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ASSESSMENT OF BITTER YAM (*Dioscorea dumentorum* [KUNTH] PAX) PRODUCTION IN OYO STATE, NIGERIA

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ABSTRACT

Production of bitter yam (*Discoreae dumentorum* [Kunth.] Pax) is low in Oyo State, Nigeria. Two varieties are mainly cultivated, but there is limited information on factors responsible for low production and varietal preferences among farmers. This study investigated the demography, farming practices and differential proximate compositions as probable causes of low production of bitter yam in Oyo State. One hundred and twenty (120) copies of structured questionnaire were administered to selected respondents. Multistage sampling was used in selecting respondents in Oyo state from local government areas constituting four agricultural zones and 12 villages to collect demographic, production-related information, and constraints to production. Data were analyzed using descriptive statistics as well as analysis of variance (ANOVA). The result revealed that although bitter yam cultivation in Oyo state was male dominated (70%), majority of the farmers were old (57%), married (72%) and poorly educated (55%). Its production was for subsistence, and it was mainly grown in intercrop with other yam species. Ranked production constraints indicated poor marketability as the most extremely severe constraint, followed by labour unavailability and storage inadequacies. White bitter yam variety with superior basic proximate composition than Yellow Yam was preferred for cultivation. Subsistence production of bitter yam in Oyo state could be up-scaled through government intervention via farmer-centered education and public awareness and provision of infrastructure to facilitate cultivation, transportation, and storage.

Keywords: Production constraints; proximate composition; conservation

INTRODUCTION

Yam is a starchy staple component of Nigerian's diet. It is so important that new yam festivals are celebrated in many traditional communities in the country, including marriage ceremonies. It symbolizes fertility in the culture of nation (IITA, 2023). Among edible yams in Nigeria and whole of West Africa is bitter yam or trifoliate yam, a monocotyledonous crop (Afoakwa and Sefa-Dedeh, 2001; Medoua *et al.*, 2005). Bitter yam (*Dioscorea dumentorum*) is a high yielding edible yam species in Nigeria out of some 600 species identified in various

parts of the world (Agbor-Egbe and Treche, 1995; Jayakody *et al.*, 2007; IITA, 2017; Iwuchukwu and Okwor, 2017).

Production of bitter yam in many communities in Nigeria is linked primarily to consumption (Adeigbe *et al.*, 2015), especially for sustenance, cultural affiliation. In Ojoto and many Igbo-speaking communities of eastern Nigeria, bitter yam is regarded as food for adults (Egbuonu *et al.*, 2014). Afoakwa and Sefa-Dedeh (2001) reported that bitter yam is the most nutritious of the commonly consumed yam species, with fairly high protein content and a well-balanced amino acid. Martin and Degras (1978) reported that bitter yam is not widely distributed because of the inferior quality of the tubers.

However, despite its high nutritional, medicinal and potential industrial uses, it is not widely cultivated (Coursey, 1967; Martin *et al.*, 1983, Iwuchukwu and Okwor, 2017). In southwest Nigeria, there are two well-known cultivars of bitter yam (yellow and white varieties - TDd yellow and TDd 3100 respectively). However, production and importance of various varieties of bitter yam are not fully documented compared to other species of edible yams in Nigeria. It is scarce in markets and there is dearth of information on factors that affects its production, particularly in Oyo state, which is known to be a main food hub of southwest Nigeria. Therefore, this study was designed to generally assess factors that may contribute to production of bitter yam in Oyo State. Specifically, the objectives of the study were to evaluate the demography of farmers in four local governments in Oyo State where bitter yam is produced; determine constraints to production of bitter yam in the four local governments; and compare proximate composition of two main varieties of bitter yam (yellow and white varieties) mainly cultivated in the four local government areas.

METHODOLOGY

Description of Study Area

The study was conducted in four agrarian Local Government Areas (Surulere, Ona-ara, Oorelope and Afijio) of Oyo State, Nigeria. The local governments are among the rural areas that constitute the food basket of Oyo State. The State has a landmass of 32,249.10 km^2 out of which 27,107.93 km^2 is cultivable, representing 84.1% of its total landmass (OYSADEP, 2001). The total population of Oyo State as at 2006 was 5,580,894, with Surulere, Ona-ara, Oorelope and Afijio local government areas having populations of 140,339; 265,571; 104,004; and 132,184 respectively and contributed 16.4% to the entire population of the State (NPC, 2006). The projection of populations of the four local government areas by 2022 was 917,600 persons (NPC 2006). Crops grown in the study area include yams, maize, cassava, millet, plantain, tobacco, cocoa, oil palm, kola nuts, and several fruits (Daud *et al.*, 2018).

Sampling Procedure

Multistage sampling procedure was employed in the selection of respondents in each of the agrarian local government areas. The stages included State level, where one local government was randomly selected in each of the four agricultural zones. The LGAs are Ona-Ara LGA in Ibadan/Ibarapa zone, Surulere LGA in Ogbomosho zone, Afijio LGA in Oyo zone, and Oorelope LGA in Shaki zone. In the second stage, three villages were purposively selected in each of these LGAs, based on reports of extension workers on bitter yam

cultivation. In all, a total of 12 villages were used for the study (Table 1). In the third stage of sampling, 30 respondents were selected in each LGA to make a total of 120 respondents for the study.

Data Collection

Key variable assessed in the study were demography of bitter yam farmers, their socio-economic attributes, extent of bitter yam production, constraints to bitter yam production (ranked on a scale of 1 to 6, 1 being most severe and 6 being least severe), preference for a particular variety of bitter yam against the other yams. These were assessed using a validated structured questionnaire. The proximate characteristics of the two bitter yam varieties that may influence differences in preference for production and consumption was also assessed.

Table 1: Sampling locations and sample size

Zones	LGAs	Villages	Number of Respondents
Ogbomosho	Surulere	Atapa	10
Ogbomosho	Surulere	Iwofin	10
Ogbomosho	Surulere	Kere	10
Shaki	Oorelope	Igbeti	10
Shaki	Oorelope	Igboho	10
Shaki	Oorelope	Igbope	10
Oyo	Afijio	Fiditi	10
Oyo	Afijio	Jobele	10
Oyo	Afijio	Iware	10
Ibadan/Ibarapa	Ona-ara	Olubode	10
Ibadan/Ibarapa	Ona-ara	Ogunbode	10
Ibadan/Ibarapa	Ona-ara	Olorisa	10

Proximate Composition Analysis

Two varieties of bitter yam tubers (TDd Yellow and TDd 3100) were obtained from International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria and subjected to proximate composition analysis. Samples were rinsed with distilled water, cut into small chips and oven-dried at 40°C for 48 hours, before being homogenized into fine powder using a laboratory grinder. The two powders were labeled Y and W for TDd Yellow and TDd 3100 respectively. Proximate compositions were determined at Kappa Biotechnology laboratory, Bodija, Ibadan, Oyo State, Nigeria.

Moisture, ash, crude fat and crude fibre were determined following the official methods of the association of official analytical chemists (AOAC, 1999). Crude protein was determined by converting percentage of nitrogen obtained from the micro-kjeldahl method (Pearson, 1976) to crude protein by multiplying by 6.25. Carbohydrate was determined deducting the percentage Nitrogen value.

Plate 1: Tubers and tissue colours of white (A) and yellow (B) (TDd 3100 and TDd Yellow) varieties of bitter yam

Data Analysis

All data obtained from respondents on demography, socioeconomic, bitter yam production and preference for a particular variety were analysed with descriptive statistics using SPSS software (Version 20.0). Proximate composition values of the two varieties of bitter yam were analysed using Analysis of Variance (ANOVA). Fisher's LSD Post hoc test was carried out to separate the means that were significantly different at 0.05 level of probability.

RESULTS

The respondents involved in bitter yam production in the study area were mainly males (70%) comprising of both young adults and aged persons. The least age of respondents was 21 years, with 31% of them within age range of 51 to 60 years. Aged rural dwellers (51 years and above) were mostly involved in bitter yam production accounting for 58% of the respondents. Majority of the respondents were married (72%), with large household sizes. Respondents with 5-7 household size constituted 33% of the sample, while those with 8-10 household size constituted 28% (Table 1). Many of the respondents were illiterate or with a low level of education.

The yam is mostly intercropped with other crops of interest, such as white yam and water yam. Its cultivation by the respondents was mostly for subsistence (Table 2). The proportion of respondents who preferred to cultivate white bitter yam variety was 48%, while those who preferred to cultivate yellow bitter yam variety was lower (25%), Only 27% of respondents preferred to cultivate varieties. Constraints facing productivity of bitter yam are multifaceted (Table 3). However, the major constraints associated with declining bitter yam production in the study area in order of severity were poor marketability (1) unavailability of labour (2), insufficient storage facility (2), poor transportation system (4), insufficient planting materials (5), and lack of government support (6).

Table 1: Distribution of the respondents based on socioeconomic characteristics

Variables	Frequency	Percent
Gender		
Male	82	70
Female	36	30
Age		
21-30	12	10
31-40	17	14
41-50	21	18
51-60	36	31
61-70	24	20
>70	8	7
Marital Status		
Married	84	72
Single	6	5
Divorced	10	9
Widow/Widower	17	14
Family Size		
2-4	29	25
5-7	39	33
8-10	33	28
>10	16	13
Educational Level		
Non-Formal	65	55
Pry School	29	25
Sec School	14	12
Higher Institution	10	9

Table 2: Distribution of the respondents based on farming system, other crops cultivated and purpose of bitter yam cultivation in Oyo State, Nigeria

Variables	Frequency	Percentage
Bitter yam variety grown		
Yellow	30	25
White	57	48
Yellow and White	31	27
Farming system		
Monocropping	7	6
Intercropping	111	94
Main crop grown with bitter yam		
White Yam	51	48
Yellow Yam	18	17
Water Yam	5	5
Cassava	22	21
Tomatoes	2	2
Maize	8	8
Purpose for cultivation		
Consumption only	66	56
Consumption and Sale	49	42
Sale only	3	2

Table 3: Distribution of the respondents based on constraints to bitter yam cultivation in Oyo State, Nigeria

Factors	Mild Constraint	Severe Constraint	Very severe constraint	Rank
Labour unavailability	28	37	9	2
Poor marketability	8	19	41	1
Lack of government support	17	5	10	6
Insufficient storage facility	30	53	7	2
Poor transportation system	32	9	15	4
Insufficient planting materials	22	20	4	5

Rank: 1 = Greatest constraint; 6 = Least constraint

This study revealed varying amounts of various proximate chemicals in the two bitter yam varieties. Moisture contents and crude fibres in yellow bitter yam (TDd yellow) were not significantly different from that of white bitter yam (TDd 3100) (Table 4). Other proximate parameters were however significantly different. TDd yellow contained 7.90% protein, which is higher than what was obtained in TDd 3100. Likewise, ash and carbohydrate contents of TDd yellow variety were significantly higher in the yellow variety than in the white variety. White bitter yam (TDd 3100) contained a higher proportion (0.93±0.06%) of ether extract, carbohydrate (79.80±0.10%) and ascorbic acid (9.77±0.15 mg/100g).

Table 4: Proximate analysis of TDd Yellow and TDd 3100 varieties of bitter yam

Parameters	TDd Yellow ± S.E.	TDd 3100 ± S.E.	LSD (p<=0.05)
Moisture %	8.57±0.15	8.37±0.15	0.35
Protein %	7.90±0.10	7.07±0.06	0.19*
Ether Extract (Fat) %	0.67±0.15	0.93±0.06	0.26
Ash %	1.77±0.15	1.53±0.12	0.21*
Crude Fibre %	1.30±0.10	1.47±0.06	0.19
Carbohydrate (%)	80.63±0.32	79.80±0.10	0.54*
Ascorbic Acid (mg/100g)	8.37±0.15	9.77±0.15	0.35*

* = Significant differences exist between the parameter values of the two varieties of bitter yam. LSD (P<0.05) = Least significant difference at 5% level of probability. S.E. = standard error

DISCUSSION

Bitter yam production in Oyo State is threatened by a number of demographic and socioeconomic factors. On the demographic side, aged people are mostly involved in its cultivation, with the contribution of young people (not less than 21 years old) being small. Old people would not be able to cultivate large farms. The farmers are mostly with non-formal education. This means that they might not be able to tap into conventional methods of cultivation and information on its improvements. It may also impede their access to information and advances in technical know-how of bitter yam production, such as improved varieties, alternative sources of planting and advanced propagating forms. Yellow variety was lower in cultivation than White variety in Oyo State. The level of bitter yam production was low in the study area because it could not possibly hold large farmlands. This is in corroboration of the findings of FAO (2014) that yam is produced in Africa by small-holder

farmers. The old aging population of bitter yam farmers signifies that the future of agriculture and specifically bitter yam production is bleak in the study area, since old farmers may not be energetic to carry out strenuous tasks associated with its production, which Iwuchukwu and Onwubuya (2012) warned about. Bitter yam production in the study area was mainly done by males. The higher proportion of males to females in bitter yam production lend credence to Torimiro and Oluborode (2006) who reported that farming occupation in rural areas is dominated by male gender as a mean of livelihood and also in agreement with Chukwu and Ikwelle (2000) who reported that yam is a specific crop of men; women's participation in its cultivation is marginal. The study also showed that most of the respondents preferred white bitter yam production to yellow bitter yam. This may be demand-driven since consumers may prefer a more energy-yielding and more palatable variety from a proximate composition point of view. The white variety had higher carbohydrate, ether extract and ascorbic acid, which determines derivable energy and taste. The cultivation was also constrained by poor marketability of bitter yams, labour unavailability, and inadequate storage facilities, which explains why bitter yam is cultivated at subsistence level in the Oyo State.

The findings of this study apart from identifying more constraints that are specific to bitter yam producing areas in Oyo State, they are consistent with some of the constraints identified in other producing areas of Nigeria, such as drudgery associated with intensive labour demand in Enugu State, Nigeria (Iwuchukwu and Okwor, 2017), poor organization of market and the hardening phenomenon in storage that Fabienne *et al.* (2020) identified in Benin, and according to Verter (2015), an unconducive environment and investment climate that should necessitate the Nigerian government to subsidize farm inputs and provide affordable loans to smallholder yam farmers for a sustainable production.

CONCLUSION

Bitter yam production in Oyo State is mainly at a subsistence scale. The production of bitter yam in Oyo State is affected by demography of farmers, their education level, socioeconomic status, and proximate composition-driven demand between TDd 3100 and TDd yellow varieties, apart from infrastructural and market-related constraints. These factors would continue to worsen the production outlook for bitter yam in Oyo State, unless quick actions are taken to address the underlying factors revealed in this study. Therefore, it is recommended that government should design specific programmes that would encourage higher cultivation, irrespective of varietal type by providing incentives in the form of planting materials, good roads and support for storage facility through the auspices of Root and Tuber Research Institute of Nigeria and Oyo State Agricultural Development Agency. Bitter yam farmers could be organized into cooperatives and be encouraged to produce for industrial and international markets. The government should ensure efficient extension services in the study area by organizing workshops and training on nutritive potentials of bitter yam. These will encourage large scale production. The cultivation of the two varieties, being comparatively nutritious, should be encouraged.

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