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Study on the effect of number of Sprouts per stand on yield and yield components of Cassava in Ado Ekiti, Nigeria

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ABSTRACT

Field trials were carried out at the farm of Livestock development unit of Ekiti state Ministry of agriculture, Erinfun, Ado Ekiti (7°40′ N, 5°15′ E) in 2010/2011 and 2011/2012 cropping sessions to assess the effects of sprout number per cassava stand on the performance of cassava *Manihot esculenta*. The treatments which represented the number of shoots allowed to survive from sprouted shoots per stand were single shoot; double shoots; triple shoots and multiple shoots. At four weeks after planting (4WAP), sprouted shoots were detached to the required number per stand in each treatment. Multiple shoots produced the tallest plants while single and double shoots per stand gave the shortest plants. Single shoot per stand produced the highest stem girth figure, number of initial and final branches, fresh shoot biomass, number of tubers per plant as well as tuber yield per hectare. While the percent peel per tuber was lowest in the single and double shoots per stand, the highest percentage of peel per tuber was recorded in the multiple shoots cassava plants. It is concluded that sprouted cassava should not be allowed to be more than two shoots per stand for optimum cassava tuber yield.

Introduction

Cassava (*Manihot esculenta* Crantz) is the third most important source of calories in the tropics, after rice and maize. Millions of people depend on cassava in Africa, Asia and Latin America. It is grown by poor farmers, many of them women, often on marginal land. For those people and their families, cassava is vital for both food security and income generation [1].

The global cassava harvest in 2012 was estimated at more than 280 million tonnes, which is 60 percent increase since 2000. Global average yields have increased by almost 1.8percent a year over the past decade, to 12.8 tonnes per hectare. With better crop and soil management, and higher yielding varieties more resistant to drought, pests and diseases, cassava could produce average root yields estimated at 23.2 tonnes [2]. Of the over 228 million tons of cassava produced worldwide in 2007, Africa accounted for 52% with Nigeria producing 46 million tons making it the world's largest producer [3].

The potential of agriculture to be the industrial and economic springboard in Nigeria's economic development is a fact that cannot be over emphasized. According to a recent report of the United Nations Food and Agriculture (FAO), Nigeria is sure to earn at least $1.3 billion from cassava chips export in 2014 out of the current production of about $18 billion [4].

Cropping could possibly be intensified with appropriate plant arrangement on the field and by modifying cassava canopy in order to introduce a late season crop like cowpea. This was intended to increase productivity of the land and also prevent weeds infestation [5].

Cassava is planted primarily for tuber production but can be cutback, pruned or defoliated for various reasons in different parts of Africa. The pruned parts are fed to small ruminants in Southern Nigeria [5]. Pruning of cassava to reduce light interception and excess leaf area produced by some cultivars had been reported to have benefited legumes planted in the late season [6]. It had been reported that stimulated cutback in cassava had no negative effect on the performance of cassava [7].

The present work was designed to assess the effects of number of sprouts that were allowed to survive per plant on the growth and yield of cassava in this study area with the aim of recommending appropriate pruning strategy for cassava growers for optimum production.

Materials and methods

The study was carried out at the farm of Livestock Development unit of Ekiti state Ministry of agriculture, Erinfun, Ado Ekiti in 2010/2011 and 2011/2012 sessions. Ado Ekiti is located on Latitude 7^0 40'N and longitude 5^0 15'E in South-western Nigeria. The location is characterize by a bimodal rainfall pattern with an annual mean of 1450mm. Cassava cuttings (TMS419) of between 20 and 25cm long were planted in April of each year of the trials. The land which had been under *Tithonia diversifolia* fallow for two years, were manually cleared, trashes packed and ridged before planting. Each ridge measured 9m long with 1m between ridges. Planting was done at 1m apart on the ridge to make a plant population of 10000 plants per hectare. Planting was done in April of 2010 and 2011 and harvested in February of the following year. The following treatments which represented the number of shoots from sprouts' number per stand were assessed: single shoot; double shoots; triple shoots and multiple shoots. Each treatment consist four ridges which were replicated four times. The whole experiment was laid out in randomize complete block design replicated four times. At four weeks after planting (4WAP), sprouted shoots were detached to the required number per stand in each treatment. At twelve weeks after planting (12WAP), average plant height, stem girth, number of initial branches and number of leaves per shoot were assessed. At forty two weeks after planting (42WAP), the average number of terminal branches per shoot was assessed. At harvest (i.e. 52WAP), fresh

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shoot biomass per stand was determined from five randomly selected plants per treatment before tuber uprooting. Uprooted cassava tubers were counted and weighed per stand. All data were subjected to statistical analysis of variance and means compared using the Fisher's least significance difference (LSD).

Results

Table 1 shows the effects of shoots number per stand on the height and stem girth of cassava at 12WAP. The tallest plants were recorded in the multiple shoots followed by the triple shoots per stand while the shortest plants were observed in the single shoot per stand. The heights obtained in the single and double shoots were not significantly different. Similar stem girths were recorded in the single and double shoots per stand. The multiple shoots recorded the lowest girth followed by the triple shoots per stand while single shoot per stand was highest.

The effects of number of shoots per stand on number of first and terminal branches of cassava shoots are presented in Table 2. The number of the initial branches was similar in the single shoot per stand and double shoots per stand. Also the number of initial branches was identical in the triple and multiple shoots which were lower than the branches from either the single or double shoots. Number of terminal branches was highest in the single shoot while the lowest was observed in the multiple shoots per stand. The single and double shoots were not significantly different in terms of number of terminal branches. The number of terminal branches observed in the triple shoots were however higher than those of multiple shoots.

Fresh shoot biomass was higher and identical in the single and double shoots while the multiple and triple shoots produced lower fresh shoot biomass (Table 3). The number of tuber per stand shows that single shoot produced the highest while multiple shoots produced the lowest number of tubers per stand. While the triple and multiple shoots stands produced identical number of tubers in 2010/2011 season, triple shoots gave higher number of tubers than the multiple shoots in 2011/2012 season.

Effect of number of shoots per stand on the tuber yield per hectare and percent peel per tuber is presented in Table 4. Tuber yields per hectare were highest in the single and double shoots per stand which were not significantly different. The lowest tubers were recorded in the multiple shoots per stand. Triple shoots produced higher tuber yield than the multiple shoots per stand. Percent peel per tuber was lowest in the single shoot per stand but similar to those of double shoot per stand. The highest percentage of peel per tuber was recorded in the multiple shoots cassava plants.

Table 1. Effect of number of shoots per stand on plant height and stem girth of cassava at 12WAP

Treatment	Plant height (cm)		Stem girth (cm)	
	2010/2011	2011/2012	2010/2011	2011/2012
Single shoot	121.1c	120.4c	9.5a	9.2a
Double shoots	123.8c	124.2c	8.9a	8.6a
Triple shoots	131.8b	133.6b	5.8b	5.0b
Multiple shoots	138.2a	139.4a	4.1c	4.8b
LSD	5.95	4.71	1.22	2.45

Means with the same letter(s) within column are not significantly different (P=0.05)

Table 2. Effect of number of shoots per stand on number of first and terminal branches of cassava shoot

Treatment	Number of first branch		Number of terminal branches	
	2010/2011	2011/2012	2010/2011	2011/2012
Single shoot	3a	3a	10a	9a
Double shoots	3a	3a	9a	8a
Triple shoots	2b	2b	6b	5b
Multiple shoots	2b	2b	4c	3c
LSD	0.61	0.90	1.45	1.82

Means with the same letter(s) within column are not significantly different (P=0.05)

Table 3. Effect of number of shoots per stand on fresh shoot biomass and number of tubers per stand

Treatment	Fresh shoot biomass (Kg)		Number of tubers per plant	
	2010/2011	2011/2012	2010/2011	2011/2012
Single shoot	1.89a	1.98a	10a	9a
Double shoots	1.84a	1.92a	9a	9a
Triple shoots	1.21b	1.46b	5b	6b
Multiple shoots	1.05b	1.41b	4b	3c
LSD	0.56	0.43	1.68	2.80

Means with the same letter(s) within column are not significantly different (P=0.05)

Table 4. Effect of number of shoots per stand on cassava yield and percent peel per tuber

Treatment	Tuber Yield (tonnes per hectare)		Percent peel Tuber^{-1}	
	2010/2011	2011/2012	2010/2011	2011/2012
Single shoot	47.5a	48.2a	6.98c	6.09c
Double shoots	45.1a	44.0a	7.21c	6.31c
Triple shoots	24.2b	22.5b	12.14b	9.85b
Multiple shoots	14.5c	11.1c	14.26a	12.98a
LSD	9.2	10.1	1.23	2.31

Means with the same letter(s) within column are not significantly different (P=0.05)

Discussion

The taller plants observed in multiple shoots without a corresponding girth increase could have resulted from high competition between these shoots which led to etiolated plants. There probably was little or no competition in the single and double shoots resulting to thicker and shorter stems. Similar height increase in multiple plants per stand had been reported [8]. It had also been reported that tallest plants occurred under higher planting densities [9, 10]. More branches were produced early and at terminal growth periods of the cassava plants with single and double shoot while multiple and triple shoots produced lower number of branches during these growth periods.

The highest tuber yields in terms of number and weight peer plant obtained from the single and double shoot plants might have resulted from the highest shoot biomass from these plants as against the lowest biomass of the multiple and triple shoots plants. The lowest yield from the multiple shoots plants might be due to high biomass production without a corresponding yield increase. Reports have showed that low density plant produced higher vegetative growth parameters than high density plants [11]. Multiple shoots plants are also likened to increase plant density which had been reported to have a negative influence on yield of plants [12, 13]. The highest percentage of cassava tuber peel recorded in the multiple shoot plants as compared to the low peel percentage in the single and double shoot plants is a further indication of poor performance of the multiple shoot plants.

It is concluded from this study that multiple sprouts if allowed to grow to maturity may adversely reduce the number of

tubers per plant and subsequently reduce the fresh tuber yield per hectare. Therefore it is advised that sprouted cassava shoots should not be more than two per hill to achieve optimum cassava yield.

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