STORAGE EFFECTS ON CASSAVA PLANTING MATERIAL QUALITY AND SUBSEQUENT VIABILITY AND GERMINATION.

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Abstract

Quality of stem is an important factor to determine the viability, germination and plant vigour, consequently the tuber yield of cassava. Storage of cassava stakes before planting can affect the quality of the cutting. Therefore, the aim of the study was to determine the storage effects on cassava planting materials of different sizes as it affect viability and germination. The study was conducted between February to March, 2018 at the Crop production laboratory and the experimental farm of University of Agriculture, Makurdi. The experiment consisted of 3 treatments and each was replicated three times. Each of the treatment consisted of 3 cuttings of different sizes. These were kept in a force draft oven, maintained at a constant temperature of 35^0C. The percentage weight loss of the cuttings was taking every 24hours for 132 hours. At the end of the experiment the cuttings were planted in the green house to assess their percentage viability, germination and plant vigour. The cuttings with bigger girth (9.5cm) had the least percentage weight loss of 17.33% and highest percentage germinations (88.89%) and of good vigour, while cassava cutting with smallest girth (5.5cm) had the highest percentage weight loss of 32.12% which resulted in no germination at all. It is therefore concluded and recommended that mature cutting of about 9.5cm girth be store for future cultivation.

Keywords: *cutting, cassava, girth, weight, pathogenic organisms and germination*

Introduction

Cassava (*Manihot esculenta* Cruntz.) is native to America. It was introduced to Africa during the last part of the 16th century. It adapted quikly to the traditional tropical African farming systems and has become a staple food for the continent (Hahn, *et. al.*, 1980). Some local names for cassava in Nigeria include “Ege”, “Paki”, “Akpu” or “Rogo”. Although most root crops produced viable and true seeds; root and tuber crops are usually propagated vegetatively (Okoli, 1985; Penh 2015).

The propagules for most root and tuber crops are bulky and large quantities are required to plant one hectare. Cassava for example, requires 10,000 - 25cm cuttings to

establish one hectare. The multiplication ratio in the crop is low, it is between 1:10 to 1:12; in contrast to one seed of maize which can multiply itself 90,000 times in a year, in two season crop (Okoli, 1985).

Theoretically, one plant can be obtained from each node, however, Dahniya and Kallon (1984); Bridgemohan and Bridgemohan (2014) reported that one node cuttings can be multiplied by direct planting in the field under the wet tropical conditions of Sierra Leone, but usually come with low percentage germinations. The reasons being that 1-3 node cutting are very short and are therefore more susceptible to rapid dehydration. Other things being equal, the longer the cassava cuttings used for planting, the greater the yield expected from it (Mdenye, *et al*., 2018). As a result, cuttings measuring 40 – 50cm give a consistently higher yield than those measuring 15 – 20cm. the greater yield of the longer cutting is probably due to the greater number of nodes from which roots (if they are submerged) or shoots can arise. Also, the longer cuttings contain greater amounts of stored food materials which the cuttings can utilize before they become self- sufficient. Even though long cuttings may yield more than shorter ones, it is impracticable in many cassava-growing regions. This is due to shortage of the planting materials and the bulky nature of the stakes, if they are to be transported over a long distance. Storage of the stakes therefore become a must if cassava must be propagated in the subsequent season. One important process that occurs in cassava planting material during storage is loss of moisture which has a strong influence on stake viability while probably also affecting biochemical transformations within the stakes. This work therefore aim at determine the effects of storage on the quality and subsequent germination of cassava cuttings of different sizes.

Materials and Method

Study site:

The research work was carried out at the Crop production laboratory and the experimental farm of University of Agriculture, Makurdi, Benue State. Makurdi is located between latitude 7.41^0 N and longitude 8.37^0 E and on altitude of 97m above sea level.

Experimental Design

Cassava stakes of TMS 8303, was obtained from the University of Agriculture Makurdi experimental farm. The stakes were cut into 21cm cuttings, bearing 6-18 nodes. The experiment consisted of 3 treatments and each was replicated 3 times. Each of the replicate consisted of 3 cuttings to make a bundle. The treatments were separated by the girth and the weight, such that we have big, medium and small cuttings. Each bundle constituting a plot was weighed fresh and kept in a force draft oven, maintained

at a constant temperature of 35^0C, (the average temperature of Makurdi during dry season).

The weights of the cuttings of different girths were taken every 24 hours for 132 hours and the moisture losses were expressed as percentages of the initial weights. This was to determine the moisture threshold level of the different cuttings. During the storage in the oven, some pathogens were identified and observed under light microscope. After the experiment, all the cuttings were planted out in the green house and their viability was assessed. Germination score of the cuttings were taken 3 weeks after planting, this was to determine the viability and strength of the cuttings.

Data analysis:

All the data collected were subjected to analysis of variance (ANOVA).Parameters showing significant differences among the means were further separated using Least Significant Difference (LSD) test.

Results and Discussion:

All the cuttings stored in the oven shows a general increase in the average daily percentage weight loss as the day progresses (Fig.1). However, the rate of increase in weight loss of the smallest size cutting (55.80g) was greater than the other two, while the biggest sized cuttings (463.00g) showed a gradual increase in the weight loss, even lower than the medium sized cuttings (Fig. 1).

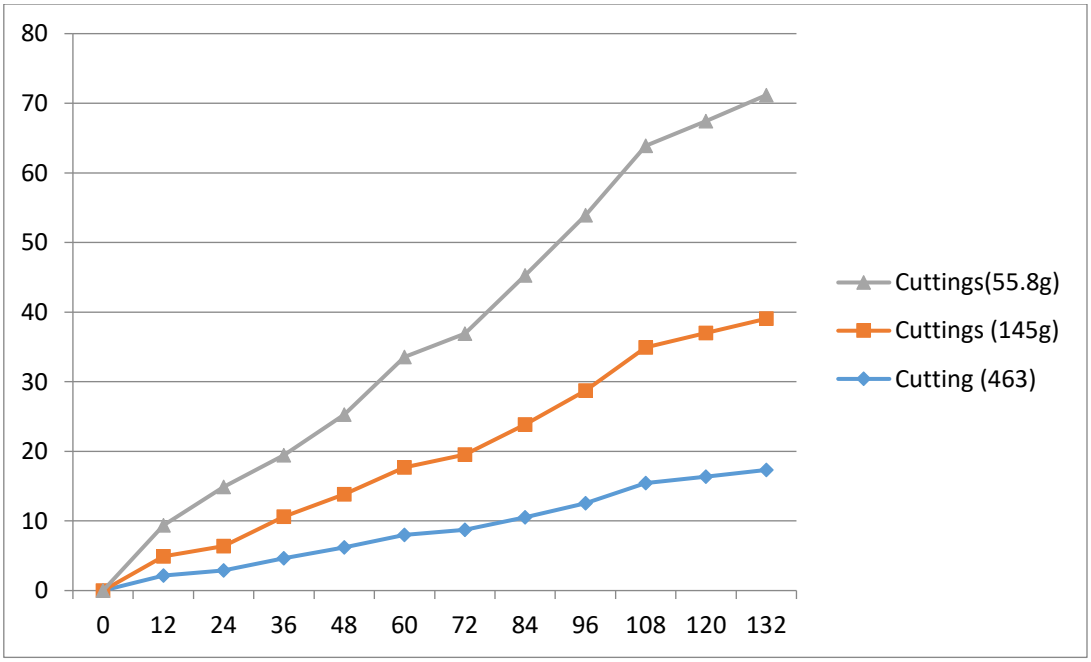

Fig.1: Daily percentage weight loss from cassava cuttings oven-dried at 35^0C for 132 hours

The percentage weight loss and percentage germination were presented in table 1. It was observed that the cuttings of 9.50 girth and weight 463.00g had the least percentage weight loss of 17.33% and it also gave the highest germination percentage (88.89%) after 132hours of storage in the oven. This was followed by the medium size (145.10g) cuttings of 5.50 girth with 21.72% weight loss and percentage germination of 44.45%. While the cuttings with small sized (55.80g) and 3.50 girth has the highest weight loss (32.12%) and has zero percentage germination (table1). This result underscore the work of Leihner (1983) that says stakes losses

Table 1: The % weight loss and % germinations of three different sizes of cassava cuttings oven-dried for 132 hours at 35^0C.

Cuttings	Girth (cm)	AV. No. of nodes	Length (cm)	Fresh wt. of bundle (g)	Wt. loss (%)	Germination (%)
Big size	9.50	9	21.00	463.00	17.33[a]	88.89[a]
Med size	5.50	8	21.00	145.10	21.72[b]	44.45[b]
Small size	3.50	16	21.00	55.80	32.12[c]	0.00[c]
Std Error					± 0.717	± 0.379

Means along the column followed by the same alphabets are not significantly different at p<0.05 and 0.01 by LSD viability when dehydration reduces moisture content to less than 60%. However, it has been agreed by several researchers that moisture loss of cuttings during storage have strong influence on stake viability and vigour, which in turn may have influence on some biochemical properties of cuttings that influences sprouting and nutrition of stored cuttings (Leihner, 1984; Mdenyel *et al*., 2016 and Mdenye *et al*., 2018).

The small size of the cuttings also likely to contributed to the loss in viability of the cuttings, which is line with the report of Davou and Nwankiti (1990) who recommended cuttings from the middle of the stem where the tissues are relatively matured (8 – 18 months) and are likely to be free of mosaic virus, and that the thickness of the cutting should not be less than one half the diameter of the thickest part of the stem of the particular variety being used else, there will be rapid loss of moisture. This result also tally with the work of Leihner (1983) who observed that early crop germination depend on sizes and nutritional status of planting material.

Other important transformation that could have occurred in stored stakes as a result of continued respiration is that; as any other living plant tissue, stored stakes continue to respire and thus lose carbohydrates during storage. Rate of loss is particularly high at the beginning of storage and slows down later, this could probably be attributed to the reduction in the moisture status of the stakes after longer storage periods (Promkhambut, 2014).

Organisms isolated from dried cuttings after the treatment includes *Fusarium semitectum, Botryoplodia theobroma* and Curvularia species. All the treatments were affected by the organisms isolated but the effect was very pronounced in small sized (55.80g) cuttings. This could be attributed to the soft nature of the cuttings vis-à-vis age of the cuttings. Cock (2011) and FAO (2013) attested to this fact that the cassava cuttings are said to be good if they are of right stem girth and stem age (between 8 – 18 months), but are liable to pathogenic attack in the store at higher moisture stage and younger age.

Table 2: Percentage protein loss of three different sizes of cassava cuttings oven-dried for 132 hours at 35^0C.

Cuttings	Girth (cm)	Protain loss (%)
Big size	9.50	47.80^{ns}
Med size	5.50	50.00^{ns}
Small size	3.50	52.30^{ns}
Std Error		± 0.816

Ns = not significant

The biochemical composition of the cuttings especially the protein content, was also affected during the storage. There were general reductions in the protein content of the cuttings, even though, the losses were not significantly different still, the small size (3.5cm girth) cuttings had the highest percentage protein loss of 52.3% (table 2). This could be attributable to the presence of some micro-organisms which can use organic nitrogen compounds as energy source. This result is in line with general observation made by some workers that; during storage, the protein level of some crops falls with

a concomitant increase in free amino acids of various species but normally including some of the Nitrogen storage variety (Kadas and Linder, 1977; Kurogi *et al.*, 1979).
The observation from this study showed that hot environment like Makurdi has a negative effects on the loss of weight, germination and viability of cassava planting materials. The excessive dehydration, weight loss and pathogen attack resulted to poor quality of the planting materials and in effect poor germination percentage.

Conclusion and Recommendation:

The results obtained from this study shows that the most important factor that contributed to cassava-cuttings weight loss, germination and early growth vigour are the cutting girth/age and the environmental temperature/relative humidity. These factors exposes the stored cuttings to excessive dehydration and attack of secondary infections. In this study, it was observed that as the day progresses, the weight loss also progresses and the effect was more on the smaller cuttings. Big sized cutting with 9.50cm girth had the lowest weight loss (17.33%) and the highest germination percentage (88.89%) while the smallest sized cuttings with girth 3.50cm had the highest percentage weight loss (32.12%) and zero germination percentage.
For these reason, it is recommended that:
i) In case of commercial cuttings production they should consider the girth/age of the stakes to be stored. However, cuttings with girth 9.50cm is recommended for storage in Makurdi, Benue state.
ii) In hot environment, duration of storage should be as short as possible to avoid higher moisture loss and vital cuttings nutrition (protein) which results to poor cuttings germination and viability.

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