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On-farm Farmers' Participatory Variety Field Evaluation and Culinary Quality Assessment of Hybrid White Yam (*Dioscorea rotundata* Poir) Genotypes for Official Release for Commercial Yam Production in Nigeria

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Abstract **– Genotypes released by plant breeders as varieties are often being rejected by farmers. To solve this problem, Farmers as end-users are involved in variety selection. This was done by carrying out On-farm trial in farmers' fields across eight states in Nigeria with the objectives to test the performance of promising genotypes under farmer growing conditions and to test farmers' acceptance by ranking the varieties for yield, yield component attributes and culinary quality. Eight yam genotypes were distributed to 32 selected farmers. Twenty farmers (ten males and 10 females) were used per location. The performance of each variety per trait was assessed by each farmer assigning and putting one card only in the bag. The result of the pooled mean percentage of the field evaluation and culinary assessment showed that five yam genotypes (07/00405, 98/00933, 99/Amo/080, 03/0058 and 99/Amo/064) scored 70% and above. These five genotypes were nominated for release as the farmers' choice in terms of field performances and culinary attributes.**

Keywords **– Acceptability, Culinary Assessment, Field Performance, Official Release.**

I. INTRODUCTION

The yam plant is a monocotyledonous and annual herbaceous plant. It has long climbing stems which wind themselves around supports [12]. A single plant produces between one and five tubers of varying shapes, each may weigh up to 7.0kg. Certain species produce dioscorine, a toxic alkaloid that is destroyed by cooking. However, rich in starch and protein, yam is very popular tropical food. It grows in light, well drained soils and often the most fertile land is set aside for yam cultivation.

The yams are the most important staple food crops in West Africa [7] except for cereals [4], [19]. They also form an important staple food source in tropical countries including East Africa, the Caribbean, South America and Southeast Asia. However, West Africa remains the most important yam producing region of the World [18]. In view of its past significance in rural economies, the present decline in the cultivation of yams in Nigeria is surprising. Visitors to parts of the forest zone in the 1850s observed that yams there were one of the chief articles of food, "the staff of life" and the staple food of the population. In the transitional zone between the forest and savanna, yams and maize formed the staple food of the population [1]. Of the 600 known species of yams, only six are food yams [5]. Out of these, the most popular is the white yams, (*Dioscorea rotundata)* which originated in West Africa and accounts for 90 percent of world production which is about 25 million metric tonnes, Nigeria is the largest world producer of white yam [3], and consumer of yam [9]. Nigeria alone produces 70 per cent or 17 million metric tonnes of the world output of white yams. Also the country contributes about 70% (about 31.5 million tonnes) annually of the world food yams. The yam zone of West Africa is restricted peripherally to the forest and savanna areas of Nigeria, Ghana, Cote d'voire, Cameroon, Benin and Togo. [14]. Among the cultivated species of yam, white guinea yam (*Dioscorea rotundata* Poir) is considered to be indigenous to West Africa [5]. Some researchers in yam systematics have even gone a step further to pinpoint the Niger-Benue trough of Nigeria as the centre of domestication for the white guinea yam [10].

In Traditional yam growing areas, the setts of seed yam are planted in mounds especially made at the end of the rainy season before the soil becomes too hard to work on. The yams are planted during the dry season and begin to sprout at the onset of the next rainy season, during which tubers are gradually formed. Stakes are usually provided for the yam vine to climb on; either cut sticks or dried maize and guinea corn stems that have been left in the field for that purpose.

Harvesting of the tubers starts in the middle or later part of the rainy season. In northern parts of Nigeria where yam growing is relatively new, the planting is usually done on ridges, and staking is extremely rare [2].

The yam tuber is prepared in several ways for eating. It could be eaten boiled, roasted, fried, mashed or pounded to provide important energy. The yam tuber can be put to other uses such as a cash/export crop; livestock feed and has cultural values. It could be used in ceremonies such as marriages and funerals [2]. Farmers of old prided themselves in the number of yam tubers in their barns. It was traditionally a demonstration of the success of a farmer. The advent of new yams is a reminder of traditional festivities.

Due to increasing population mainly in the developing countries of Africa, yam production is no longer meeting the aggregate demand. In order to meet annual demand, yam production must increase by 3-4%. At present, yam production is only marginal due to lack of improved and high yielding disease/pest resistant varieties [13], high cost of planting materials, storage losses from infection, low multiplication ratio, high manual labour requirement for weeding, staking and harvesting. Therefore future

increases in yam output will have to rely on higher yield and necessitate that constraints to production be tackled [15]. Since tubers could be eaten boiled, roasted, fried, mashed or pounded to provide important energy, variability in white yam (*Dioscorea rotundata)* is almost the only avenue through which local farmers and consumers can obtain yams of their desired traits.

Since the improvement in the knowledge of the floral biology of yam, many hybrid yam genotypes have been developed. The candidate genotypes have to passed through many evaluation stages including the two year mandatory NCRP (Nationally Coordinated Crop Release Project) trials across all the agro-ecological zones by Scientists, they were further be tested on-farm to provide the end users (the farmers) the opportunity to participate in the varietal selection of superior varieties in terms of yield, quality and agronomic performance.

New bred yam varieties need to be tested on-farm. On-farm trials are an effective way to improve client-orientation of breeding programs by formalizing farmer involvement in the variety testing process [22]. They can also be an important first step in variety dissemination, since data from on-farm trials are usually required for official varietal release, and farmers will be keen to obtain planting materials of varieties that perform well in trials [23]. Standardization of procedures is important for easy and meaningful analysis and presentation of results. However, circumstances, including population density, the presence of organized farmer groups, their previous experience with yam, and budgets can dictate varying approaches to on-farm variety testing. Often there is a mismatch of what the researchers and farmers (end users) consider as the best variety. This probably explains the low adoption rates for some of the research generated varieties and the dominance of farmer varieties in some areas. There are also cases of varieties adopted by farmers having previously been rejected by the breeding programs. On-farm variety testing is aimed to bridge the gap during the variety development [25]. In view of this fact, a systematic investigation into the on farm testing was carried out to address those problems, the study was initiated with the objectives of investigating the effect of the new yam varieties on the farmers, to introduce the yam varieties to users (farmers) – initial step for variety/technology transfer, to test performance of promising yam varieties under farmer growing conditions and researcher-farmer management, to test farmers' acceptance and ranked preference of the varieties for yield and quality attributes (including taste tests),To obtain feedback (in terms of what farmers like in a variety) to breeders and to build farmers' capacity on variety assessment. Therefore the objective of this work is to test the performance of promising varieties under farmer growing conditions and researcher-farmer management, to test farmers' acceptance and ranked preference of the varieties for yield and yield component attributes and culinary quality acceptability among the farmers and to recommend the yam genotypes for official registration and release for commercial production for farmers in Nigeria.

II. Materials and Methods for On-Farm Evaluation

Farmer selection: Individual farmers, farmer groups or farmer field schools were selected on the basis of being well organized, easily accessible, representative of the resource poor and willingness and ability to host yam trials. The trials were planned by the researchers, Agricultural extension staff and lead farmers, and were farmer-researcher managed. The On-farm trials were conducted in 8 locations. Eight varieties, 07/00405, 99/Amo/144, 99/Amo/109, 86/02665, 99/Amo/080, 99/amo/064, TDr98/00933 and TDr03/0058 selected from NCRP were distributed to selected farmers. The farmers were instructed to include the best local variety in that area making it a total of nine varieties that were evaluated. Four farmers were selected per state, and eight states were involved. The ADPs were used to coordinate and supervise the farmers. Each farmer was considered a replicate in each state while the state constituted a trial site. The varieties were evaluated along with the local best in each location for fresh tuber yield, associated agronomic traits such as plant vigour, pests and diseases reactions, tuber yield, tuber shape, tuber flesh colour, early maturity and eating quality.

Seedbed: The farmers selected the sites for the trials. Mounds (about 0.6 - 1.0 m diameter) at 1.0m x 1.0m or ridges 1.0m apart were used depending on the choice of the farmers and gradient of the land. One yam sett weighing 50g were planted on mounds singly, a total of 20 clones and a total of 12 mounds in the middle (net plot) $12m^2$ were harvested for yield data analysis.

Yield data analysis: Analysis of variance was performed on the tuber yield data collected using the SAS GLM procedure (SAS, 1992). Means were separated using standard error On-farm farmers' participatory variety selection in the field.

On each location 10 men and 10 female farmers were invited making a total of 20 farmers to assess the field performance of the hybrid white yam clones in terms of: vegetative growth, reaction of the hybrid white yam genotypes to pests and diseases, tuber yielding ability, assessment of tuber surface skin texture and tuber flesh colour. Each farmer was given 3 different cards each; Green means highly acceptable, Yellow means moderately acceptable while Red means not acceptable/rejected. Each farmer used the different cards to select the trait of each variety he or she accepted or rejected. The cards were secretly put into a ballot bag by each of the farmers. Later the cards were collected, separated into male and female and then counted before converted to percentage. If the mean percentage for the general acceptability of the male and female was above 70%, the variety would be selected as generally accepted genotype(s).

Assessment of Culinary/Eating Quality: Acceptability of the clones when cooked was measured by soliciting for farmers' response based on the following criteria: appearance/colour, taste, flavour, starchiness, fibrousness and poundability. They were asked to give

scores for the above criteria using three different card colours namely Green, Yellow and Red. Green means highly acceptable, Yellow means moderately acceptable/manage while Red means rejection (ie where Red is very poor, Yellow is intermediate). Twenty farmers (10 men farmers and 10 female farmers) per location were selected. The cards for men were clearly marked 'M' while the cards for females were marked 'F'. Each individual farmer was assigned 3 cards to vote secretly on each individual genotype the trait(s) the farmer appreciates in a genotype. After the secret balloting, the ballot bag was collected and separated into male and female. Based on the card colour, mean percentage of men and female that appreciated a particular variety was pooled. If the general acceptability of the genotype in terms of field performance and culinary was 70.0% or above, that variety is deemed to be acceptable by the farmers.

III. Results

The tuber yield performance of the hybrid yam genotypes in farmers' fields are presented in Table I.

Table i: Tuber yield (t/ha) of hybrid white yam genotypes under on-farm pre-release trial in 8 States of Nigeria during 2015 Cropping season

Clones	Abia	Oyo	Niger	Edo	Benue	Nasarawa	Ebonyi	Anambra	**Mean**	**Rank**
07/00405	15.6	17.8	14.7	15.2	19.2	17.2	13.1	18.2	**16.4**	**5**
99/Amo/080	22.7	15.5	16.6	17.8	14.2	16.3	28.5	16.9	**18.6**	**3**
99/Amo/064	24.8	13.6	18.9	12.2	19.2	17.6	14.6	21.9	**17.9**	**4**
98/00933	24.6	15.4	25.8	23.6	39.6	22.6	17.3	15.4	**23.0**	**1**
99/Amo/144	13.7	12.6	14.3	16.5	11.6	18.8	13.6	17.7	**14.9**	**6**
03/0058	21.8	16.4	24.7	17.6	28.2	16.2	37.6	18.7	**22.7**	**2**
99/Amo/109	13.2	4.1	9.1	10.2	8.6	15.1	17.2	16.2	**11.7**	**9**
86/02665	12.4	10.8	11.6	6.2	22.3	12.0	6.8	13.5	**12.0**	**7**
Local best	7.8	7.9	10.5	4.2	13.6	7.9	13.2	9.5	**9.3**	**8**
Mean	**15.73**	**12.02**	**14.6**	**12.5**	**17.2**	**14.5**	**15.9**	**14.5**	**13.8**	
Sig. level	P<0.05	P<0.05	P<0.01	P<0.01	P<0.01	P<0.01	P<0.05	P<0.01		
SED	7.21	6.94	6.52	6.41	5.30	7.13	5.22	6.14		
CV%	18.4	13.63	15.32	11.04	9.81	12.60	13.02	21.73		

There was significant variation in tuber yield of the yam genotypes evaluated on-farm in the various locations (Tables I). In all cases, the candidate clones for release had in most cases out yielded the local best and the national check variety. The yield of the genotypes ranked 1 to 6 performed more than the local best and National check varieties. However, the yam genotype 98/00933 yielded highly in the farmers fields with mean yield of 23.0t/ha and was ranked first, followed by the genotype 03/0058 with mean yield of 22.7t/ha and was ranked second while the least was the genotype 99/Amo/109 with mean yield of 11.7t/ha and was ranked nineth. The growth performance and pests and disease response of the genotypes, as well as tuber skin texture and flesh colour were presented for farmers' to assess and to make their choice by selection of trait(s) that was the best while the crops are still growing in the field at the locations. The "Farmers Participatory Field Evaluation" and selection of the hybrid white yam genotypes and percentages obtained in the varietal selection is presented in Table II and the Summary of the "Farmers Participatory Field Selection" is presented in Table III.

Table ii: Farmers Participatory Field Evaluation of hybrid white yam genotypes and Percentage of Males and Females Responses in Varietal selection

Genotypes	Gender	Assessment of vegetative growth			Assessment of pests and diseases			Assessment of Yielding Ability			Assessment of Skin surface texture			Assessment of Flesh Colour			General acceptability		
		Red	Yellow	Green	Red	yellow	green	Red	Yellow	Green	Red	Yellow	Green	Red	Yellow	green	Red	Yellow	Green
07/00405	M	0	0	10	0	8	2	0	1	9	0	1	9	0	0	10	0	10	40
	F	0	2	8	0	8	2	0	3	7	0	0	10	0	0	10	0	13	37
98/00933	M	0	1	9	0	0	10	0	2	8	0	0	10	10	0	0	10	3	37
	F	0	2	8	0	0	10	2	2	6	0	0	10	3	0	7	5	4	41
99/Amo/080	M	0	0	10	1	2	7	1	0	9	0	0	10	0	2	8	2	4	44
	F	0	1	9	1	2	7	1	1	8	1	3	6	1	2	7	4	9	37
03/0058	M	1	1	8	0	2	8	2	2	6	1	1	8	0	3	7	4	9	37
	F	1	2	7	0	2	8	1	2	7	0	4	6	0	0	10	2	10	38
99/Amo/064	M	0	2	8	0	0	10	0	0	10	1	1	8	0	2	8	1	5	44
	F	0	2	8	1	1	8	0	2	8	0	0	10	1	0	9	2	5	43
89/02665	M	0	1	9	0	1	9	0	2	8	1	1	8	0	0	10	10	5	44
	F	4	4	2	4	2	4	8	1	1	6	2	2	0	5	7	22	14	44
Local best	M	0	0	10	2	2	6	0	0	10	0	2	8	2	0	8	4	4	42
	F	0	0	10	0	2	8	3	0	7	0	2	8	0	5	5	3	9	38
99/Amo/109	M	8	2	0	7	2	1	9	1	0	5	0	5	2	5	3	31	10	9
	F	7	1	1	6	2	2	9	1	1	2	8	0	3	6	1	27	18	5

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Table iii: Summary of Farmers Participatory Field Selection

Genotypes	Gender	Assessment of plant field traits			General acceptability			
		RED	YELLOW	GREEN	% Rejected	% Moderately accepted	% Highly accepted	Mean percentage acceptability
07/00405	Male	0	10	40	0.0	20.0	80.0	
	Female	0	13	37	0.0	26.0	74.0	77.0%
98/00933	Male	10	3	37	20.0	15.0	74.0	
	Female	5	4	41	10.0	8.0	82.0	78.0%
99/Amo/080	Male	2	4	44	4.0	8.0	88.0	
	Female	4	9	37	8.0	18.0	74.0	81.0%
03/0058	Male	4	9	37	8.0	18.0	74.0	
	Female	2	10	38	4.0	20.0	76.0	75.0%
99/Amo/064	Male	1	5	44	2.0	10.0	88.0	
	Female	2	5	43	4.0	10.0	86.0	87.%
89/02665	Male	1	5	44	2.0	10.0	88.0	
	Female	0	6	44	0.0	12.0	88.0	88.0%
Local best	Male	4	4	42	8.0	8.0	84.0	
	Female	3	9	38	6.0	18.0	76.0	80.0%
99/Amo/109	Male	31	10	9	62.0	20.0	18.0	
	Female	27	18	5	54.0	36.0	10.0	14.0

The farmers assessed the hybrid white yam genotypes in terms of vegetative growth, reactions to pests and diseases, and during harvest the following traits were evaluated: the yielding ability, tuber surface skin texture and tuber flesh colour (Table II). The summary of the general acceptability results presented on Table 4 revealed that none of the farmers rejected the genotype 07/00405 hence the zero percent that was scored. However, 80% of the males and 74% of the females accepted the hybrid white yam genotypes. The mean percentage acceptability was 77%, which showed that if the variety were to be released, greater number of the farmers would accept it as variety for commercial cultivation.

When the traits of the genotype 98/00933 was assessed during field performance and at harvest, 20% of the male farmers rejected the genotype, 15% of the male farmers moderately accepted the field performance while 74% of the male farmers highly accepted the field performance. On the other hand, 10% of the female farmers did not appreciate the way the genotype performed in the field, 8% of the female farmers moderately manage the performance, while 82% of the female farmers highly accepted the field performance of the genotypes. The mean percentage acceptability result showed that 78% of the farmers would accept this genotype if it is released as variety for commercial yam cultivation,

The field assessment of the genotype 99/Amo/080 showed that 40% of males farmers rejected the genotype field performance, 8% would manage how it performed in the field while high significant percentage (88%) of the male farmers accepted the genotype field performance. However, 8% of the female farmers rejected the genotypes based on how they performed in the field, 18% of the female farmers would manage the field performance of the genotype while 74% of the female farmers highly accepted the genotype's performance in the field. The mean percentage acceptability revealed that significant number (81%) will accept the crop as a variety if released as a commercial cultivar.

When the field performance of the genotype 03/0058 was evaluated, 8% of the male farmers and 4% of the female farmers rejected the genotype based on how it performed in the field, 18% of the male farmers and 20% of the female farmers claimed that the performance of the crop in the field was manageable/moderate while significant number as high as 75% male farmers and 74% of female farmers appreciated how the crop performed in the field. The mean percentage acceptability showed that as high as 75% of the farmers will accept this crop as a variety if it is released as a commercial variety.

The field assessment of the genotype 99/Amo/064 was carried out by both male and female farmers. Two percent of male farmers and 4% of female farmers rejected how the crop performed in the field, 10% each of male and female farmers claimed they could manage the field performance of the crop while 88% of male and 86% of female farmers highly accepted the way the genotype performed in the field. However, the mean percentage acceptability indicated that 87% of farmers would accept this crop as a variety if released as a commercial variety.

When the variety TDr 89/02665 was evaluated, it was surprised that 2.0% of the male farmers and 0% of the females still reject the variety although being used as the national variety and as a check variety as a result of its yield performance across yam growing belts of the country. Ten percent of the males and 12% of the female farmers appreciated the moderate performance of the genotype in the field. The mean percentage acceptability level which was as high as 88.0% indicated that large number of farmers still accepted its performance in the field.

During the evaluation, the farmers' local best still has its merits and demerits. For instance 8.0% of the male farmers and 6.0% of the female farmers rejected how their variety performed in the field in terms of yield, canopy production, pests and diseases resistance/tolerance plus tuber shape and texture. However 8.0% of the male farmers and 18.0% of the female farmers appreciated the crop's field performance, while 84.0% male and 76.0% female farmers highly appreciated the field performance of their variety. The mean acceptability percentage was 80.0% which indicated that the farmers still like their crop which they have been cultivating for a very long time and get used to it.

The field performance of the genotype 99/Amo/109 by the farmers indicated that 62.0% of the male farmers and

54.0% of the female farmers did not appreciate/rejected how the genotype performed in the field. The percentage of male farmers that moderately accepted the field performance was 20.0% while the female farmers was 36.0%. However, 18.0% of the male farmers and 10.0% of the female farmers accepted how the crop performed in the field. The mean percentage acceptability indicated that if the crop was released to the farmers for cultivation, only 14.0% of the farmers will accept planting the crop.

Farmers' participatory culinary evaluation of the hybrid white yam

Culinary quality such as palatability tests were carried out on the white yam clones in all the 8 locations. Farmers were given cards: Red, Yellow and Green to award points (mark) to cooked samples of the clones based on appearance, taste, flavour, starch and fibre content, and general acceptability. Red means very bad, Yellow means intermediate/manage, while Green means very good. The results of the Farmers participatory evaluation of culinary quality are presented in Table IV and the summary of the result is presented in Table V.

Table IV: Farmers participatory evaluation of culinary quality

Genotypes	Gender	Assessment of cooked appearance			Assessment of cooked Taste			Assessment of starchiness			Assessment of fibrousness			Assessment of cooked Tenderness			Overall Acceptability		
		Red	Yellow	Green	Red	Yellow	Green	Red	Yellow	Green	Red	yellow	Green	Red	Yellow	Green	Red	Yellow	Green
07/00405	M	5	0	5	0	0	10	0	0	10	0	0	10	0	0	10	5	0	45
	F	0	0	10	0	0	10	0	0	10	0	0	10	0	0	10	0	0	50
98/00933	M	4	0	6	2	0	8	0	0	10	0	0	10	0	0	10	6	0	44
	F	0	2	8	0	2	8	0	0	10	0	0	10	0	0	10	0	4	46
99/Amo/080	M	0	1	9	1	1	8	0	0	10	0	0	10	0	0	10	1	2	47
	F	0	1	9	0	1	9	0	0	10	0	0	10	0	0	10	0	2	48
03/0058	M	0	0	10	0	0	10	1	1	8	0	0	10	0	1	9	12	21	47
	F	0	0	10	0	0	10	1	0	9	0	1	9	1	0	9			47
99/Amo/064	M	1	0	9	0	0	10	0	1	9	0	0	10	0	0	10	10	10	48
	F	0	0	10	0	0	10	0	0	10	0	0	10	0	0	10			50
89/02665	M	0	0	10	0	2	8	0	1	9	0	1	9	0	0	10	02	43	46
	F	0	0	10	0	1	9	0	0	10	2	0	8	0	2	8			45
Local best	M	0	0	10	1	0	9	0	0	10	0	0	10	2	2	6	32	211	45
	F	0	0	10	0	2	8	2	6	2	0	0	10	0	3	7			37
99/Amo/109	M	1	1	8	0	2	9	3	2	5	2	0	7	2	0	8	8	5	37
	F	0	2	8	1	2	7	0	1	9	2	2	6	1	2	7	4	9	37

Note: M = Male, F = Female

Table v: Summary of Culinary Result

		Assessment of culinary characteristics			General acceptability			
Genotypes	Gender	RED	YELLOW	GREEN	% Rejected	% Moderately accepted	% Highly accepted	Mean percentage acceptability
07/00405	Male	5	0	45	10.0	0.0	90.0	
	Female	0	0	50	0.0	00	100.0	95.0%
98/00933	Male	6	0	44	12.0	0.0	88.0	
	Ffemale	0	4	46	0.0	8.0.	92.0	90.0
99/Amo/080	Male	1	2	47	2.0	4.0	94.0	
	Female	0	2	48	0.0	4.0	96.0	95.0%
03/0058	Male	1	2	47	2.0	4.0	94.0	
	Female	2	1	47	4.0	2.0	94.0	94.0%
99/Amo/064	Male	1	1	48	2.0	2.0	96.0	
	Female	0	0	50	0.0	0.0	100.0	98.0%
89/02665	Male	0	4	46	0.0	8.0	92.0	
	Female	2	3	45	4.0	6.0	90.0	91.0
Local best	Male	3	2	45	6.0	4.0	90.0	
	Female	2	11	37	4.0	22.0	74.0	82.0
99/Amo/109	Male	8	5	37	16.0	10.0	74.0	
	Female	4	9	37	8.0	18.0	74.0	74.0

The summary result of the culinary evaluation indicated that 10.0% of male and 0.0% of female farmers rejected the palatability test of the genotype 07/00405 while significant number of male farmers (up to 90.0%) and female farmers (100.0%) accepted the taste and food quality of the genotype. However, the over all mean percentage acceptability indicated that significant number

of farmers (95.0%) highly accepted the food quality of the genotype.

The food quality of the genotype 98/00933 was also evaluated, 12.0% of the males and 0.0% of the female farmers did not appreciate the food quality of the genotype. Zero percent of the male and 8.0% of the female farmers accepted moderate taste of the food quality while 92.0%% of the male and 94.0% of the female farmers highly accepted the food quality of the genotype. However, 90.0% of the male and female in the mean percent acceptability appreciated the food quality of the genotype.

The culinary evaluation was carried on the genotype 99/Amo/080, 2.0% of the males and 0.0% of the female farmers rejected the food and taste quality of the genotype, 4.0% each of the male and female farmers appreciated the food quality and taste moderately. Nevertheless high percent of male (94.0%) and female (96.0%) farmers highly accepted the food quality and taste test of the genotype. The mean percentage acceptability indicated that 95.0% of both male and female farmers highly accepted the food quality of the genotype.

When the assessment of the culinary quality of the food products from the genotype 03/0058 was carried out, 2.0% male and 4.0% female farmers rejected the food quality. Also, 4.0% male and 2.0% female farmers claimed they would manage the food quality of the genotype. However 94.0% each of the male and female farmers highly accepted the food quality from the genotype. The mean percentage acceptability of 94.0% indicated that both male and female farmers accepted the food quality of the genotype.

The genotype 99/Amo/064 culinary quality was evaluated, 2.0% male farmers and 0.0% female farmers rejected the food quality of the genotype while 2.0% and 0.0% of males and female farmers respectively claimed they could manage the food quality from the genotype. Ninety six percent (96.0%) of the male farmers and 100.0% of the female farmers highly accepted the food quality of the genotype. The mean percentage acceptability of 98.0% was an indication that both male and female farmers accepted the food quality of this genotype.

The culinary test of the check variety TDr98/02665 revealed that 0.0% of the males and 4.0% of the female farmers rejected the food quality of the genotype. However, 8.0% of the male and 6.0% of the female farmers respectively still managed the food quality of this genotype. Ninety-two percent (92.0%) male and 90.0% female farmers highly accepted the food taste of the genotypes. The mean percentage acceptability of 91.0% indicted that both male and female farmers still adopt this variety as their crop.

Six percent (6.0%) of male farmers and 4.0% of the female farmers still do not like the food products from their local variety. Four percent (4.0%) of male farmers and 22.0% of the female farmers continued to manage the food quality from the local best. Ninety percent (90.0%) of the males and 74.0% of the female farmers highly accepted the taste quality from their local best. The significant high percentage of 82.0% of both male and female farmers is still attached to their local crop.

The farmers' participatory evaluation of the culinary quality of the genotype 99 Amo/109 as presented in Tables iv and v showed that 16.0% of the male farmers and 8.0% of the female farmers who consumed the yam genotype did not like it. The 10.0% of the male farmers and 18.0% of the female farmers moderately accepted the culinary quality of the genotype. However, 74.0% of the male farmers and 74.0% of the female farmers highly accepted the culinary quality of the genotype. The mean percentage acceptability of the culinary quality indicated that if the genotype were to be released as a variety, 74.0% of both male and female farmers would cultivate it as a result of the genotype's culinary quality. The candidate clones were among the clones that had moderate to high acceptance among the farmers and consumers.

At the end of the exercise, respondents were asked to compare the clones using pair-wise ranking to select 5 top best yam genotypes for release to farmers for cultivation. The following hybrid yam genotypes were selected: 07/00405, 98/00933, 99/Amo/080, 03/0058 and 99/Amo/064.

IV. Discussion

On-farm trials is one of the challenges in plant breeding and other experiments with plants. Testing for crops behaviour in farmers' fields with farmers across multiple environments is therefore a standard procedure in plant breeding as well as other experiments [16]. The outcome of these experiments is data sets from multiple environments, and these need to be analyzed using descriptive statistical methods that allows the scientist to draw conclusions relating to genotypes that farmers appreciated most [20].

On-farm variety testing during the variety development is the only way farmers and and other end-users are allowed to make the choice of selecting varieties of their choice on which to adopt for cultivation. Often, there is a mismatch of what the researchers and farmers (end users) consider as the best variety [11]. When farmers are forced to accept variety which is not their choice, this probably explains the low adoption rates for some of the research generated varieties and the dominance of farmer varieties in some areas. There are also cases of varieties adopted by farmers which was previously been rejected by the breeding programs [21]. The high mean percentage of acceptability in of the genotypes performance in farmers' field and high mean acceptability of the culinary quality was an indication that the farmers would accept and adopt those genotypes if they are released as varieties. Any of the genotypes with low mean percentage acceptability indicated that farmers would not accept it since they have found reasons for rejecting it despite their good quality [6]. The genotype 99/Amo/109 had low field performance and based on this, only 14.0% of the farmers accepted it. Therefore, if released by the breeding programme, low number of farmers would accept it for cultivation. Although, the variety had good culinary quality which

made a staggering 74.0% of farmers to appreciate it. Its low field performance may be bases for rejection by farmers. High yielding genotypes are farmers most sort attributes [8].

Overall Acceptability of the Candidate clones was above 70.0%. However, the national Check and farmers' local best still scored above 70.0% an indication that they still like the qualities of the national check and that of their local best being a cultivar they have known for a long time [16].

According to [16], to meet the quality needs of pre-release hybrid yams, there is needs to take into account the farmers and consumers preferences when developing and selecting yam varieties and in most cases this can be addressed through participatory variety selection. The attributes considered most important by farmers and consumers were identified and ranked by the farmers themselves.

V. Conclusion

The performance of these genotypes in farmers' field and the culinary evaluation by the farmers/consumers indicated that these genotypes could be appreciated by the farmers. However, the farmers overall field and culinary evaluation indicated that farmers' choice for adoption was the following varieties: 07/00405, 98/00933, 99/Amo/080, 03/0058 and 99/Amo/064.

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