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Dynamics of trifoliate yam (*Dioscorea dumentorum*) production in Enugu State, Nigeria

Abstract

Trifoliate yam (*Dioscorea dumentorum*) is one of the under-utilized species of yam with little or no research and industrial application in spite of its enormous potentials. In view of the possibility of loosing the crop in the universe especially in the study area, if the current situation is not reversed, the study was carried out to assess dynamics of trifoliate yam production in Enugu State, Nig. Data were collected from 108 trifoliate yam farmers that constituted sample for the study. Mean score, standard deviation, Pearson correlation and factor analysis were used in analysing the data. Results on dynamics 0f production show that mean size of land allocated to trifoliate yam production was relatively steady, mean cost of input and income were increasing while mean output was decreasing within the years under consideration (before 2001 to 2014). Years of experience in trifoliate yam production (0.254; p≤0.008), farm size (0.364; p≤0.000) and portion of farmland cultivated with trifoliate yam (50.421; p≤0.000) were determinants of trifoliate yam production. Serving as a staple food (M=2.29) and promotion of good health were perceived ae importance of trifoliate yam while, Technical/land, institutional/infrastructural and economic/physical problems were extracted as causes of decline in trifoliate yam production in the area. The study therefore recommends that favourable land ownership policy/law that will allow farmers to acquire land for agricultural purpose should be enacted and implemented by government while awareness campaign on the potentials of trifoliate yam should be carried out by extension agencies in order to boost the interest of the masses in production, consumption and industrial utilisation of the crop.

Key words: Dynamics trifoliate yam production Enugu State Nigeria

Introduction

Yam (*Discorea Spp*) is an important agricultural crop in Nigeria, though its importance in the diets of the various tribes in the country varies (Abiodun and Akinoso, 2014). Nigeria is by far the world's largest producer of yams, accounting for over 70% of the world production(Ukpabi and Akobumdu, 2015).There are over 600 species of yam worldwide but six species can be considered as the edible ones in the tropics. These are white yam (*Dioscorea rotundata*) yellow yam (*D. cayenensis*), water yam (*D. alata*), trifoliate yam (*D. dumentorum*), arial yam (*D. bulbifera*) and Chinese yam (*D. esculenta*) (Idumah, Owombo and Ighodaro 2014).

Trifoliate yam *(Dioscorea dumetorum)* as one of the species in the genus Dioscorea has other common names as African bitter yam, wild yellow yam, trifoliate (three-leaved) yam and cluster yam. Bitter (trifoliate) yam is known as 'ji una' or 'ji ona' in Ojoto and many Igbo speaking area in the south-eastern Nigeria, where it is regarded as food for the adult (Egbuonu, Nzewi and Egbuonu, 2014). It can also be used as a vegetable, but not

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pounded into 'fufu'. Owing to its soft texture, it is favoured by old people with poor teeth. The wild forms are regarded as famine food.

Being a high yielding and cheaper crop, it could serve as raw materials for food formulation. The dried tubers can be used in breweries as a base for the preparation of beer . The tubers of trifoliate yam, when properly processed like some other yams, can be used in the production of yam flakes; instant flour for the bakery sector or starch in diverse pharmaceutical preparations (Ukpabi, 2010). Bitter yam serves as food of choice for the diabetic patients and as herb for the treatment of various ailments. In the South-western Nigeria, bitter yam is utilized in the treatment of malaria (Dike, Obembe and Adebiyi, 2012), suggesting a widespread ethno-medicinal importance of bitter yam. Yet it remains an underutilized tropical tuber (Owuamanam, Iwuoha, Onuegbu, Ogueke and . Nwosu, 2013) that may be driven into extinction in no distant future

A research in Enugu North agricultural zone of Enugu state by Iwuchukwu and Onwubuya (2012) shows that average yield (kg/ha) of *D. Dumetorum* for 2006, 2007 and 2008 were 22,337kg/ha; 19,563kg/ha and 17,800kg/ha respectively These data obviously suggests decrease in *D. dumetorum* production in the area. Certain factors like high costs of planting material and labour, decreasing soil fertility, inadequate yield potential of varieties, as well as increasing levels of field and storage pests and diseases associated with intensification of cultivation (International Institute for Tropical Agriculture (IITA), 2013) might be responsible for the decline. Personal, social, economic, institutional factors such as age ,educational level, sex, ownership of farmland, farming experience, farm input, extension contacts etc may also have direct or indirect relationship with this decline.

There is also limited information on the use of flours from trifoliate yam in food industries and at household levels in Nigeria. This could probably be due to lack of information on the usefulness and importance of the flours for functional food products(Abiodun and, Akinoso 2014). In line with this fact Onuegbu, Iwuoha, Onwuamanam and Ihediohamma, (2011) reported that so far the yam has found no industrial application. Worst also, the crop is yet to attract adequate research interest in its production, consumption and in tapping the potentials of this crop.

Hence, there is need to investigate on this under-utilized species of yam. This will be useful in boosting the potential uses of the tuber in the food, animal feed and cosmetic or

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pharmaceutical industries. Additionally, increased study on *Dioscorea dumetorum* could add to the likelihood of exploitation of the specie as an economic plant and bring about further work on its cultivation (Ezeocha, Ojimelukwe, and Onwuka. 2012) in order to reap the benefits of this crop and retain it in the universe. In view of the afore mentioned facts, the study examined dynamics of trifoliate yam production in Enugu State, Nigeria. Specifically, the study:

i described socio-economic characteristics of trifoliate yam farmers in the study area;

ii described their production trend ;

iii ascertained determinants of output of these farmers;

iv ascertained potentials/uses of trifoliate yam and

v ascertained causes of decline in trifoliate yam production in the area.

Methodology

The study was carried out in Enugu State, Nigeria. Enugu State is one of the states in the Eastern part of Nigeria. The state shares borders with Abia State and Imo State in the south, Ebonyi State in the east, Benue State in the northeast, Kogi State in the northwest and Anambra State in the west. The state is made up of seventeen (17) Local Government Areas and six agricultural zones.

Enugu is located in a tropical rain forest zone with two distinct seasons of rainy and dry seasons The average annual rainfall is about 2,000 mm. The State had a population of 3,267,837 people at the Census held in 2006. Economically, the state is predominantly rural and agrarian. Major crops cultivated include, cassava, yam, cocoyam, vegetables, oil palm, rice etc. while major livestock reared are poultry, sheep, goat and cattle. (Ozor and Nnaji, 2010).

Population and Sample

Trifoliate yam farmers in Enugu State constituted the population for the study. A multi-stage sampling technique (Ladele and Chah,2015) was employed in selecting the respondents as follows;

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Stage one: from the six agricultural zones in the state, three zones namely Udi, Enugu Ezike and Nsukka, were purposively selected because of their involvement in trifoliate yam production.

Stage two: two blocks where trifoliate yam were mostly produced were purposively selected from each of the zones giving a total of six blocks for the study.

Stage three: from each of the selected blocks three cells where trifoliate yam farmers can be mostly found were purposively selected giving a total of eighteen circles for the study.

Stage four: from each of the circles, six trifoliate yam farmers were purposively selected giving a total of one hundred and eight (108) respondents for the study.

Data for the study were collected from the respondents through the use of well structured and validated interview schedule. It contained relevant questions based on each of the objectives of the study. Data were collected on age, sex, marital status, educational level: and years spent in acquiring formal education, years of farming experience, years of experience in trifoliate yam production, household size and monthly income. In order to assess trend in production of trifoliate yam, respondents were requested to estimate size of farmland they allocated/cultivated with trifoliate yam (in hectare), cost of input (in Naira), output (in kg) and income (in Naira) realized from the product (trifoliate yam) before 2001, 2001 to 2007 and 2008 to 2014.

A list of possible potentials/ uses of trifoliate yam was provided while the respondents were also requested to include other potentials/uses of trifoliate yam that were not in the list. Further, they rated the extent they perceive them as potentials/uses of trifoliate yam on a four point Likert-type scale of “to a great extent, to a moderate extent, to a little extent, and to no extent”, with nominal values of “3, 2, 1 and 0” respectively. These values were added to obtain 6, which was further divided by four to obtain 1.5 that is the mean and decision point. Variables with mean scores greater than or equal to 1.5 were regarded as potentials/uses of trifoliate yam while variables with mean scores less than 1.5 were regarded otherwise.

Causes of decline in trifoliate yam production were captured using a three point Likert-type scale of “to a large extent, to a little extent and to no extent”, with nominal values of “2, 1 and 0” respectively. Respondents were requested to rate the causes using the scale mentioned above. Data generated were further subjected to factor analysis.

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Percentage, mean score standard deviation, Pearson correlation(Agwu and Egbule, 2015) ppand factor analysis (varimax rotation and Kaiser Normalization where a variable with a loading of 0.4 and above is considered as having a high loading and may be used in naming a factor) were used in data analysis.

Results and discussions

Socioeconomic characteristics of the respondents

Sex and age

Greater proportion (66.7%) of the respondents were males while 33.3% were females (Table 1). The domination of male respondents in this study may be derived from the fact that traditionally in most rural communities of Nigeria, yam (including trifoliate yam) is an economic and gender stereotypic crop. Yam requires fertile land, nutrients as well as time and energy because of drudgery (staking, several weeding operations, harvesting etc) associated with its production. Women who are weaker sex d are already engaged in domestic chores may not cope with these laborious activities coupled with the fact that they lack access to credit, inputs and extension services, as well as landownership and rights which limit their agricultural production (The Guardian, 2016). Hence, men anchor yam production and it is regarded as men's crop.

Entries in Table 1 further show that 29.7% of the respondents were between 41 and 50 years, 27% were above 60 years while 16.7% were between 31 and 40 years. The mean age of the respondents was about 54 years implying that these respondents were fairly old people. These aging farmers in trifoliate yam production implies that the future of agriculture and specifically trifoliate yam production in the area is bleak because there will be reduced rates of productivity and a loss of competitiveness for the sector in the future.. Old farmers may not be energetic to carry out strenuous tasks associated with trifoliate yam production and even expand their trifoliate yam farm for more output and yield. In line with this, a study that examined the perception of farmers as to the effects of ageing on their involvement in agricultural activities concluded a significant difference in their level of involvement in all the agricultural activities examined for the two periods. (Fasina, 2013). Also, if younger farmers or successors are not groomed in trifoliate yam production, the conservation and availability of the crop in the universe may not be guaranteed,

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Marital status and Household size

Table 1 further shows that majority (89.8%) of the respondents were married while about 70% of them had household size of 6 to10 persons. Mean household size of the respondents was about 7persons. The higher percentage of married farmers in trifoliate yam production and relatively large household size of the respondents are common among rural households in Nigeria. The importance of these features lies on the fact that they lead to increase in human population which in turn provides cheap labour for manual agriculture that characterize agriculture in developing countries. In congruence, Abu and Soom (2016) posited that number of persons in the household is the source of family labour to work on the farm. Hence easy access to cheap family labour reduces cost of labour and production, and increases food production /productivity.

Educational level

Table 1 also indicates that 30.6% of the respondents completed primary education, 23.1% attempted primary education, 17.6% attempted secondary education while 15.7% had no formal education. The mean number of years spent in acquiring formal education was about seven (7) years. Thus, 84.3% of the respondents may be said to be literate but at different levels. Education is important in the improvement of agricultural productivity such that formal education opens the mind of the farmer to knowledge, non- formal education gives the farmer hands- on training and better methods of farming and informal education keeps the farmer abreast with changing innovations and ideas and allows farmer to share experience gained (Oduro-Ofori , Aboagye and Acquaye, 2014). It is also a precondition for adoption and diffusion of innovation. Therefore, trifoliate yam farmers that are educated are more likely to access, experiment and adopt useful innovation that will help to boost trifoliate yam production.

Farming experience and years of experience in trifoliate yam production

Forty eight percent of the respondents had 21 to 40 years of experience in farming, 30.4% had 41- 60 years while their mean years of experience in farming was about 38 years (Table,1) . Table 1 also shows that 49% of the respondents had 21 to 40 years of experience in trifoliate yam production, 23% had 1 – 20 years of experience, 22.2% had 41 – 60 years of experience in trifoliate yam production while their mean years of experience in trifoliate yam production was about 34 years. The findings suggest that the respondents moved into

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trifoliate yam production after four years of engagement in agriculture. They also had quite a long years of experience in trifoliate yam production specifically and farming generally. Which will make them to be less risk averse, invest in agriculture with prediction of the successful outcome of their farming ventures.

Monthly income

About 20% of the respondents earned between ₦ 10,001 and ₦ 20,000; 17.6% earned between ₦1,001 and ₦10,000 while 14.8% earned between ₦ 20,001 and ₦ 30,000 (Table 1). Their mean monthly income was ₦17,458.33 (approximately 62USDollars) showing that these respondents were low income earners and hence poor irrespective of their involvement in yam/trifoliate yam production. The finding contradicts the fact that yam production significantly improves the living standard of farmers and serves as an important tool for poverty alleviation (Osayande and Osabuohien, 2016) . In corroboration with the finding, International Fund for Agricultural Development (IFAD) (nd) stated that despite Nigeria's plentiful agricultural resources and oil wealth, poverty is widespread in the country, especially in rural areas, where up to 80 percent of the population lives below the poverty line.

Table 1: Percentage distribution of the respondents based on their socio economic Characteristics

Socio economic	Frequency	Percentage (%)	Mean (M)
Sex			
Male	72	66.7	
Female	36	33.3	
Marital status			
Single	3	2.8	
Married	97	89.8	
Widowed	8	7.4	
Household size			
0	3	2.8	
1-5	25	23.1	
6-10	74	68.6	7
11 and above	6	5.6	
Age			
21-30	1	0.9	
31-40	18	16.7	
41-50	32	29.7	53.7
51-60	29	27	
61 and above	28	25.9	
Educational level			
No formal education	17	15.7	

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Primary education attempted	25	23.1	
Primary education completed	33	30.6	**7**
Secondary education attempted	19	17.6	
Secondary education completed	10	9.3	
Tertiary education	4	3.7	
Farming experience in years			
1-20	17	15.7	
21-40	52	48	38.2
41-60	33	30.4	
>60	6	5.6	
Years of experience in trifoliate yam production	17	23	
1-20	52	49	
21-40	33	22.2	33.6
41-60	6	5.6	
>60			
Monthly income			
None	31	28.7	
1001-10000	19	17.6	
10001-20000	22	20.3	₦17,458.33
20001-30000	16	14.8	
30001-40000	9	8.3	
>40000	2	1.8	

Source: field survey, 2014

Total size of farm land owned and portion cultivated with trifoliate yam

Table 2 reveals that majority (76.9%) of the respondents had 0 to 1 hectare of farm land, 22.3% had 2 to 3 hectares while 0.89hectare was average size of farmland owned by the respondents. Out of these farmlands owned 38% of the respondents cultivated 0 to 0.20 hectare of farmland with trifoliate yam, 29.7% cultivated 0.21 – 0.40 hectare, 21.2% cultivated 0.41 – 0.60 hectares while 11.2% cultivated more than 0.60 hectare of farmland with trifoliate yam. The mean size of land allocated to trifoliate yam production by the respondents was 0.29 hectare which was about one third of the mean size of land they owned. This small size of land owned and cultivated with trifoliate yam may be an indication that these respondents are subsistent farmers. Smallholder agriculture has long served as the dominant economic activity for people in sub-Saharan Africa, and will remain enormously important for the foreseeable future (Gollin 2015). Unfortunately, investments in subsistence agriculture may not necessarily yield high benefits in comparison to other possible uses of development resources. Boosting the scale of production should be seen as one of the major strategies that will enhance viability of agriculture especially in developing countries.

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Table 2: Distribution of respondents according to farm size

Farm size	Frequency	Percentage (%)	Mean (M)
Farm size (in hectare)			
0-1	83	76.9	
2-3	24	22.3	0.89
>3	1	0.9	
Portion of farm land cultivated with trifoliate yam (in hectare)			
0.00-0.20	41	38	
0.21-0.40	32	29.7	
0.41-0.60	23	21.2	0.29
>0.60	12	11.2	

Source: field survey, 2014

Production trend of trifoliate yam

Entries in Table 3 reveal production trend of trifoliate yam. The Table shows that a mean (M) of 0.21 hectares of land was cultivated with trifoliate yam before 2001 while 0.22 hectares and 0.21 hectares were cultivated with trifoliate yam in 2001-2007 and 2008 to 2014.

The Table further reveals that the mean cost of production of trifoliate yam before 2001 was ₦ 650.47 whereas ₦1,777.78 and ₦ 2,756.48 were spent by the respondents between 2001-2007 and 2008 to 2014 respectively on trifoliate yam production.

The Table also shows that the respondents produced about 634.95kg of trifoliate yam before 2001 while 456.44kg and 445.23kg of trifoliate yam were produced between 2001 to 2007 and 2008 to 2014 respectively.

The mean income earned by the respondents from trifoliate yam production before 2001 was ₦3,611.11 while ₦6,004.63 and ₦8,208.33 were earned by the respondents in 2001-2008 and 2008 to 2014 respectively in its production (Table3).

The findings show that production trend of trifoliate yam in the area is not stable which corroborates with the fact that yam production has gone some dramatic changes in many parts of the world and growth rate of yams output is far from consistent, especially in Ghana and Nigeria partly due to the unattractiveness of farming and low prices of yams in the

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market (Verter1 and Bečvařova1, 2015). Specifically, the mean cost of input used for growing this specie of yam has been recording increase before 2001 to 2014. The mean size of land allocated to trifoliate yam production may be said to be relatively steady from 2001 t0 2014. It further shows that the quantity of trifoliate yam produced before 2001 t0 2014 has been decreasing whereas income generated/earned from trifoliate yam over the years has been tremendously increasing. This is in contrast with the fact that there is a positive relationship between the producer price and the volume of yam production such that increase in the producer price will induce smallholder farmers to increase productivity (Verter1 and Bečvařova1, 2015).

However, increase in income irrespective of decrease in output seen in this research, may be as a result of increase in price of the commodity due to its scarcity which may be termed inflation. This condition is not ideal because actually farmers are investing more and harvesting less. When this trend continues, there may be money to buy trifoliate yam but no trifoliate yam to buy which is a way of loosing this specie and aggravating food insecurity.

Table 3: Production trend of trifoliate yam

Production trend	Before 2001 Mean (M)	2001 to 2007 Mean (M)	2008 to 2014 Mean (M)
Size of land cultivated to trifoliate yam (in hectares)	0.21	0.22	0.21
Cost of production (₦)	650.47	1,777.78	2,756.48
Quantity of trifoliate yam produced (kg)	634.95	456.44	445.23
Income from trifoliate yam (₦)	3,611.11	6,004.63	8,208.33

Source: field survey, 2014

Relationship between socio-economic factors and output of trifoliate yam farmers

Entries in Table 4 indicate that respondents' years of experience in trifoliate yam production (0.254; $p \leq 0.008$), farm size (hectare) (0.364; $p \leq 0.000$). and portion of farm land cultivated with trifoliate yam (hectare) (50.421; $p \leq 0.000$) were socio-economic factors that had positive and significant relationship with quantity of trifoliate yam they produced. The implication of this finding is that as the years of experience of these farmers in trifoliate yam production, farm size and portion of farmland allocated to trifoliate yam production increase their output (on trifoliate yam) increases as well. Thus, a change in these socio-economic

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characteristics brings about a considerable change in the output of trifoliate yam and may be said to be determinants of trifoliate yam production in the area.

This is expected because it is a known fact that "experience is a good teacher" .Long experience in trifoliate yam production may enable these farmers to gain skill, technique and expertise to manage their farm well which invariably culminates to efficiency that is manifested in increased output and even productivity. Land is a major asset/ factor of production especially in agriculture. Although, land/ farm size may not always and directly reflect productivity or yield but size of land a farmer has or has access to use for agriculture determines his scale of production and possibility of expansion and mechanization of the farm. Hence, ownership of large farm , may increase the possibility of putting big land in to agricultural use specifically trifoliate yam production and this will invariably increase output and productivity and vice versa. Also, as farm size increases, farmers take more interest in farming business and would likely search for needed information on how to improve their yields (Abu and Soom, 2016).

Table 4 Relationship between some socio-economic factors and output of trifoliate yam farmers

Socio-economic characteristics	Pearson correlation (r)	p. value level of significance	Mean	Standard deviation	N
Age of respondents	0.143	0.140	53.7	11.85	108
Number of years in formal education	0.057	0.561	7.35	5.55	108
Household size	0.083	0.395	6.78	2.23	108
Farming experience	0.174	0.072	38.17	15.73	108
Years of experience in trifoliate yam production	0.254**	0.008	33.56	18.05	108
Farm size	0.364**	0.000	0.89	0.69	108

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Portion of farm cultivated with trifoliate yam	0.421**	0.000	0.29	0.27	108
Personal contact with extension agents	0.106	0.275	0.25	0.57	108
Monthly income	0.015	0.875	17,458.33	17486.33	108

****Correlation is significant at the 0.05 level (2-tailed) n=number of respondents Source: field survey, 2014**

Potentials/uses of trifoliate yam

Data in Table 5 reveal that only income generation (M=2.62) was perceived by the respondents as economic potential/use of trifoliate yam. Also, use of trifoliate yam as a staple food (M=2.29) was perceived as nutritional potential/use while promotion of good health through consumption (M=2.08) was perceived as medical/health potential/use of trifoliate yam by these respondents.. The findings tend to suggest that much have not been known about potentials and uses of trifoliate yam especially it's uses in the treatment of certain diseases and ailments and in pharmaceutical and other industries. In conformity, Adelekan, Arisa, Adeniran and Racheal (2013) posited that trifoliate yam is a specie of yam in which limited work has been done in terms of its production and utilization though it is high yielding compared to other yam species. Worst still, two localities in the country (Nigeria) were found to consider *D. Dumetorum* (trifoliate yam) as a food taboo(Ukpabi,2015) while there is lack of information on the usefulness and importance of the flours for functional food products (Abiodun and Akinoso, 2014) and its traditional food processing techniques(Ukpabi, 2015).These lapses associated with trifoliate yam may stifle initiative and inventive efforts geared towards boosting production, consumption and industrial utilization of the crop.

Table 5: Mean scores on potentials/uses of trifoliate yam

Perceived potentials/uses	Mean (M)	Std. Deviation
Medical/health potentials/uses		
Treatment of diabetes	1.04	1.03
Treatment of rheumatoid Arthritis	0.5	0.77
Treatment of stomach pain (colic)	0.6	0.96
Treatment of menstrual disorders	0.28	0.71

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Used as starch in diverse pharmaceutical preparations	0.4	0.78
Promotion of good health through consumption	2.08*	0.92
Industrial potentials/uses		
Used as flour for the bakery sector	0.21	0.53
Production of yam flakes	0.46	0.81
Economic potentials/uses		
Generation of income	2.62*	0.65
Enhancing foreign exchange earning	1.45	1.11
Nutritional potentials/uses		
Staple food	2.29*	0.84
Used as a vegetable	0.39	0.76

Source: field survey, 2014

Causes of decline in trifoliate yam production

Technical/land, institutional/infrastructural and economic/physical problems were extracted as causes of decline in trifoliate yam production (Table 6). Specific loadings under the technical/land-related cause (factor 1) were land tenure system (0.812), land degradation/infertile land/soil (0.680), poor tools and farm machines (0.617), insufficient land for large scale production (0.579) and lack of agricultural inputs (0.560). Land is a major factor of production especially in agriculture. Unfortunately, land tenure system(transferring of land from parents to male offspring) and increase in population that are prevalent in developing world like Nigeria lead to reduction in size of farm land owned and accessible to individual/farmers. Consequently, available farmlands are overused which leads to their degradation demanding inputs like organic and inorganic manures to boost their fertility.

Poor transport system (0.717), poor marketing system (0.686), problem of basic social amenities (0.602), lack of good agricultural education (0.588), cultural barriers(0.580), poor extension activities (0.483) and lack of awareness of nutritional, economic and health values of trifoliate yam among farmers and consumers (0.438) were variables that loaded high under institutional/ infrastructural cause (factor 2). Obviously, lack of social. amenities that characterises rural area and cultural barrier as noted above can hinder production and consumption of trifoliate yam. Also agricultural extension service may be said to be weak in Nigeria. Many farmers lack education especially informal type from agricultural extension that will empower them with skills, techniques and innovations on agriculture. However, Nigeria is currently in search of a tailor-made and home-grown agricultural extension system that will disseminate technologies, enhance good agricultural practices, facilitate farmer education, adoption and utilization of local and transferred modern trends in agriculture and

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fast-track wealth and job creation .through the value chains and alleviate poverty (Nigerian Tribune, 2015). Thus strengthening extension system nay go a long way in reversing the decline in trifoliate yam production.

Also, poor finance (0.671), pest and disease attack (0.641), lack of seed yam (0.571), Erosion (0.539), unpredictable climate (0.482) and high cost of seed yam (0.462) were factors that loaded high under economic/physical cause (factor 3) (Table 6) .Pests and diseases infestations and vagaries of weather are major problems in agriculture generally and trifoliate yam specifically because they do not allow farmers to carry out agricultural tasks with precision and they can reduce yield substantially. In support of the finding of this study, Idumah, Owombo and Ighodaro, (2014) have identified lack of adequate farm inputs and lack of improved seed yam as problems faced by farmers in yam production .

Table 6: Causes of decline in trifoliate yam production

Perceived causes of decline	**Technical/land-related (Factor 1)**	**Institutional /infrastructural causes (Factor 2)**	**Economic / physical causes (Factor 3)**
Problems of good storage and processing facilities	0.589*	0.117	-0.108
Poor extension activities	0.062	0.483*	0.361
Poor marketing system	0.215	0.686*	-0.115
Pest and diseases attack	0.032	0.105	0.641*
Unpredictable climate	0.347	0.013	0.482*
Lack of agricultural inputs (e.g fertilizer)	0.560*	0.357	-0.232
Insufficient land for large scale production	0.579*	0.195	0.264
Lack of seed yam	0.367	0.059	0.571*
High cost of seed yam	0.320	-0.065	0.462*
Drudgery associated with trifoliate yam production	0.430	0.406	0.056
Problems of land tenure system	0.812*	-0.118	-0.017
Problems of basic social amenities	0.066	0.602*	0.097
Poor financing	0.152	-0.198	0.671*
Poor transport system	0.128	0.717*	-0.010
Lack of good agricultural education	0.086	0.588*	0.220
Poor tools and farm machines	0.617*	0.093	0.307
Unstable policies and programs of government	-0.363	0.500	0.438

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Erosion	-0.088	0.036	0.539*
Land degradation/infertile land/soil	0.680*	0.164	-0.112
Cultural barriers associated with trifoliate yam	-0.047	-0.580*	0.043
Lack of awareness about the nutritional, economic and health values of trifoliate yam among farmers and consumers	-0.309	0.438*	0.356
Change in taste by the younger generation in terms of food/trifoliate yam consumption	0.236	-0.149	0.082
Lack of interest on the part of the youths in agricultural production	-0.197	-0.026	0.060
Quest for 'white collar' jobs	0.295	-0.161	0.299
The belief that trifoliate yam can kill or make one mad if consumed in some places	0.086	0.330	0.183
Destruction caused by stray animals	-0.112	0.350	-0.033

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
Source: field survey, 2014

Conclusion

It can be deduced from the study that trifoliate yam farmers in the area were males who were married, literate and aged. They had long years of experience in farming and /trifoliate yam production but owned small farm land and cultivated small portion of this farmland with trifoliate yam. Cost of input and income from trifoliate yam production had been increasing, land cultivated with trifoliate yam had been steady while output had been decreasing before 2001 to 2014. Years of experience in trifoliate yam production, farm size . and portion of farm land cultivated with trifoliate yam were factors that determined output of these farmers. Technical, land, institutional, infrastructural, economic and physical problems were causes of decline in trifoliate yam production in the area.

Recommendations

1. Awareness campaign on the potentials/uses of trifoliate yam should be carried out by extension agencies / organisations. This will help to boost the interest of farmers and other people in production, consumption and utilisation of the crop locally and industrially as well as in exportation of the crop for income.
2. Favourable land ownership policy/law that will allow farmers especially trifoliate yam farmers to acquire and use land for agricultural purpose should be enacted and

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implemented by the government. In this way farmers can expand their enterprise for more output, yield, biodiversity conservation and income.

3. Government and non-governmental organisations should provide institutional support like incentives and subsidies in form of loan, seed yam, manure, agrochemicals, extension services to these farmers. Infrastructural support like construction of good roads, market, hospital etc should also be provided in the area. These supports will invariably motivate, boost and consolidate the efforts of these farmers in trifoliate yam production and agriculture.

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