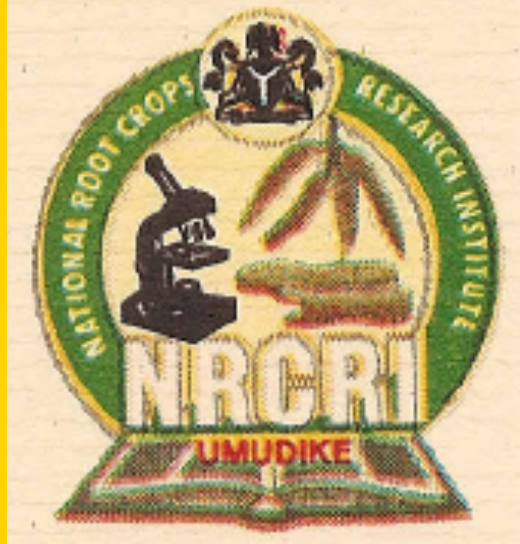


CLONAL EVALUATION TRIAL OF YELLOW ROOT CASSAVA GENOTYPES IN SOUTH EASTERN NIGERIA

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ABSTRACT

Clonal evaluation stage is the first field trial after seedling evaluation in a conventional breeding cycle of cassava. Yellow root cassava contains carotene, a precursor of Vitamin A which is an essential micronutrient for good health, sight and immune system booster. Twenty-nine yellow root cassava genotypes and two check varieties (TME 419 and TMS 30572) were evaluated for agronomic parameters, response to major pests and diseases of cassava and quality traits at Umudike, South-Eastern Nigeria in 2010/11 cropping season. The experimental design was randomized complete block design replicated twice using a single row plot of 5m for each genotype. The genotypes were evaluated for fresh root yield (FRY), dry matter (DM) and total carotene (TC) contents at 12 MAP and the data were subjected to analysis of variance. There were highly significant differences among the genotypes for the three parameters. The genotypes showed high resistance to major pests and diseases having severity scores of 1 or 2. TC content ranged from 5.0µg/g to 7.1µg/g; FRY ranged from 1.0 to 25.2 t/ha; dry root yield (DRY) ranged from 0.3 to 9.3 t/ha while dm content ranged from 19.6% to 40.89%. The genotypes with high TC content also had high DM content ranging from 32% to 40%. The genotypes are currently being evaluated in preliminary trial at the same location after which the top genotypes in relation to all the traits of interest will be selected for multi-locational trial.

Keywords: total carotene, dry matter, fresh root yield, dry root yield, clonal evaluation, yellow root cassava, vitamin A deficiency

INTRODUCTION

Cassava is the third most important source of calories in the tropics (FAO, 2010) and sixth most important crop, in terms of global annual production (FAOSTAT, 2010). Its production and processing provide employment and income for the rural poor, especially women and children (Sarma and Kunchai, 1989). However, currently used varieties of cassava have poor nutritional quality as the concentrations of pro-VA carotenoids, iron, zinc, and protein are very low and the roots contain toxic cyanogens (McMahon et al., 1995). Cassava can provide an adult's daily recommended allowance for energy by about 80% while providing an average of 10-20% for Vitamin A, iron and zinc (Sayre et al., 2011). Vitamin A is an essential micronutrient for the normal functioning of the visual and immune systems, growth and development, maintenance of epithelial cellular integrity and for production (ACC/SCN, 2000). Improving the Vitamin A status of children reduces mortality rates by 23 to 30% (West, 2001). Eradication of VAD remains a global public health challenge (Thakkar et al, 2009). VAD is more common in developing countries where impoverished populations lack adequate resources to diversify diets and purchase foodstuffs or supplements. Such populations must rely on pro VA carotenoids from plant food to meet VA requirements (West, 2001). In addition to the direct effect of VAD, there is growing evidence of vitamin A having synergistic effects with iron and zinc bio-availability (Graham & Rosser, 2000). We report here the agronomic parameter and TC content of some cassava genotypes evaluated in a clonal trial in 2010/11 season at Umudike, Nigeria.

MATERIALS AND METHODS

A set of 281 yellow root cassava genotypes were established in a clonal evaluation trial in 2010 at NRCRI, Umudike in a randomized complete block design experiment replicated twice. Five cuttings of each genotype were planted in a row plot of 5m. The genotypes were scored for resistance to major pests and diseases of cassava and plant architecture (type), during growth of the plants. Shortly before harvesting at 12 MAP, the genotypes were evaluated for dry matter (DM) and total carotene (TC) contents using storage roots milked from the selected plants in each plot. The roots were scored using colour chart with colour ranging from white to pink (Fig. 1). The total carotene analysis was carried out using HarvestPlus Procedure at carotene laboratory of NRCRI, Umudike. The remaining plants were harvested at 12 MAP to evaluate the genotypes for fresh root yield (FRY) and other yield-related parameters.



Figure 1: Colour chart for visual estimate of carotene content in cassava.



Figure 2: Variation in root pulp colour of some high beta carotene cassava genotypes

RESULTS AND DISCUSSION

Most of the genotypes evaluated in this trial were resistant to major pests and diseases of cassava (Table 1). FRY ranged between 1.0 and 25.2 t/ha while dry root yield (DRY) ranged between 0.3 and 9.3t/ha among the selected genotypes (Table 1). Fig. 2 shows the level of variation in root pulp colour among the high beta-carotene cassava genotypes. The total carotene (TC) content ranged between 0.9 and 7.1µg/g among the 281 yellow root cassava genotypes evaluated in the trial. The high variation observed among the genotypes for TC contents is an indication that there is opportunity for improvement of cassava for the trait.

The highest carotene content of 7.1 µg/g observed in one of the genotypes evaluated in this trial seemed to be lower than that of varieties UMUCASS 37 and UMUCASS 38 (formerly called TMS 01/1412 and TMS 01/1371, respectively). The top 29 genotypes (Table 1) in terms of TC content were selected from this trial for further evaluation in 2011/12 season in a preliminary trial using UMUCASS 38 as the positive check and TMS 30572 as the negative check. The genotypes will be evaluated for TC content and other parameters studied during the clonal trial.

Table 1: Total carotene content, yield, pests and diseases scores of selected genotypes from 2010/11 clonal evaluation trial

Clones	CMD		CBB		CAD		CGM		CM		Plant type	CCS	% DM	FRY (t/ha)	DRY (t/ha)	TC (µg/g)
	S	I	S	I	S	I	S	I	S	I						
NR10/0423	2	40	1	0	1	0	1	0	1	0	2	5	36.9	25.2	9.3	7.1
NR10/0347	4	80	2	80	2	60	1	0	1	0	3	6	30.6	19.5	6.0	6.8
NR10/0369	3	60	1	0	2	60	1	0	1	0	2	4	28.7	13.2	0.3	6.6
NR10/0370	1	0	1	0	1	0	1	0	1	0	3	4	27.8	10.1	2.8	6.5
NR10/0388	1	0	1	0	1	0	1	0	1	0	2	4	33.0	11.8	3.9	6.5
NR10/0367	2	100	1	0	1	0	1	0	1	0	2	4	29.6	10.4	3.1	6.5
NR10/0353	2	75	1	0	1	0	1	0	1	0	2	4	19.6	7.2	1.4	6.5
NR10/0346	2	75	1	0	1	0	1	0	1	20	1	5	26.0	5.5	1.4	6.3
NR10/0495	3	40	1	40	1	20	1	20	1	0	1	5	26.4	1.0	0.3	6.2
NR10/0464	1	0	1	0	1	0	1	0	1	0	2	6	29.6	9.2	2.7	6.2
NR10/0387	1	0	1	0	1	0	1	0	1	0	3	4	25.1	13.9	3.5	6.1
NR10/0384	3	100	2	20	2	60	1	0	1	0	2	4	20.6	7.0	1.4	6.0
NR10/0172	2	60	1	0	2	20	1	0	1	0	2	4	25.5	6.1	1.6	5.9
NR10/0186	1	33	1	33	1	33	1	33	1	33	1	5	23.6	6.0	1.4	5.8
NR10/0332	2	75	2	25	1	0	1	0	1	0	2	4	26.8	15.9	4.3	5.7
NR10/0343	3	100	2	75	1	0	2	50	1	0	1	6	25.6	4.5	1.2	5.7
NR10/0218	3	75	1	0	1	0	1	0	1	0	2	4	33.9	6.3	2.1	5.6
NR10/0342	2	60	1	0	1	0	1	0	1	0	2	5	35.7	8.3	2.9	5.5
NR10/0350	2	80	1	0	1	0	1	0	1	0	2	4	29.4	14.7	4.3	5.4
NR10/0241	1	0	1	0	1	0	1	0	1	0	3	4	36.2	18.0	6.5	5.4
NR10/0341	2	75	1	0	2	40	1	0	1	0	3	5	23.5	8.8	2.1	5.3
NR10/0195	1	0	1	0	1	0	1	0	1	0	1	4	35.5	13.0	4.6	5.3
NR10/0339	1	0	1	0	1	0	1	0	1	0	2	5	31.2	4.5	1.4	5.3
NR10/0382	2	33	1	0	1	0	2	33	1	0	2	4	31.3	11.2	3.5	5.2
NR10/0193	1	0	1	0	2	40	1	0	1	0	3	3	26.3	16.0	4.2	5.1
NR10/0214	1	0	1	0	3	50	1	0	1	0	3	4	38.1	11.5	4.4	5.1
NR10/0426	2	40	2	20	1	0	1	0	1	0	2	4	40.9	14.4	5.9	5.1
NR10/0385	1	0	1	0	2	40	1	0	1	0	2	3	37.1	5.1	1.9	5.1
NR10/0191	1	0	1	0	1	0	1	0	1	0	3	4	32.0	8.2	2.6	5.0
TMS 30572	4	80	2	100	2	40	1	0	1	0	2	2	26.2	10.5	2.7	1.1
Average	2.0	42.7	1.2	13.1	1.3	15.4	1.1	4.5	1.0	1.8	2.1	4.3	29.8	10.6	3.2	5.7
Maximum	4	100	2	100	3	60	2	50	1	33	3	6	40.9	25.2	9.3	7.1
Minimum	1	0	1	0	1	0	1	0	1	0	1	2	19.6	1.0	0.3	1.1
CV (%)	48.6	87.4	33.9	205.4	41.9	144.6	23.8	273.6	0	392.6	31.5	20.4	18.0	49.3	59.4	18.4

CMD = cassava mosaic disease; CBB = cassava bacterial blight; CAD = cassava anthracnose disease; CGM = cassava green mite; CM = cassava mealybug; Plant type = Plant architecture; CCS = colour chart score; % DM= percent dry matter content; FRY = fresh root yield; DRY = dry root yield; TC = Total carotene content. All pest and diseases scores were measured on a scale of 1 to 5 where 1 is highly resistant and 5 is highly susceptible.

CONCLUSION AND FUTURE PERSPECTIVES

The genetic variability observed among the genotypes evaluated in this trial for carotene content provides a good opportunity for improvement of cassava for carotene content. Genotypes that combine higher total carotene content than the positive check with good agronomic parameters will be selected for further evaluation in advanced trial.

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