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The Growth and Tuber Yield of Cassava as Affected by Cassava Peel Compost Application

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Authors' contributions

This work was carried out in collaboration between all authors. Author ASA wrote the draft of the manuscript. Author WBA designed the study and managed the statistical analysis. Author OOS managed the literature searches and corrected the draft. Authors WAL and KKO edited the tables and references. All authors read and approved the final manuscript.

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ABSTRACT

This study was conducted to assess the effect of cassava peel compost rates on the growth and tuber yield of cassava. The treatments were prepared in six compost rates as: 0, 5, 10, 15, 20, and 25 t/ha respectively and they were applied to cassava and arranged in a randomized complete block design with three replications. Growth and yield parameters were taken from 4th weeks after planting till harvest. The data collected were subjected to analysis of variance (ANOVA) at 5% level of probability and the resulted means were separated using Duncan Multiple Range. The results showed significance differences among the treatments applied. Application of 10 t/ha compost significantly produced taller plants at all growing stages and also produced higher leaf number at 6,8 and 12 weeks after planting. Furthermore the highest tuber weight was observed from addition of 15 t/ha compost. It is concluded that compost application improves the growth and tuber yield of cassava when applied at range 10 and 15 t/ha.

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Keywords: Cassava; compost; tuber yield; fertilizer.

1. INTRODUCTION

Cassava (*Manihot esculenta*) belongs to the family euphorbiaceae and one of the most important tuber crops in the world. It is grown in tropical and sub tropical areas of the world and was originated in tropical America and later introduced to Africa in the Congo basin by the Portuguese [1]. It is rich in carbohydrate, calcium, vitamins B and C as well as essential minerals. These nutrients vary according to variety, age of harvesting, soil condition and climate [2]. Cassava is made into various food forms such as gari (toasted granules), chips/flour, fermented pastes or fresh root among others which are major important staple food for rural and urban households in Nigeria. Cassava is also useful as a raw material in the brewing, baking and livestock industries [3].

Nigeria is the largest producer of cassava in the world [4] with about 45 million metric tonnes and its cassava transformation is the most advanced in Africa [5]. Cassava is grown throughout the tropics and could be regarded as the most important root crop, in terms of area cultivated and total production [6]. Cassava is a major food crop in Nigeria and it is strategically valued for its role in food security, poverty alleviation and as a source of raw materials for agro-allied industries in Nigeria [7,8]. It also has a huge potential for the export market which made it a crop that attracts foreign exchange [9].

In urban areas, cassava consumption of poor households is double that of rich households. In rural areas, poor households consumption of cassava is triple that of non-poor households. When dried, cassava is both conservable and transportable over long distances [4].

One major problem facing the production of cassava is poor soil fertility of the Saharan soil. This is as a result of continuous cultivation of farm land over a long period of time. This has been a pattern of farmlands practices especially in the tropics. The only way out is the application of fertilizers either as organic or inorganic. Inorganic fertilizers are always out of reach by the farmers due to high price as many farmers cannot afford the cost of inorganic fertilizers in addition to the scarcity experienced in the country. Organic fertilizer has been found as the most suitable alternative because when applied to soil it releases nutrient into the soil at a steady rate and improve the soil structure, also help to improve the activities of micro organisms living in the soil. It adds organic matter into the soil there by increasing the fertility and percolation of the soil which renders the soil more penetrable for the tuber leading to increase in the yield of the cassava tubers. The study was therefore set up to investigate the effect of cassava based compost on the growth and development of cassava.

2. MATERIALS AND METHODS

The study was conducted at the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria located at Latitude $8,10^{N}$ and Longitude $4,10^{E}$ with 420 m above sea level. It has a bimodal rainfall pattern between 1150 mm and 1250 mm per year. The region has the minimum temperature of 28℃ and maximum of 33℃ with high humidity of about 74%. The soil is sandy loamy with $_{P}H$ of 5.81, total N of 0.26 gkg^{-1} and organic carbon of 2.90 gkg^{-1} organic matter of 2.90 gkg-1, available P, 7.40 gkg-1, available K 0.26 kg-1 exchangeable Ca, 3.11 cmolkg-1, exchangeable Mg 0.59 cmolkg-1. The compost was prepared from cassava peel, poultry manure and grasses. It was mixed in a ratio of 3:1:1 using a pit composting method as outlined by Akanbi [10] (Table 1).

Table 1. Chemical properties of matured cassava peel compost

Properties	Matured compost
%N	6.60
%P	10.20
%K	1.82
%Ca	2.80
%Mg	0.56
%Fe	320.80
%Zn	98.50
%Cu	16.80

The experimental plots were ploughed, harrowed and were laid out in a randomized complete block design with three replications. The plot size was 9 m x 6 m (54 m^2) with a total of 300 heap per plot spaced at 1 m x 1 m. Planting was done and later weeding was done by the use of hoe at two weeks after planting and when necessary. The compost manure was applied two weeks before planting at the rates of 0, 5, 10, 15, 20 and 25 t/ha while the plants were allowed to grow

and develop to maturity. Four plants per plot were tagged for observations and measurement starting from 4 weeks after planting and fortnightly till 12 weeks after planting. Growth and yield parameters were taken which were: Number of leaves, Plant height, Number of branches, height at branching, Number of tuber per plant, Length of tuber, Width of tuber and their weights.

The data obtained were subjected to analysis of variance (ANOVA) at 5% level of probability and the means were separated using Duncan Multiple Range Test (DMRT).

3. RESULTS

Cassava peel compost application has significant effects on the vegetative growth parameters of cassava (Tables 2, 3, 4). Plant height showed a significant difference at all growth stages where application of 10 t/ha compost produced taller plants and the least from the control plant. The highest number of leaves were produced from the addition of 10 t/ha compost at, 6, 8 and 12 weeks after planting while at 10 weeks after planting addition of 5 t/ha had the highest significant number of leaves followed by plants that received 10 and 15 t/ha compost (Table 2). Height at branching produced significant difference and application of 15 t/ha compost gave the highest value followed by 5 and 20 t/ha respectively while the rest of the treatments did not differ statistically. There was no significant difference among the number of branches produced by the cassava plant at all growth stages with the respect to compost applications (Table 3).

The yield parameters of cassava plants were also significantly affected by the compost application. The variance in the number of tuber per plant was significant and the plants subjected to 15 t/ha compost treatment performed best and the least from 5 and 0t/ha compost rate (Table 4). The length of tubers was also affected by the compost application and application of 20 t/ha compost had significant higher length which does not differ statistically from 10 and 15 t/ha compost application. Also width of the tuber was statistically highest from plants that received 20 and 10 t/ha compost and the least from the control. Application of 15 t/ha compost treatment produced the highest tuber weight which was significantly followed by 20 and 25 t/ha with the least weight from the control.

Table 2. Effect of cassava peel compost on the height of cassava plant at various growth stages

	4 wap	6 wap	8 wap	10 wap	12 wap
0 t/ha	7.1b	14.2c	25.1c	39.7b	51.7b
5 t/ha	10.2ab	18.9b	30.0bc	47.5ab	53.0b
10 t/ha	11.6a	22.4a	40.0a	52.5a	73.1a
15 t/ha	10.2ab	20.6ab	34.0ab	42.1ab	62.7ab
20 t/ha	9.9ab	19,0ab	31.1bc	47.7ab	55.6b
25 t/ha	8.2b	17.6b	30.1bc	43.8ab	56.5b

WAP = Week after planting, Values with different letters along column are significantly different using DMRT at 5% probability level

Table 3. Effect of cassava peel compost on number of leaves of cassava plant at various growth stages

Treatments	4 wap	6 wap	8 wap	10 wap	12 wap
0 t/ha	43.0a	40.0c	41.0c	50.1c	57.2c
5 t/ha	36.0a	42.7c	57.3b	87.7a	73.7b
10 t/ha	39.7a	61.7a	74.0a	77.0b	83.3a
15 t/ha	38.7a	33.7c	44.3c	70.7b	66.0bc
20 t/ha	23.3a	50.7b	62.3b	67.3ab	80.7a
25 t/ha	31.0a	59.3a	68.7ab	58.7bc	77.0b

WAP = Week after planting, Values with different letters along column are significantly different using DMRT at 5% probability level

Table 4. Effect of cassava peel compost on the height at branching and number of branches of cassava plant

Treatments	Height at branching	Branch number
0 t/ha	96.1b	3.0a
5 t/ha	106.4ab	3.1a
10 t/ha	98.6b	2.8a
15 t/ha	119.7a	2.8a
20 t/ha	106.5ab	3.1a
25 t/ha	93.0b	2.7a

Values with different letters along column are significantly different using DMRT at 5% probability level

Table 5. Effect of cassava peel compost on the yield parameters of cassava plant at harvest

Treatments	Weight of tuber(kg)	Length of tuber	Width of tuber	Number of tuber /plant
0 t/ha	4,8c	41.3b	11.6c	3.0b
5 t/ha	5.1bc	42.3b	14.7bc	3.0b
10 t/ha	6.7b	51.0a	28.2a	4.0ab
15 t/ha	8.2a	50.8a	19.6b	5.0a
20 t/ha	7.0ab	56.1a	34.5a	4.0ab
25 t/ha	7.3ab	48.2ab	21.2b	4.0ab

Values with different letters along column are significantly different using DMRT at 5% probability level

4. DISCUSSION

Cassava peel compost application influenced the growth and yield of cassava and the results are statistically better than the control plants. This supports the work of [11] that the use of compost has a great potential for improving soil productivity and crop yield through improvement of the physical, chemical and microbiological properties of the soil as well as nutrient supply. Application of 10 t/ha compost produced the highest plant height and leaves number. This confirms the work of [12], that compost releases nutrients such as N and makes available to crop need in a synchronized manner throughout the growing period which help to improve the physiological activities such as cell division that improve the plant growth. Compost rate of 15 t/ha produced the highest number of tuber. This is because compost ensured long time supply of nutrient which benefited cassava that stayed in the field due to its slow release of nutrients, also the compost application improved soil water holding capacity and also reduced evaporation by acting as soil temperature buffer making sufficient moisture available to growing tubers [13].

5. CONCLUSION

The application of compost improves the tuber yield of cassava which can translate to an increase in income and standard of living of farmers who engaged in cassava production.

It is therefore recommended from the study that compost application rates of 10 and 15 t/ha is adequate for the optimum growth and tuber yield of cassava.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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