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Effect of different methods of *Chromolaena odorata* compost preparation on the growth and yield of cucumber (*Cucumis sativa*) in southwestern Nigeria

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ABSTRACT

Objectives: To determine the best method of compost preparation for optimal growth and fruit yield of cucumber (*Cucumis sativa*).

Methodology and results: Composts were prepared using *Chromolaena odorata* and other organic materials under three methods of composting, i.e. polyethylene sheet, plastic drum and pit methods. After composting, 2.5 kg. ha^{-1} of compost made through each of the composting methods and their combinations were applied to cucumber plants. The experiment was arranged in a randomized complete block design with 3 replications. Chemical compositions of the composts and growth and yield attributes of cucumber were assessed. The results showed that the various composting methods had significant effects on the chemical compositions of the *Chromolaena* composts. The application of compost prepared using drum significantly increased the vine length, number of leaves, fruit weight, total number of fruits and fruit yield of cucumber above the control plants in which no compost was applied.

Conclusion and application of findings: The nutrient content of the composts is greatly influenced by the composting method. The nutrient compositions of the compost, and the growth and yield of cucumber were significantly improved by the composting using the drum, and therefore this method is adjudged to be the best.

Key words: *Chromolaena odorata*, composting methods, nutrient content, cucumber, yield.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a member of the cucurbitaceae family that originated from Asia. It is now cultivated worldwide. In tropical Africa, it can be found in most city markets and including supermarkets (Grubben & Denton, 2004; Robinson & Decker-Waters, 1997).

The main use of cucumber is for the immature fruits in salads. Fruits are sliced or cut into pieces and served with vinegar or a dressing, on their own or mixed with other vegetables. The seed, young leaves and cooked stem are also consumed in some parts of Asia. It is highly nutritious and the edible portion is about 85% when peeled. Seed kernels contain approximately 42% oil and 42% protein (Holland *et al*., 1991; Rubatzky & Yamaguchi, 1997; Grubben & Denton, 2004.).

Chromolaena odorata is a perennial succulent or semi-woody shrub belonging to the Asteraceae family. This plant species is native to

central and South America and it is now distributed throughout Africa and tropical Asia (Muniappan & Marutani, 1991). In traditional medicine, a decoction of the leaf is used as a cough remedy and as an ingredient with lemon grass and guava for the treatment of malaria. The juice processed out of the crushed leaves is applied to cuts to stop bleeding. *C. odorata* shoot contains 1.26% Nitrogen, 0.67% Phosphorus, 1.08% Potassium, 2.33% Calcium and 0.005% Magnesium (Olabode *et al*., 2007). *C. odorata* grows in wild bushes without any organized cultivation. Indeed it is considered to be a weed in most farming systems.

Composting is the biological decomposition of organic materials into a humus-like substance called compost. The process occurs naturally, but can be accelerated and improved by controlling environmental factors. If raw wastes are put directly into the soil, the decomposition processes will rob the soil of nitrogen, an important nutrient for plants. Soil incorporation of plant materials is one method of composting, but it requires leaving the area fallow. Finished compost from a pile of composting materials is typically a more uniform product with a better balance of nutrients. It can be used throughout the growing season in many different types of application. In addition, a properly controlled composting environment can ensure production of high temperature needed for killing weed seeds, diseased plant tissue and pathogenic organisms (Gomez-Guillamon, 1996).

The objective of this study was to determine the best method of compost preparation, nutrient compositions of the composts and its effect on the growth and yield of cucumber.

MATERIALS AND METHODS

Experimental site: The experiments were conducted on an alfisol soil at the Teaching and Research farm of the Faculty of Agricultural Sciences, Ladoke Akintola University of Technology, Ogbomoso, within the guinea savannah agro-ecological zone of Nigeria. Ogbomoso is located at 8°10'N and 4°10'E and the climate is cold and dry from November to March and warm and moist from April to October. The maximum and minimum temperature is 33 and 28 °C, respectively. The humidity of this area is high (about 74%) all year round except in January when dry wind blows from the north. Annual rainfall is over 1000mm (Olaniyi, 2006).

Compost preparation and assay: The materials used for the compost were dried *Chromolaena odorata* plant matter (10kg), well cured poultry manure (5kg), woodash (2kg), soil (5kg) and 5 litres of water. Woodash, loam soil and water were included to reduce pH, reduce loss of volatile nitrogen and moisten and aid the decomposition processes (Olaniyi & Akanbi, 2008). These were air dried, pounded and sieved to remove large particles.

In order to determine the effect of composting methods on the nutrient compositions of compost, the composting materials were subjected to three different compost preparation methods, namely plastic drum, polyethylene sheet and pit methods. The composting materials were arranged in two layers and spread evenly in either plastic drum, polyethylene sheet and pit composting methods. Turning and watering of the composting materials in each composting method was carried out at 14 and 21 days interval(Olaniyi and Akanbi, 2008).

The *Chromolaena* compost from each composting methods after 60 days of composting were bulked, air-dried and ground to pass through a 2mm x 2mm sieve for chemical analysis determination. Available phosphorus and total nitrogen were determined separately by Technicon A All method (Technicon, 1975) while exchangeable Ca, Mg, K, Fe and Zn were quantified using an atomic absorption spectrophotomer (IITA, 1982).

Effect of compost on cucumber performance: Cucumber (*Cucumis sativa* L.) seeds were obtained from the seed company, Kano, Nigeria and sown directly into a well prepared 2m x 1m beds.

Eight raised beds representing eight compost treatment combinations in three replicates were made and the treatments were randomly assigned to beds within each block to fit into a randomized complete block design. The composts derived from each composting methods were used as organic fertilizer and applied to the soil by bound method at 3 weeks after sowing. The treatments included; a control, 2.5 t. ha^{-1} of compost derived from each of plastic drum, polyethylene sheet and pit composting methods and their various combinations (1.25 t. polyethylene x 1.25 t. ha^{-1} drum, 1.25 t. polyethylene x 1.25 t. ha^{-1} pit, 1.25 t. drum x 1.25 t. ha^{-1} pit, and 0.83 t. Polyethylene x 0.83

t. drum x 0.83 t. ha^{-1} pit). These were evenly distributed to their respective plots. Weeding was done manually at 3 weeks intervals and insect pests controlled by applying neem extract at the rate of 2ml per litre of water applied at 2 week intervals.

Plant growth parameters such as plant height and number of leaves were assessed at two week intervals. The number of fruits, fruit diameter and; fruit yield were assessed at harvest.

All data were subjected to analysis of variance using SAS-GLM (SAS, 1989) procedure and means separated where applicable using the Least Significant Difference at 5% probability level.

RESULTS AND DISCUSSION

Chemical compositions of the matured compost The nutrient compositions of the *C. odorata* composts were significantly (P≤0.05) influenced by the different composting methods. Compost from the drum method, closely followed by the compost from polyethylene sheet method had the highest nutrient element content (nitrogen, phosphorus, potassium, magnesium, calcium, iron and Zn) while the least values were in compost from pit method (Table 1). The higher quality of compost prepared by the drum method might be due to the better environment provided for the micro-organisms by combining organic materials, air, moisture and temperature to their best advantage (Ngeze, 1992). Also loses of nutrients through leakages could have reduced nutrient loss from the compost prepared from drum composting method.

Table 1: Chemical compositions of compost as affected by composting methods.

Parameter	**Chemical**						
Composting methods	%N	%P	%Ca	%Mg	%K	ppmFe	ppmZn
Plastic drum	0.82	1.83	0.94	0.52	0.39	1,813.84	390.86
Polyethylene sheet	0.71	1.72	0.88	0.50	0.38	1,609.62	371.15
Pit	0.68	1.65	0.82	0.49	0.37	1,415.50	315.38
LSD (0.05)							
Treatments	0.02	0.01	0.01	0.01	0.01	1.60	0.60

Table 2: Effect of compost on growth parameters of cucumber as affected by composting methods.

Composting method and rate(t.ha^{-1})	**Vine Length (cm** Weeks after planting			**Number of leaves** Weeks after planting		
	2	4	6	2	4	6
Control	10.6	21.2	24.7	9.9	13.9	16.1
Polyethylene sheet	16.9	30.5	33.4	14.1	18.6	20.6
Pit	13.0	29.4	32.2	14.5	17.8	19.6
Drum	18.5	34.5	33.5	11.9	22.5	22.3
50%poly+50% drum	16.8	29.8	33.3	14.0	20.4	21.5
50%poly+50%pit	16.5	24.5	27.5	13.4	16.0	17.1
50%drum+50%pit	15.0	27.5	33.4	12.2	17.1	18.6
33.3%poly+33.3pit+33.3drum	15.0	28.5	33.0	12.2	17.6	19.4
LSD (0.05)						
Treatments	1.27	0.9	0.7	0.6	0.9	0.7

Plant growth parameters: The vine length and the number of leaves of cucumber plants were significantly (P≤0.05) influenced by compost preparation method. The highest vine length and number of leaves were recorded from plants treated with compost from the drum method, followed closely by compost from combined or mixing part of compost from polyethylene and drum composting methods (table 2). This result reconfirmed the findings of Olaniyi and Akanbi (2008), and Akanbi et al (2005) who reported that compost promotes the growth parameters of cabbage and tomato, respectively. The highest growth parameters obtained from compost derived from drum method indicates it provides more nutrients to the cucumber

plant than compost from other methods. The superiority of compost derived from drum method over compost from other methods might also be due to the less leakage, reduced nutrient loss and better decomposition during composting (Ngeze, 1998).

Yield and yield components: Except for fruit length, the yield components were significantly influenced by the composting method. The best fruit weight per plant and total or marketable fruit yield of cucumber were obtained from plants treated with compost derived from drum method while the least marketable yield was from the control treatment (without compost). The results show that the application of compost irrespective of the composting method improves yield and yield components of cucumber, as reported by others (Akanbi *et al*., 2005; Olaniyi & Akanbi, 2008).

CONCLUSION

Generally, this study revealed that different composting methods significantly influenced the compost nutritive values and cucumber performance. The composting method that resulted in the highest fruit yield performance of cucumber was the drum method. Since the drum composting method improved nutrient contents of compost and more durable than other methods, it can be used to replace the pit method commonly used by farmers.

Table 3: Effect of compost on the yield and yield components of cucumber as affected by different composting methods.

Composting method and rate(t.ha^{-1})	Numbers of fruits/plant	Fruit length (cm)	Diameter (cm)	Fruit weight/plant (g)	Total fruit/yield (t.ha^{-1})
Control	1.4	14.0	3.7	193.8	0.49
Polyethylene	3.5	14.0	4	825	2.06
Pit	2.4	13.3	40	453	1.13
Drum	4.4	14.9	4.9	1,070	2.68
50%poly+50% drum	4.0	14.0	4.2	858.0	2.15
50%poly+50%pit	2.4	13.8	3.8	441.7	1.10
50%drum+50%pit	2.5	13.6	3.9	464.2	1.16
33.3%poly+33.3pit+33.3drum	3.0	13.9	3.9	646.7	1.62
LSD (0.05)					
Treatme nts	0.80	NS	0.40	0.94	0.53

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