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Effect of Organic and Inorganic Fertilizer on the Proximate Content of Seedlings of Five Cassava Varieties

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Abstract
Cassava is the largest source of food carbohydrate in the tropics. A new hybrid of cassava is the yellow variety with some new varieties from International Institute of Tropical Agriculture. The high preference served around the consumer is due to its high yield and high concentration of B-carotene, a precursor of vitamin A. It also resistant to pests and drought, the yellow variety attracts a lot of investigation towards their stabilization. The study therefore, investigated the effect of organic and inorganic fertilizer on the proximate content of the young seedling of three varieties of cassava. The selected varieties were IITA-TMS-IBA 30572, IITA-TMS-IBA 070593, and IITA-TMS-TMEB419. Young seedlings were raised in 9 cm Petri dish in the laboratory. Sprouting seeds were planted on sterile sandy loamy soil. The growth promoters used were Inorganic fertilizer (NPK) and Organic fertilizer (cow dung and compost). Proximate analysis including moisture content, dry matter, fat, ash content, crude fiber, crude protein, total sugar, starch and total cyanide. All the proximate components investigated in the seedlings varied. Seedlings treated with NPK showed high moisture content in all varieties. Compost manure enhances all the component of the proximate analysis in the three varieties investigated. Organic fertilizer enhanced the proximate component in the root of IITA-TMS-IBA 070593 only.

Keywords: Cassava varieties,Cassava seeds ,proximate contents,organic Fertilizers,inorganic fertlizer.

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Introduction

Cassava is the third largest source of food carbohydrates in the tropics, after rice and maize. Cassava is a major staple food in the developing world, providing a basic diet for over half a billion people (Fauquet and Fargette, 1990). It is one of the most drought-tolerant crops, capable of growing on marginal soils (FAO, 1995). A new hybrid of cassava is the yellow cassava which has three varieties, UMUCASS 36, UMUCASS 37, and UMUCASS 38, being developed by International Institute of Tropical Agriculture (IITA) in Nigeria for their high concentrations of β-carotene, a precursor of Vitamin A. The new yellow varieties have high yields and are resistant to many pests and diseases and do not suffer during droughts (Egesi *et al.*, 2006).In the present study, increase in proximate composition of this cassava variety may be ascribed to the various levels of fertilizers used. This assertion is in accordance with the submission of Shafeek *et al.* (2012) who reported that application of manure to the cassava plant caused an increase of the nutritional elements in rooting zone. Consequently more nutrients were absorbed to enhance the growth of the plant which in return improve the nutritional compositions of both the leaves and root of the cassava. Also, moisture has been reported to be an important parameter in the preservation of cassava flour; very high levels greater than 14% allow for microbial growth and therefore low levels are favourable and give relatively long shelf life (Monday *et al.,* 2017**;** Edet *et al.,* 2017**)**.

This study is therefore aimed at improving the growth and development of young seedlings of fine varieties of new and stable hybrids of cassava seedling raised from their seeds. This is monitored through their proximate contents. This is with the view of having more stem for multiplication processes for repetitive propagation spanning 3-4 planting seasons.

Materials and Methods.

Seed collection

The seeds of five varieties of cassava (*Manihot esculenta* Krantz.) were obtained from cassava breeding unit of International Institute of Tropical Agriculture Ibadan, Oyo State. The varieties were IITA-TMS-IBA0110368, IITA-TMS-IBA980505, IITA-TMS-IBA30572, IITA-TMS-IBA070593, and IITA-TMS-TMEB419, This research was carried out at the laboratory and Screen house of the Department of Pure and Applied Botany, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

Seed germination test

Twenty (20) seeds were plated in 9cm sterilized Petri-dish containing a what-man filter paper already moistened with water and arranged in three replicates using complete randomized design (CRD) method in the Department of Pure and Applied Botany Laboratory (Agboola *et al.,* 2004).

Treatments

The treatments used on seedlings were organic manure (cow dung {CD} and compost) and inorganic manure: N.P.K. (15-15-15) chemical and proximate parameters collected.

Proximate analysis

Moisture contents, fat, Ash, Crude fiber, Crude protein, Carbohydrate of the selected seedlings of cassava varieties was done, based on the vegetative parameters for plant with high record of performance which reduce the number of treatment of plant taken for proximate analysis from six (6) to three (3).

Determination of moisture content

The vacuum method was used in determining the moisture content of the samples. The vacuum method was used because the samples do not contain volatile non-water components (Hedge and Hofreter, 1962).

Calculation

The percentage moisture content in the samples was calculated using the formula below:

$$\% \text{ moisture} = \frac{\text{weight of moisture x 100}}{\text{weight of sample}}$$

Crude protein determination

The method of Hedge and Hofreter (1962) was,

Crude protein =% total crude protein - % crude protein in filter paper residue

Crude fibre determination

The crude fibre content was determine using the A.O.A.C., 2005 method

$$\% \text{ fibre} = \frac{\text{Difference in weighing x 100}}{\text{weigh of sample (gm)}}$$

Determination of total ash

The determination of inorganic substances as residue after ignition of food samples at specific temperatures is the basis of ashing. This was determined using the method of A.O.A.C., (2005).

Calculation

$$\% \text{ Ash} = \frac{\text{Ash weight (gm)x 100}}{\text{Sample weight (gm)}}$$

Determination of total lipid by Soxhlet Method

Calculation

$$\% \text{ Fat} = \frac{\text{Weight of fat}}{\text{Weight of sample x 100}}$$

Determination of total carbohydrate (Anthrone method)

The total carbohydrate content was measured by hydrolyzing the polysaccharides into simple sugars by acid hydrolysis and estimating the resultant monosaccharides, according to the method of (Hedge and Hofreter, 1962).

Calculation

Amount of carbohydrate present in 100mg of the sample = (mg of glucose / volume of test sample x 100).

Statistical analysis

Data collected were expressed as means ± standard deviation. The means were compared by Analysis of Variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (DMRT). Level of significance was set at $P<0.05$.

Results

Effect different Pre-sowing treatments on emergence of seeds of three varieties of cassava

Table 1 shows the effect of different pre-germination treatments on emergence of five cassava variety seeds. The treatments showed significant ($p< 0.05$) effects on germination of seeds of all varieties tested. On general observation, germination in seeds of all cassava varieties treated with normal water IITA –TMS-IBA30572 ($0.88±0.11^a$), IITA –TMS-IBA30572 ($0.46±0.073^a$), IITA –TMS-TMEB419 ($1.02±0.15^a$), were significantly higher than the values of germination in the cassava varieties treated with warm water, boiling water and concentrated sulphuric acid

Effects of different manures on proximate composition of IITA-TMS-IBA30572 root

The effect of different manures on the proximate content of IITA-TMS-IBA30572 root is as shown in fig 1, there was significant differences in the proximate content. Dry matter (36.39 mg/100g), fat (0.27 mg/100g), ash (1.24 mg/100g), crude fibre (2.42 mg/100g), crude protein (2.60 mg/100g), carbohydrate (29.87 mg/100g), starch (54.97 mg/100g) and sugar (1.20 mg/100g) were significantly ($P < 0.05$) higher in IITA-TMS-IBA30572 treated with 0.5g compost manure. Also, moisture content (73.49 mg/100g) was significantly higher ($P < 0.05$) in the cassava treated with 0.2g NPK was recorded in the IITA-TMS-IBA30572 treated 0.5g CD.

Effect of different manures on proximate contents in root **of IITA-TMS-IBA070593**

Results revealed no significant difference ($P > 0.05$) in the amount of carbohydrate, starch and cyanide content of seedlings treated with 0.5 compost manure, 0.2g NPK and 0.5g cow dung (CD). The treatments showed significant ($P < 0.05$) effects on moisture, dry matter, fat, ash, crude fibre and sugar. Dry matter (30.84 mg/100g), ash (0.99 mg/100g) and crude protein (2.04 mg/100g) were significantly higher ($P < 0.05$) in IITA-TMS-IBA070593 treated with 0.2g NPK as well as fat (0.19 mg/100g and 0.22 mg/100g) and sugar (0.74 mg/100g and 0.75 mg/100g) in the root of the cassava treated with 0.5g CD and 0.2g NPK (Fig. 2).

Effect of different types of manures on proximate content of IITA-TMS-TMEB419

There was significant difference ($P < 0.05$) on the proximate content of the cassava treated with the manures (Fig 3), Results showed that dry matter (34.92), fat (0.24), ash (1.09), crude fibre (2.14 mg/100g), crude protein (2.27 mg/100g), carbohydrate (29.18 mg/100g), starch (54.14 mg/100g) and sugar (0.45 mg/100g) were significantly higher ($P < 0.05$) in the root of the cassava treated with 0.05 compost manure. Moisture (78.08 mg/100g) and cyanide (8.21 mg/100g) were significantly higher ($P < 0.05$) in the root of IITA-TMS-TMEB419 treated 0.2g NPK compared with the parameters in other treatments under study

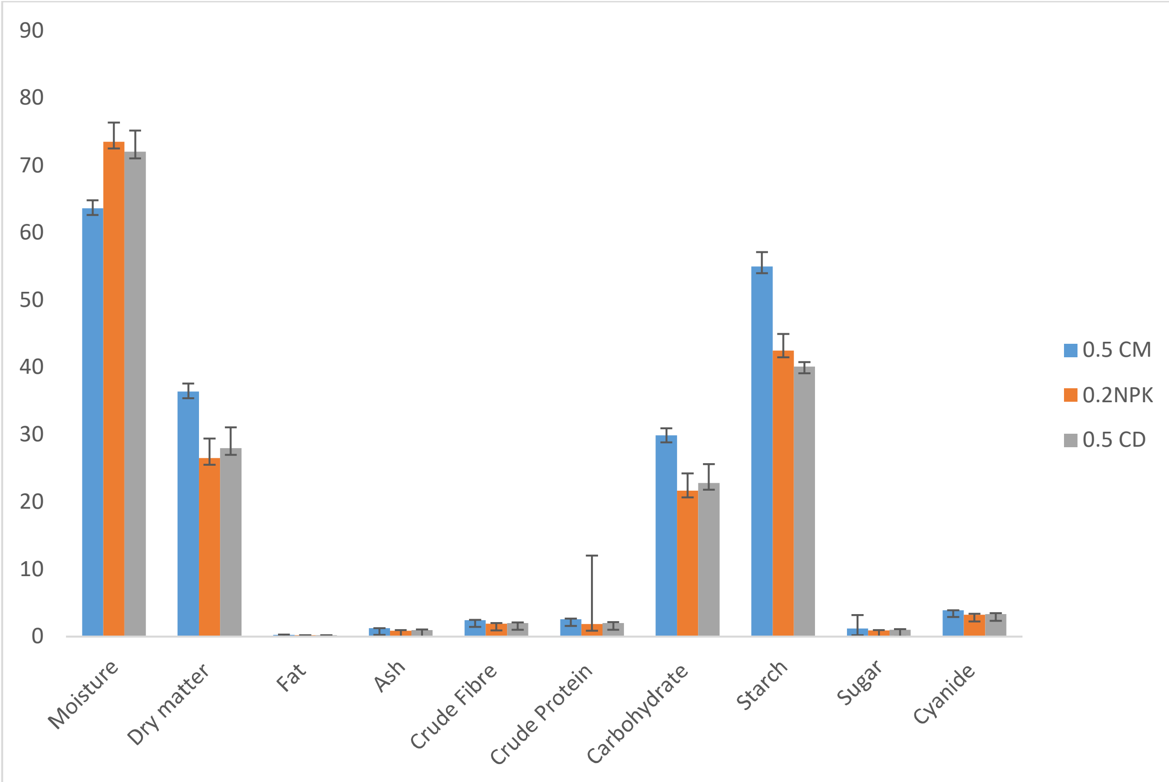

Fig 1: Proximate content in the root of IITA-TMS-IBA30572

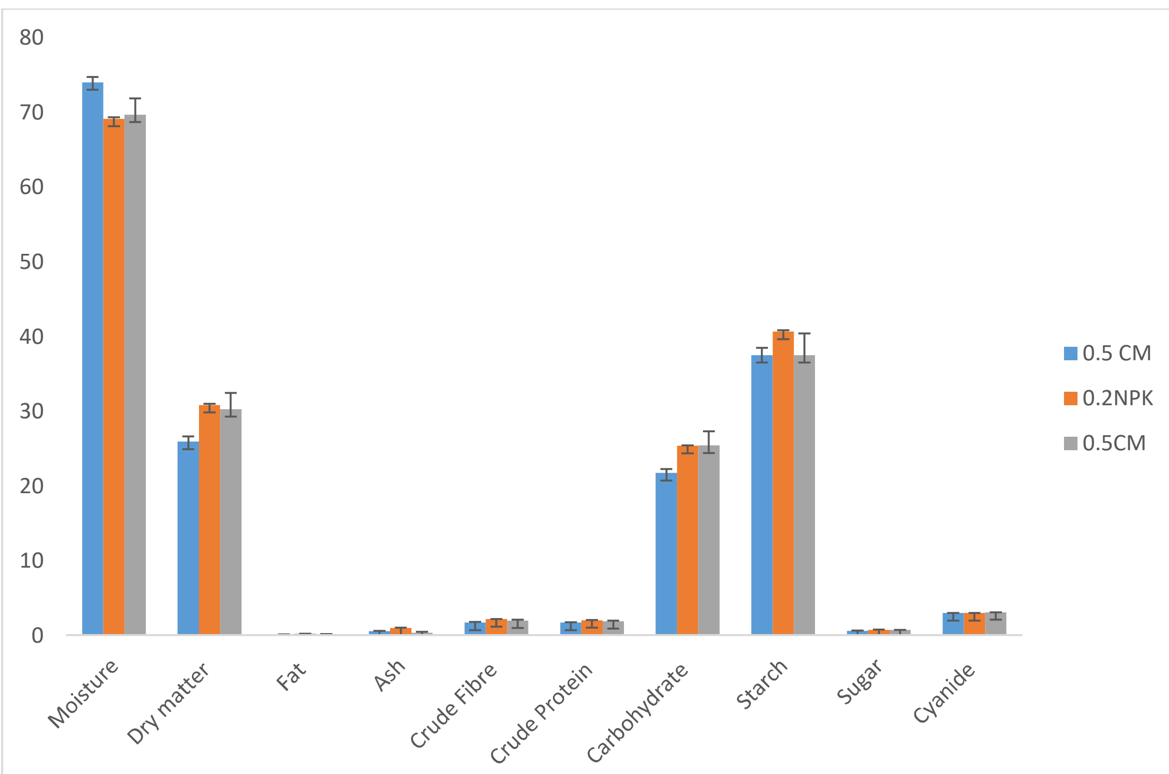

Fig 2: Proximate content in the root of IITA-TMS-IBA070593

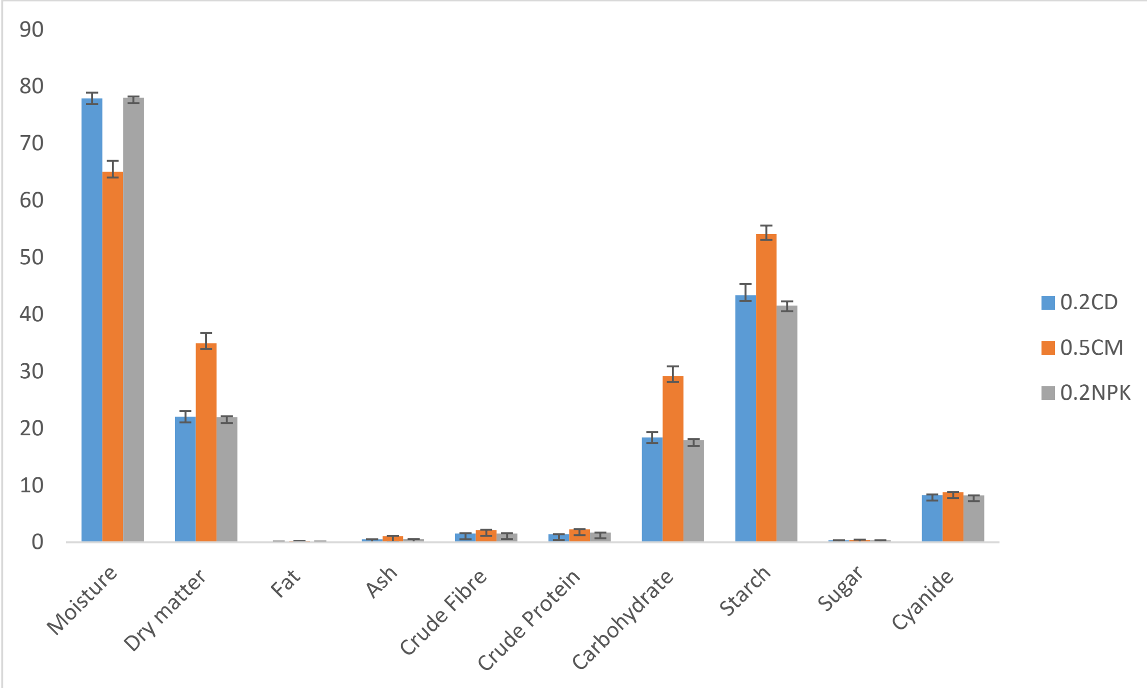

Fig 3: Proximate content in the root of IITA-TMS-TMEB419

Table 1: Effect different Pre-sowing treatments on emergence of seeds of all varieties of cassava

Pre germination treatments	**Emergency of seeds in the Varieties**		
	IITA –TMS-IBA30572	**IITA –TMS-IBA070593**	**IITA –TMS-TMEB419**
Normal water	0.88±0.11[a]	0.46±0.07[a]	1.02±0.15[a]
Hot water	0.00±0.00[b]	0.10±0.05[b]	0.13±0.05[b]
Boiling water	0.00±0.00[b]	0.00±0.00[b]	0.00±0.00[b]
Concentrated sulphuric acid	0.00±0.00[b]	0.00±0.00[b]	0.00±0.00[b]

Means ± SE followed by different superscripts across columns are significantly different at $p < 0.05$ using Duncan's Multiple Range Test DMRT

Discussion

In the present study, increase in proximate composition of this cassava variety may be ascribed to the various levels of fertilizers levels used. This assertion is in accordance with the submission of Shafeek *et al.* (2012) who reported after series of research, that addition of manure to the cassava plant caused an increase of the nutritional elements in rooting zone; consequently more nutrients were absorbed to enhance the growth of the plant which in return improved the nutritional compositions of both the leaves and root of the cassava. High moisture content (MO) recorded in the root of cassava treated with 0.2 CD, 0.5CM and 0.2 NPK across the 3 cassava varieties investigated suggests that the treatment could influence maximum nutritional potential of the cassava at the growth phases studied. Also, (MO) has been reported to be an important parameter in the preservation of cassava flour; very high levels greater than 14% allow for microbial growth and therefore low levels are favourable and give relatively long shelf life (Monday *et al.,* 2017**;** Edet *et al.,* 2017**)**.

The study also showed low and significant differences in amount of fat, crude fibre and crude protein content. The difference observed in the quantity of parameters amongst the studied variety may be attributed to varietal differences or deferential responses of the proximate content of the cassava to the treatments. In addition, Low fat content recorded in this study, may indicate that these cassava varieties characterized low fat content. These results correspond to that reported in findings of Somendrika *et al*. (2017). The ash content is used as a benchmark to determine the mineral constituent (Adepoju *et al.,* 2010; Monday *et al.,* 2017). High amount of carbohydrate recorded in this study may indicate those cassava roots are rich in starch or sugar, as an important source of vitality in the animal feed stuff. On the general note, results of this study base on the concentrations of proximate content in these cassava varieties suggest the relevance of carbohydrate, moisture, crude fibre, ash and protein as essential nutrients for energy production, transport of metabolic product, and for repair of lost cells and tissues (Monday *et al.,* 2017).This investigation showed that aside 0.5g NPK, 0.2g Cow dung improved agronomic parameters of the cassava varieties studied. The study revealed that organic fertilizer (0.5g Compost and 0.2g cow dung) improved the proximate content of the cassava variety. The study also showed that the proximate content of cassava can be enhanced using cow dung.

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