash (89%) + rock phosphate (5%) – C_4. A common application of cow dung (5%) and matured compost (1%) along with microbial culture was also made to all the composts. All the additives were added on fresh weight basis with respect to fresh weight of sugarcane trash to make up to equivalent weight in each treatment. Microbial culture containing *Pleurotus florida* and *Trichoderma viridae* was used at 1 kg per tonne of trash in all the treatments and at 1/2 kg per tonne of trash in case of phosphorus solubilizing

Table 1. Nutrient composition of matured enriched sugarcane trash compost. All the treatments received cow dung (5%) and matured compost (1%) along with microbial culture.

Treatments	pH	EC (dS/m)	OC (%)	N (%)	P (%)	K (%)	Lignin (%)	Cellulose (%)
C_1 : Sugarcane trash (94%)	7.12	0.19	41.28	0.70	0.15	0.41	21.45	28.21
C_2 : Sugarcane trash (44%) + Green manure (25%) + Poultry manure (25%)	7.38	0.39	35.98	2.96	0.42	1.16	18.06	21.15
C_3 : Sugarcane trash (44%) + Yeast sludge (50%)	7.32	1.82	37.10	3.10	0.28	0.95	19.80	25.85
C_4 : Sugarcane trash (89%) + Rock phosphate (5%)	7.29	0.26	38.20	0.79	0.46	0.45	20.84	27.26

bacteria in C_4. In each treatment, heaps of 3 m length, 2 m width and 1.5 to 2 m height were used to prepare compost. All the heaps were made in the open field on a leveled rigid soil. The trash and additives were added layer by layer with sprinkling of water between each layer to maintain 60% moisture. The heaps were covered by a PVC sheet. After 1 month, the heaps were turned and water was sprinkled before they were covered again by PVC sheet. The turnings were given to all the heaps at an interval of 30 days. The heaps of composts were retained for 120 days, after which they were stored for further use.

Agronomic Evaluation of Composts

A field experiment was conducted at Mandya district of Karnataka during December 2005–April 2006 to evaluate the manurial value of composts under study in terms of chilli yield (cv *Pusa Jwala*). The experimental site was ploughed, leveled and a representative soil sample was collected to determine the initial fertility status of the site. The field was laid out in rides and furrows. Randomized complete block design was adopted in the study with three replications. After tillage operations, four types of composts and FYM were applied either singly or with 50% substitution of fertilizers (on N basis) to make ten treatment combinations. All manures and fertilizers were applied as basal dose. Chilli seedlings of 35 day old were transplanted with 75 cm × 45 cm spacing. The crop was maintained by following recommended package of practices.

Results and Discussion

Chemical Composition of Compost at Maturity

Chemical properties of matured composts in all four treatments are presented in Table 1. The pH of matured compost ranged from 7.12 to 7.38 indicating marginal difference in pH due to different composting treatments. But, EC of C_3 compost was as high as 1.82 dS/m as compared to C_2 compost (0.39 dS/m) and C_4 (0.26 dS/m). C_1 compost recorded lowest EC (0.19 dS/m).

Organic carbon content of matured composts ranged from 35.98% (C_2 compost) to 41.28% (C_1 compost) indicating the variation in decomposition due to difference in organic materials/additives in different treatments. C_1 and C_4 composts had marginally higher organic carbon status than C_2 compost. The trend of organic carbon status in different composting treatments was also indicated in C/N ratio at maturity, which varied from 11.96 (C_3 compost) to 58.97 (C_1 compost). In general, C/N ratio of C_2 and C_3 composts was low (11.96 and 12.15 respectively) than C_1 and C_4 (58.97 and 48.35 respectively). The variations in organic carbon revealed that the additives helped in faster decomposition of sugarcane trash. Microbial cultures used for composting in all the treatments uniformly are known for degradation of cellulose material more efficiently. But, they were more useful in C_2 and C_4 composts due to ideal C/N ratio than in C_1 and C_4. The findings in the present study concurred with the observation of Mathur et al. (1980) who reported that organic carbon content of raw materials during composting gets reduced with time. Shinde and Rote (1983) also reported that organic carbon content of compost decreased as time of composting progressed.

The compost C_2 recorded 2.96 and C_3 had 3.10% total N, as compared to low N (0.70%) in C_1. The treatment C_4 recorded slightly higher N content than treatment C_1 (0.79%). Addition of yeast sludge and incorporation of green manure like sunhemp along with poultry manure improved the N content in C_3 and C_2 matured composts respectively. Such improvement was due to higher microbial activity and high N status of composts at the beginning of decomposition. Proper blending of organic C source with biomass rich in organic N might have improved the nutrient composition of composts. Similar results were reported by Asija et al. (1984) and Srikanth (1997). C_4 recorded highest total P content (0.46%) while lowest total P content (0.15%) was recorded in C_1 compost followed by C_3 compost (0.28%). This might be due to the reduction in the total weight of the initial compost material or addition of rock phosphate, poultry manure, green manure. Yadav et al. (1992) reported that composting of sugarcane trash with Mussoorie rock phosphate and P-solubilizer increased the available phosphorus content and were further increased by inoculation with cellulolytic fungi. Total K content ranged from 0.41% in C_1, to 1.16% in C_2. The highest total potassium content (1.16%) was recorded at maturity in C_2 treatment, which may be due to addition of K rich poultry manure and green manure. This was followed by C_3 (0.95%) treatment, which contained yeast sludge as an additive. This confirms the beneficial role of high potassium content of the raw material used for composting, as observed in a similar study by Preethu (2004).

Lignin and cellulose contents were higher in C_1 and C_4 composts (21.45 and 28.21% and 20.84 and 27.79%) indicating lower extent of decomposition as compared to C_2 compost (18.06 and 21.15%). C_3 compost had mid values of lignin and cellulose per cent. Microbial succession ensures the break down of lignin and cellulose over a period of time. Although all the treatments received similar level of starting microbial cultures, lignin and cellulose decomposition was faster in C_2 and C_4 composts due to their N status than C_1 and C_4 composts, which favored faster microbial proliferation. Manual turning and shredding of sugarcane trash were also common to all the treatments. But, the benefit of larger number of micro sites for microbial decomposition due to turning and shredding was reaped in C_2 and C_3 due to faster microbial proliferation. The results have showed that microbial inoculation enhanced the degradation of lignin over a period of time. Further, the manual turning which enabled mechanical break down or shredding of the material there by exposing several micro sites for microbial decomposition. Vaccarrino et al. (1987) recorded reduced lignin content, attributing it to weakening of lignin structure over a period of time due to decomposition. The cellulose is a preferred source of organic carbon for microbes compared to lignin. Moreover, incorporation of cow dung hastens cellulose decomposition though cow dung itself is a source of cellulose. This may be the reason for general decrease in cellulose content with time.

Yield Parameters and Yield of Green Chilli

The data on yield parameters and yield of green chilli per hectare are presented in Table 2. In general,

Table 2. Yield and yield parameters of green chilli as influenced by various treatments. C_1 : Sugarcane trash (94%), C_2 : Sugarcane trash (44%) + Green manure (25%) + Poultry manure (25%), C_3 : Sugarcane trash (44%) ++ Yeast sludge (50%), C_4 : Sugarcane trash (89%) + Rock phosphate (5%), FYM : Farm yard manure, CF : Chemical fertilizer, NS : Non-significant.

Treatments	Number of fruits per plant	Fruit length (cm)	Fruit girth (cm)	Green chilli yield (q/ha)
T_1 : FYM on N basis	92.2	10.22	2.67	95.61
T_2 : C_1 on N basis	81.4	9.45	2.55	84.44
T_3 : C_2 on N basis	98.7	10.75	2.71	102.39
T_4 : C_3 on N basis	96.1	10.44	2.62	99.69
T_5 : C_4 on N basis	86.8	9.87	2.58	90.08
T_6 : 50% N through FYM + 50% N through CF	114.0	11.83	2.82	118.22
T_7 : 50% N through C_1 + 50% N through CF	103.7	11.20	2.75	107.57
T_8 : 50% N through C_2 + 50% N through CF	121.7	12.38	2.92	126.27
T_9 : 50% N through C_3 + 50% N through CF	116.7	12.27	2.88	121.05
T_{10} : 50% N through C_4 + 50% N through CF	107.2	11.55	2.79	111.17
SE ±	4.3	0.47	0.09	4.52
CD at 5%	12.9	1.40	NS	13.45

sole manure treatments recorded lower number of fruits per plant (81.4 to 98.7) than treatments receiving N through manures and fertilizers (103.7 to 121.7). T_2 recorded minimum number of fruits per plant (81.4). Among remaining treatments T_8 recorded maximum number of fruits per plant (121.7) and it was at par with T_6 and T_9 (114.0 and 116.7). T_8 recorded 28 fruits more than control and 40 fruits more than T_2 but was on par with T_9. Except T_8 and T_9, all the treatments receiving N through manures and fertilizer recorded at par values. Similarly among sole manuring treatments, all the treatments recorded statistically similar number of fruits per plant except T_2 and T_5, whose harvested fruits per plant was significantly less than other treatments.

Fruit length (cm) of chilli was significantly influenced by various treatments. The maximum fruit length (12.38 cm) was obtained with T_8 and was found to be at par with T_9, T_6, T_{10} and T_7. While the lowest fruit length was obtained with T_2 (9.45 cm). Fruit girth of chilli did not differ significantly due to various treatments. However, maximum fruit girth (2.92 cm) was found in T_8 and lowest fruit girth (2.55 cm) was recorded with T_2.

Total green chilli fruit yield per hectare was significantly influenced by various treatments. The highest green chilli fruit yield was recorded with T_8 (126.27 q/ha) and was at par with T_9 (121.05 q/ha) and T_6 (118.22 q/ha), while the lowest chilli fruit yield was observed in T_2 (84.44 q/ha). This could be attributed to the adequate supply of nutrients by the application of organic manures like poultry manure, green manure and yeast sludge through enriched compost. These organic manures increased the availability of both native and applied nutrients in soil and their uptake by crop. In addition to release of plant nutrients from the organic manures, the organic acids formed during the process of decomposition also help to solubilize insoluble nutrients to increase their availability in soil and increase fertilizer use efficiency. Increase in fruit yield with organic manures is in conformity with the findings of Mehta and Daftardar (1984), Eriksen et al. (1999) and Navindu Gupta et al. (2002).

References

Asija A. K., R. P. Pareek, R. A. Singhania and S. Singh. 1984. Effect of method of preparation and enrichment on the quality of manure. *J. Indian Soc. Soil Sci.* 32 : 323—329.

Eriksen G. N., J. C. Frank and A. B. German. 1999. Soil nitrogen dynamics and maize production in municipal solid waste amendment soil. *Agron. J.* 91 : 1009—1016

Mathur B. S., A. K. Sarkar and B. Mishra. 1980. Release of nitrogen and phosphorus from compost charged with rock phosphate. *J. Indian Soc. Soil Sci.* 28 : 206—216.

Mehta S. A. and S. Y. Daftardar. 1984. Actinomycetes occurring in soil applied with compost. *Soil Sci. Pl. Nut.* 28 : 303—313.

Navindu Gupta, P. R. Kumar, N. Chand, S. Kumar and H. C. Joshi. 2002. Potential use of MSW compost and sewage sludge in wheat. Extended summaries. Vol. 1. Pp. 1168—1169. *In 2nd Int. Agron. Cong.* 26–30 Nov 2002, New Delhi, India.

Preethu D. C. 2004. *Evaluation of quality, maturity indices and agronomic efficiency of compost prepared using coffee husk and pulp.* M.Sc. (Ag) thesis. Univ. Agric. Sci., Bangalore, India.

Shinde B. N. and B. P. Rote. 1983. Use of rock phosphate and microbial culture for the composting of sugar cane trash by heap method. *Indian J. Agric. Chem.* 15 : 147—154.

Srikanth K. 1997. *Enrichment of compost and its effect on soil properties and crop growth.* Ph. D. thesis. Univ. Agric. Sci., GKVK, Bangalore, India.

Vaccarrino C., R. B. Lutro, M. M. Triposo, E. Belloceo, G. Longana and R. Patane. 1987. Effect of SO_2, NaOH and Na_2CO_3 pretreatment on the degradability and cellulose digestibility of grape mare. *Biol. Wastes* 20 : 79—88.

Yadav K., D. Prasad, C. R. Prasad and K. Mandal. 1992. Effect of enriched compost and *Rhizobium* culture on the yield of green gram. *J. Indian Soc. Soil Sci.* 40 : 71—75.