

Farmer Participatory Evaluation of Four Hybrid Water Yam Clones in the Yam Belt of Nigeria

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Abstract

Four hybrid water yam (*Dioscorea alata*) genotypes (TDa 00/00194, TDa 00/00103, TDa 00/00104, TDa 00/00363) with two superior landraces (TDa 92-2 and UM 680) were evaluated for high and stable yields, pest and disease resistance, and acceptable food and market qualities in 2006 using the farmer participatory (FP) approach. This researcher managed trial was carried out in Umudike (humid forest), Abakaliki and Nsukka (derived savanna), and Makurdi (southern Guinea savanna). Farmers participated in evaluating the genotypes for physiological attributes, yield, and eating qualities during mid-season (August/September) and at harvest. The hybrid yams gave almost twice the tuber yield of the landraces. Also the landraces were scored higher than the landraces in terms of pest and disease resistance, plant canopy, leaf litter, etc. In terms of food quality, TDa 00/00194 (4.0) was rated a little higher than the local best UM 680 (3.9) though this did not differ from TDa 00/00104 (3.5). Results from sensory evaluation and palatability tests showed that TDa 00/00194 and TDa 00/00364 had the highest rating in food quality for *amala* preparation. In selecting water yams therefore, consideration should be based on sensory acceptance, high dry matter, and low peel loss.

Résumé

Quatre hybrides génotypes d'igname, l'eau yam (*Dioscorea alata*) (TDa 00/00194, TDa 00/00103, TDa 00/00104, TDa 00/00363 avec deux variétés supérieures de races- une variété qui tolère l'effort biotique et abiotique ayant pour le résultat la stabilité élevée de rendement (TDa 92-2 et UM 680) ont été évalués pour les rendements élevés et durable, la résistance aux ravageurs et de la maladie et les qualités acceptables de nourritures et du marché en 2006 utilisant l'approche participatives de fermier et vulgarisation (FPE). Cette chercheurs gérés essais a été effectuée dans Umudike (forêt humide), Abakaliki et Nsukka (la savane dérivée) et Makurdi (Sud de la Guinée de Savane). Les fermiers ont participé à évaluer les génotypes pour les attributs physiologiques, le rendement et les qualités consommables pendant la demi saison (août/septembre) et à la récolte. Les hybrides d'igname ont donné presque deux fois le rendement de tubercule des variétés locales. Également les hybrides ont été marqués plus élevées que des variétés locales en termes des résistances aux ravageurs et de la maladie, plante abris et les feuilles mortes etc. Sur le plan de qualité des produits alimentaires, TDa 00/00194 (4.0) ont été évaluées d'avoir une meilleure qualité en comparaison du meilleure de variété locale UM680 (3.9) bien que ceci n'ait pas différé de TDa 00/00104 (3.5). Le résultat d'évaluation sensorielle et l'acceptation de goût ont prouvé que TDa 00/00194 et TDa 00/00364 ont eu l'estimation la plus élevée de la qualité des produits alimentaires pour la préparation d'*amala*. En choisissant l'eau yam donc, la considération devrait être basée sur l'acceptation sensorielle, la matière sèche élevée et une perte réduite d'épluchure.

Introduction

There have been a number of cases where some improved varieties of crops are rejected by farmers despite their superiority over local landraces. The reason for this has been partly attributed to the inability of these superior hybrids to meet farmers' and consumers' preferences. This concern has been discussed by breeders and agronomists who agreed that farmers should be brought in at the early stages of the

breeding process to select clones based on their preferences. A number of promising white and water yam clones are being continuously developed by breeders both in the International Institute of Tropical Agriculture (IITA), Ibadan and the National Root Crops Research Institute (NRCRI), Umudike. Since 1997, NRCRI and IITA have been conducting Farmer Participatory Evaluation (FPE) of new yam hybrids to hasten the selection of farmer preferred genotypes (Olojede et al. 2000). Four such water yam clones, still at their Uniform Yield Trial (UYT) stage were collected from IITA as part of a regional yam evaluation project, and are being evaluated in different ecologies in the yam belt of Nigeria: Umudike (humid forest); Abakaliki and Nsukka (derived savanna), and Makurdi (Guinea savanna) and are being repeated in 2007. The purpose of this study is to assess the performance of the four hybrid water yam (*D. alata*) clones: (TDa 00/00194, TDa 00/00103, TDa 00/00104, and TDa 00/00364 (with TDa 92-2 and UM 680 as checks) for high and stable yields, pest and disease resistance, and acceptable food and market qualities for fresh tuber and yam flour.

Materials and Methods

First year trials were carried out at Umudike, Abakaliki, Nsukka, and Makurdi. Four promising water yam clones selected from the UYT stage at IITA Ibadan and two landraces used as checks (Table 1) were established in Umudike, Abakaliki, Nsukka, and Makurdi in 2006. These were laid out in randomized complete block designs and replicated three times in each location.

Land was prepared using the conventional method of plough, harrow, and ridge at 1 m row spacing. Plot size was 7 m × 6 m and the yams were spaced 1 m apart on the crest of the ridges. Compound fertilizer (NPK) at 400 kg/ha was applied as side-band 5–6 weeks after planting (WAP). The plots were hoe weeded at 4 + 8 + 12 WAP and the yams were staked between 5 and 7 WAP as recommended. Mini-field days were carried out at Umudike for collaborating farmers from Abia, Enugu, and Imo states and at Abakaliki for Abakaliki farmers at mid-season and at harvest to capture farmers preferences for growth habit and eating quality of each clone. Data were also taken on yam pest and disease severity.

Results and Discussion

Mean fresh tuber yield of the four hybrid clones compared with two local checks, are presented in Tables 1.

This first year result shows that the four hybrid water clones gave significantly higher fresh tuber yields; almost twice those of the landraces. The tuber yields by the landraces did not differ. Mean physical assessment of the hybrids 4 months

Table 1. Mean fresh tuber yield (t/ha) of four hybrid clones compared with two local best landraces in FPE trial at four locations in the yam belt of Nigeria in 2006.

Water yam cultivar	Fresh tuber yield (t/ha)				Mean
	Umudike	Abakaliki	Nsukka	Makurdi	
TDa 00/00194	16.86	14.64	9.16	14.48	13.78
TDa 00/00103	20.63	10.80	12.27	11.62	13.83
TDa 00/00104	22.54	10.97	10.95	17.24	15.43
TDa 00/00364	19.42	12.76	11.82	15.88	14.97
TDa 92-2	13.85	4.44	4.31	–	7.53
UM 680	15.41	11.48	3.03	.06	7.75
LSD (0.05)	6.12	7.92	5.52	5.30	5.37
CV (%)		21.17	27.56	35.52	27.69

Table 2. Evaluation of some physical attributes of four hybrid clones compared with two local best landraces by farmers drawn from Abia, Ebonyi, Enugu, and Imo states in 2006.

Water yam cultivar	Physical attributes					Mean
	Canopy	Leaf color	No. vines per plant	Disease resistance	Litter size	
TDa 00/00194	3	2	2	3	2	2.40
TDa 00/00103	3	4	2	3	2	3.00
TDa 00/00104	4	4	4	4	4	4.00
TDa 00/00364	3	4	2	3	2	2.80
TDa 92-2	2	1	2	1	2	1.60
UM 680	2	3	1	2	1	1.80

Key: 1 = Not liked ; 2 = Slightly liked ; 3 = Just liked ; 4 = Very much liked;
5 = Extremely liked.

Table 3. Food quality and palatability assessment of four *D. alata* hybrids and two landraces at harvest by farmers from Abia, Ebonyi, Enugu, and Imo states in 2006.

Water yam cultivar	Taste	Color	Texture	Poundability	Consistency	Mean
TDa 00/00194	4.5	4.5	3.5	4	4.0	4.0
TDa 00/00103	2	1.5	1.5	3	2.5	2.1
TDa 00/00104	3	3.5	2.5	3.5	3.5	3.5
TDa 00/00364	2	1	2	3	2.5	2.1
TDa 92-2	2	1.5	2	1.5	2.0	1.8
UM 680	3.5	3.5	3.5	4.5	4.5	3.9
LSD (0.05)	1.5	1.6	1.6	1.6	1.5	

Key: 1 = Not liked; 2 = Slightly liked; 3 = Just liked; 4 = Very much liked;
5 = Extremely liked.

after planting by participating farmers from Abia, Ebonyi, Enugu, and Imo states is presented in Table 2.

The physical attributes evaluated by farmers were those of plant canopy (dense or sparse), leaf color, number of vines/plant, disease resistance, and leaf litter. From their visual evaluation, the order of preference by farmers is TDa 00104 > TDa 00/00103 > TDa 00/ 00364 > TDa 00/00194. The hybrid water yams were preferred over the landraces as shown from their rating in Table 2. At harvest, the same group of farmers evaluated the eating qualities of water yams and the result of their evaluation is shown in Table 3.

Some characteristics of the hybrid *D.alata* genotypes evaluated by the food scientists at NRCRI Umudike are shown in Tables 4, 5, and 6.

The tubers of the genotypes were seen to have varied shapes, and these shapes seemed to have affected their percentage peel losses (Table 4). The tuber flesh color also varied extensively with some of them having purple/variegated color. None of the tubers had white flesh color. In food processing, low peel loss and high dry matter content tend to increase the product yield of tuberous crops.

Table 5 shows that all the water yam genotypes had dry matter content of above 25%. The dry matter content of their dried *elubo* (fermented yam flour) was also found to be high (90.50– 91.70) with values from oven-dried samples higher than those that were sun dried. It was observed that the color of the oven-dried and sun-dried secondary products (dried chips and *elubo*) looked alike. The *elubo* samples had a pH of 5–6. Only the *amala* made from TDa 00/00/03 and TDa 00/00104 were black in color (Table 6). The color of the *elubo* made from water yam genotypes ranged from cream (Ominelu) to dark brown (TDa00/00364).

Table 4. Tuber characteristics of some hybrid water yam genotypes being evaluated under the FPE trials in the yam belt of Nigeria.

Genotype	Tuber shape	Skin color		Flesh color	Peel loss (%)
		Outer	Inner		
TDa92-2	Palmitate	Brown	Purple	Purple/cream	24.33 ^c
TDa00/00364	Branched	Brown	Yellowish	Cream	25.41 ^c
TDa00/00194	Oblong	Brown	Light Yellow	Cream	19.45 ^c
TDa00/00103	Branched	Brown	Yellowish	Cream	27.07 ^{bc}
TDa00/00/104	Branched	Brown	Purple	Cream/ scanty purple	26.41 ^c
Um680	Oblong/ branched	Brown	Purple	Purple/cream	22.33 ^c

Numbers with same letter are not significantly different ($P = 0.05$) using DMRT.

Table 5. Dry matter content of the fresh tubers and the fermented flour (*elubo*).

Genotype	Dry matter (%)		
	Fresh tuber	Oven dried	Sun dried
Tda92-2	26.97	91.50	91.00
Tda00/00364	28.10	91.10	91.60
Tda00/00194	26.77	91.70	91.00
Tda00/00103	29.37	90.20	89.30
Tda00/00/104	34.03	91.30	90.70
UM680	33.07	90.40	90.20
Ominelu	39.90	90.70	90.80

Table 6. Color of the experimental dried chips, *elubo*, and *amala*.

Genotype	Dried chips	<i>Elubo</i>	<i>Amala</i>
TDa92-2	Dark brown	Brown	Brown
TDa00/00364	Tan	Dark brown	Dark brown
TDa00/00194	25% grey	Cream	Light brown
TDa00/00103	Brown	Brown	Dark brown
TDa00/00/104	Light brown	Tan	Black
99/00240	Brown	Brown	Light brown
98/01176	Brown	Brown	Brown
98/01166	Light brown	Cream	Light brown
UM680	Light purple	25% grey	25% grey
Ominelu	25% grey	Cream	Light brown

Table 7. Sensory evaluation scores* of the experimental *amala*.

Genotype	Color	Handfeel	General acceptability
Tda92-2	4.05a,b	4.35b	3.90a,b
Tda00/00364	3.95a,b	4.65a	4.00a,b
Tda00/00194	4.15a,b	4.35a,b	4.20a
Tda00/00103	2.65c	2.90d	2.65c
Tda00/00104	3.85a,b	3.60a,b,c,d	3.75a,b
99/00240	3.60a,b,c	3.50b,c,d	3.45a,b
98/01176	3.00b,c	2.95c,d	2.95b,c
98/01166	4.00a,b	3.95b,c,d	3.80a,b
UM680	3.80a,b,c	4.05b,c,d	4.05a,b
Ominelu	4.55a	4.40b	3.85a,b,c

*0 = Dislike extremely; 3 = Neither like nor dislike; 6 = Like extremely.

Numbers with same letter are not significantly different ($P 0.05$) using DMRT.

Source: Ukpabi et al. 2007.

In the sensory evaluation of the non-whitish *amala* samples (Table 7), the samples made with TDa00/00103 were rated low by the panelists. The panelists on the other hand, highly rated the *amala* from TDa 00/00194 and TDa 00/00364 (in combined scoring for color, handfeel, and general acceptability). The rest of the genotypes in the opinion of the panelists could also be used in the production of *elubo* that is used in the preparation of *amala*. This first year investigation indicates that these new water yam genotypes could be used in the preparation of *amala* meal. However, in selecting the genotypes, consideration should be based on the sensory acceptance, high dry matter content, and low peel loss.

References

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