

Analysis of Factors Affecting Fertilizer Applications by Yam Farmers in Edo State, Nigeria

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Abstract

The study assessed factors affecting fertilizer applications by yam farmers in Edo State, Nigeria. The specific objectives were to: ascertain the basic source of information among the farmers, determine the factors affecting fertilizer applications on yam production and the constraints working against yam production in the study area. Multistage sampling techniques were used in this study. Four (4) local governments out of the 18 local governments in the State were selected for the research. However, 120 yam farmers were used as the sample size. Findings showed that the majority (75%) of the farmers were male while the remaining proportions (25%) of them were female. The mean age of the farmers was 39yrs while the mean year of farming experience and the average farm size cultivated by farmers were 4yrs and 1.3ha respectively. More so, the majority (95%) of the farmers sourced information on yam technologies from fellow farmers, 66.7% sourced information from friends/ neighbors and 60.8% of the farmers sourced information from cooperatives. The major factors affecting fertilizer application include: level of soil fertility, farming experience, high cost of the technology, high rate of decay associated with the application of the technology, weed infestation and farming practiced by the farmers. Constraints to yam production in the study area are bad road network, drought problems, high cost of the seedlings, weed infestation on the crops, inadequate supply of good quality seed and disease/ pest infestation on the crop respectively. Based on these, the following recommendations were suggested to improve fertilizer application in Edo State, Nigeria. It is recommended that policy that will encourage reduction in fertilizer and agrochemical price/ subsidies should be considered and implemented so that farmers can afford it and reduce labour cost on weeding. More extension agents should be deployed to rural areas to help improve on farmers' productivity as regards to fertilizer usage. Those identified constraints (bad road network, drought problem, high cost of seedlings, weed infestations on the crops, inadequate supply of good quality seed and disease/pest infestation on the crop) that worked against yam production in the study area should be handled with proper attention.

Keywords: Yam; Factors; Farmers; Influence; Fertilizers

Introduction

Nigeria is an agrarian country with over seventy percent of the population engaged in agriculture [6]. Agriculture remains the cornerstone of the Nigerian economy and it is a sector with great potential for stimulating economic growth and employment. It accounts for about 36 - 48% of Gross Domestic Product (GDP) in the year 2016. Currently it accounts for over 70% of the nation's paid and self-employment statistics [2]. Food crop such as maize, sorghum, millet, rice, yam, cocoyam and cassava contribute about 28% to GDP, making about 75-76% of the share of the agricultural sector's contribution to GDP [20].

Before the advent of oil boom in Nigeria, agriculture was the pillar of the nation upon every citizen depends on for income and employment generations for daily livelihood. It contributed heavily to the development of the economy through the export of agricultural produce [20]. It was the main source of foreign exchange earnings which accounted for over 60% of its Gross Domestic Product (GDP) in the 1960s [19]. During the period, Nigerian economy was described as an agricultural economy because the engine of growth of the overall economy for the country was agriculture [2]. According to [6] Nigerian agricultural sector was abandoned due to oil sector in the early 1970s, and this neglect has negative consequences on the country's GDP. Currently, Nigerian agriculture has dominated by low performance which made the country that was once a net food exporter to become a net food importer.

Yam (*Dioscorea* spp) is among the oldest and vegetative recorded crop [7]. It is an important root- tuber crop in the Nigeria economy, in terms of land under cultivation [2]. Yam is an annual crop with over 600 species and out of the species, six are socially and economically staple in terms of food, cash and medicinal values in the tropics [1]. According to [15] the term root and tuber crop refers to any growing plant that store edible materials in the subterranean root, corm or tuber. However, some of the species are; *Dioscorea rotundata* (white guinea yam), *Dioscorea alata* (yellow yam), *Dioscorea rotundata* (white yam), *Dioscorea alata* (water yam), *Dioscorea esculanta* (Chinese yam) and *Dioscorea dumetorum* (trifoliolate yam). *Dioscorea rotundata* (white yam) and *Dioscorea alata* (water yam) are the most common species in Nigeria that grow in the coastal region in rain forests, wood savanna and southern savanna habitats [2]. They are grown in tropical regions and mostly produced in the savannah region of West Africa, with two separate seasons; wet and dry seasons [1].

According to [18] between 1961 and 2012, the area harvested from yam in the world increased from 1.15 million (Ha) in 1961 to 5.04million (Ha) in 2012. Yield (Hg/Ha) in the world also increased from 72.35 thousand metric tons in 1961 to 116.65 thousand metric tons in 2012. Over 58. 8 million tons of yams were produced in the world in 2012 and out of which 92.2% were from West Africa. Nigeria accounted for over 65% (38 million metric tons) of the world yam production that Valued \$7.75 billion with a cultivated area of about 2.9 million hectares of land in 2012. While Ghana and Cote D'Ivoire were the second and third positions with a wide margin of 6.6 million metric tons.

The crop is grown in Latin America and Caribbean countries like Colombia, Brazil, Haiti, Cuba and Jamaica [1]. The crop is grown throughout Africa with West Africa producing over 90% of the total world production of yam. Nigeria is the largest producer of yams in the world, followed by Ghana, Cote D' Ivoire, Benin, Togo, and Cameroon [15]. on a global scale, Nigeria alone contributes 36 million metric tons of food yams being cultivated in about 3 million hectares [1]. Average statistics show that the West African yam belt produced about 85-95% of the world's output of 38.7 million metric tonnes of yam between 2015 and 2018, and Nigeria alone produced over 75% of West African output. On the basis of quantity of root and tuber crops produced in Nigeria, yam ranks second to cassava [12,20].

Yam ranks as the most important source of dietary calories in Nigeria and is the country's most important crop in terms of gross value of production (about \$11.3 billion US dollar, FAO [12]. The crop directly supports the food and income security of almost a third (31.8%) of the population in the country [18]. Yam is one of the major cash and most consumed food crops in West African countries. Yam is a significant crop in Nigeria and it is a highly prized crop in the country. It has socio-cultural, medicinal, nutritional and economic value. It is nutritionally superior to comparable crops including sweet potato and taro [6]. It is the fifth most harvested

crops in Nigeria, following after cassava, maize, guinea corn, and beans/cowpeas [15]. However, after cassava, yam is the most commonly harvested tuber crops in the country, yam contributes more than 200 dietary calories per capita daily for more than 150 million people in West Africa and also an important source of income generation and trade. Yam tuber is widely consumed especially in West Africa and as a major staple food among the Nigerian populace [2]. Its tuber is an important source of protein, iron, and zinc to consumers. Yam also has an important social status in gathering and religious functions which is assessed by the size of yam holdings one possesses [15]. It is a good source of energy mainly from their carbohydrate contents since it is low in fat and protein. Yam can be eaten when boiled, roasted, baked or fried. It can also be processed into crude flour by drying thin slices in the sun and then pound or ground into flour. Yam can also be processed into instant flakes or fried as chips just like potato. Most of starch industries also make use of yam as an important raw material. Thus, the yam subsector ensures food security and provides job opportunities and income to all stakeholders in the yam value chain. Its peels serve as feed for livestock and as a good component of farm yard manure. It is also used as laboratory crop for scientific investigations. Yam tuber is rich in pharmacologically active substances such as dioscorine, saponin and sapogenin. Dioscorine, which is the major alkaloid in yam, is medicinally a heart stimulant. Also, it has been reported that yam is a good source of industrial starch whose quality varies with species [2]. This showed that the yam crop is a very important food and income earner for about 60 million Nigerians.

Yam production has gone some dramatic changes in many parts of the world. However, production process; bush clearing, cultivation, chemical application, harvesting and transporting to markets is still labour-intensive [21]. Yam is normally propagated through the use of small whole tubers (seed yam) or cut pieces of tuber (setts). Yam planting material forms 25–30% of the investment in ware yam production. The vegetative propagation makes the crop vulnerable to viruses and other diseases [4,5,9] which leads to the degeneration of planting material resulting in up to 50% of harvest loss for farmers [14].

In Nigeria, labour demand for yam production ranged from 300 to 400 man-days per hectare at costs of N30,000.00 - N40,000.00, which is equivalent to \$375-\$500. US Dollars. From empirical point of view, about 10,000 normal size (150- 250g) seed yams are required to cultivate a hectare for yam production. Hence, at N15.00 per seed yam, a total of N150,000.00 (\$1875.00) was required for planting materials. However, under the mini-setts as many as 60,000 mini-sets of 25-30grams are required to plant one hectare for seed yam production. A study has shown that about 35-50% of the total production cost is constituted by planting material [15]

According to [21] the country recorded tremendous yam lost in 2006 with over 3.7 million metric tons due to, inadequate preservation, storage and processing facilities, marketing and market access. The lost in the country may partly discourage rural smallholder yam farmers from fully taking part in the cultivation. Pests' related issues such as parasitic nematodes; insects such as leaf and tuber beetles; fungi such as leaf spot, tuber rot, and other viruses have also been identified as major constraints to yam production in Nigeria [21]. However, insufficient farm inputs and modern technologies are constraints to yam production in developing countries like Nigeria, Ghana, Côte d'Ivoire, Benin and Togo. More so, insufficient chemicals and fertilizer applications and the reduction of soil fertility are identified as the factors that are constraining output growth in recent time. Previous studies carried out on food crop production in Nigeria have shown that food crop farmers have low productivity because of inefficiency in resource use. It is believed that inefficiency in the use of resources, wrong choice of enterprise combination and cropping system constitute the major constraint to increased food production in Nigeria [2].

In order to place this country on the threshold of food security, some efforts were made by the researchers to improve yam production system. Those efforts include breeding varieties for distribution to farmers, development of minisett technology for rapid seed yam production, development of alternative propagation materials through vine cutting, research into non-stake yam varieties, development of soil management packages and inputs distribution by the State and Federal Governments of Nigeria [8]. However despite these efforts to improve yam production, its production besets by many problems which include weed pressure, decline in soil fertility, soil borne pests and diseases, storage pests, high labour cost of land preparation and maintenance, staking and barn making among others [8]. According to [6] Yam production in Nigeria is mainly impeded by high cost of labour and unavailability of planting material.

In recent time, it has been observed that farmers in the state do not apply fertilizer on their yam farm despite the information disseminated to them on the need of application the innovation for higher productivity by extension worker. In view of this, the study assessed the factors affecting fertilizer applications by yam farmers in Edo State, Nigeria. The specific objectives were to: ascertain the basic source of information among the farmers, determine the factors affecting fertilizer applications on yam production as well as the constraints working against yam production in the study area.

Methodology

The research was carried out in Edo State, Nigeria. The State is located in the Southern region of Nigeria with its capital at Benin City. The state is bounded by Kogi State to the Northeast and East, Delta State to the Southeast and South, and Ondo State to the West and Northwest; the River Niger flows along the state's eastern boundary demarcates the State with Anambra State. The state is made up of 4 major ethnic groups; Bini, Esan, Owan, and Etsako [17]. It is estimated that Edo State has a population of 5 million people, with farming as one of the major occupation in the state. Farmers in the state grow crops like yam, cassava maize, cocoa yam, plantains ,banana ,cocoa,among others. The State has eighteen [18] Local Government Areas which covers all the State area. They include: Akoko-Edo, Egor, Esan Central, Esan North-East, Esan South-East, Esan West, Etsako Central, Etsako East, Etsako West, Igueben, Ikpoba-Okha, Oredo, Orhionmwon, Ovia North-East, Ovia South-West, Owan East, Owan West and Uhumwonde.

Multistage sampling techniques were used in this study. Four [4] local governments out of the 18 local governments in the State were used for the research based on their activities on yam production. Here, Esan Cental, Esan west, Esan South and Etsako west local government were selected. Five communities per L.G. were selected due to their active participation in farming activities. Irrua, Ewu, Ugbegun, Opoji and Ewossa from Esan Central; Ubiaja, Emu, Ewohimi, Ulushi and Onog-Holo from Esan South; Ekpoma, Eghoro, Ido, Naoka and Ogwa from Esan West; Aviele, Awain, Jagbe, South Ibie and Uzairue-Jettu from Etsako west local government were used. This gave a total of 20 communities used for the study. Six [6] farmers each randomly sampled from each community and this gave a total sample size of 120 farmers that were used for the work. Data used for this research were collected through a structured questionnaire. Data collected were analyzed using, inferential statistics.

Results and Discussions

Socio-economic characteristics of yam farmers

Data in Table1 show that the majority (75%) of the farmers were male while the remaining proportions (25%) of them were female. This implies that male participated more actively in yam farming activities than their female counterpart in the study area. The reason could be that men regarded yam production as a tedious job that has to be handled by men in order to achieve their objective of yam farming activities in the study area or it could be gender specific, in the sense that in some areas, women are not allowed by culture to cultivate some crops like yam, and this brings about gender inequality in the social system. On the other hand, culture may not permit men to cultivate a crop like sweet potato. In the same area which can as well brings about food insecurity in the state. This finding agrees with that of [2] that 87.4% of the yam farmers were male while 12.6% were female. This could be attributed to the labour-intensive activities involved in yam production which require men who are naturally endowed with abundant strength necessary for such jobs. However, a greater proportion (47.7%) of the farmers was between the age of 30-35years, while 16.7% of the farmers fall within the age bracket of 40-45 and 50-55 years. The mean age of the farmers was 39yrs. This implies that farmers were still in their active productive years and this encourages them to put more energy in yam production activities. On the other hand, 66.7% of the farmers were married while 16.7% of them were widowed. Similarly, 57.5% of the farmers attended primary school education while 29.2% of them finished up secondary school education. This implies that farmers in the state are educated and this could increase their levels of adoption. The finding is in consonant with that of [13] that High educational attainment is expected to have a positive influence on the adoption of improved technologies such as farm mechanization, which would have high potentials to increase farm productivity. The mean year of farming experience and the average farm size cultivated by farmers were 4yrs and 1.3ha respectively.

Similarly, the mean household size of the farmers was 3 persons, while the majority (58.3%) of the farmers sourced land through renting. Since the majority of the farmers source for land through renting, this could be that some of them were migrant farmers that can only source for land for farming through renting. However, a greater proportion (66.7%) of the farmers used hired/ paid labour as their main source of labour, while 43.3% of the farmers sourced farm inputs from their fellow farmers. Hired labour was mostly used by the farmers; this could imply that yam production associated with rigorous and tedious process that could not allow farm family to finish up so easily before the maturity. Based on these farmers may resort to hire labourers to meet up the needs of yam farm activities. More so, majority of the farmers sourced farm inputs from fellow farmers and this may attribute to the belief that the fellow farmers were their only reliable source of farm inputs that can give them what they need in the appropriate time. Access to agro inputs increases the propensity to adopt an improved technology, that is, it will tell us, even if a farmer is aware of a technology it's access to farmers is of the most important in adoption process. Therefore, access to farm input is a necessary condition for adoption of a technology in a social system. On the other hand, 66.7% of the farmers belong to social organization while 75% and 62.5% of the farmers did not have access to credit facilities and extension contact respectively. Since the majority of the farmers belonged to membership of social system in the area, this implies that they are in a better position to adopt improved technologies that could result in higher productivity and poverty alleviation in the study area. The effect of this may be that most of the yam farmers in the study area enjoy the benefit accrued to co-operative society through pooling of resources together for a better extension, efficiency and effective management of resources for profit maximization. This finding agrees with that of that co-operative groups ensured that their members derived benefits from the groups such as they could not derive individually. Participation in social organization could be advantageous to farmers because, farmer's social organization offer an effective channel for extension contact with large number of farmers. Therefore, it increases farmer's update of new technology practices such as improved yam production technologies. Access to credit provides the farmers with a means of their farms. It also determines the ease with which a farmer adopts new practices and technologies in farmers' enterprise. Therefore, access to credit facilities is one of the major factors that decides whether a farmer will adopt an innovation or not in a given social system. This finding agrees with that of access to credit obtained was a major factor influencing the adoption of Irish potato in Kaduna state, Nigeria.

In terms of extension visit majority of the farmers did not have enough contact with the extension agents, this could be because of the limited numbers of extension agents in Nigeria or this may imply that some of the farmers missed out one or more extension training due to their active engagements in other scheme of family issues. According, extension visit has a positive influence on adoption of improve crop like FARO-44 rice production technologies. However, frequent contact with extension agents gives farmers the opportunity to learn about the availability and the use of new farming techniques. More so, farmers in the area acknowledged that extension visit had help them to increase their knowledge, attitude and the volume of their produce as well as helping them for higher level of credit from financial and business institution/ organization. Therefore, the positive impact of contact with extension service is explained by the fact that farmers who have contact with extension organizations are likely to hear about improved varieties and thus have more incentives to adopt these new agricultural technologies for improvement of live hoods.

Table 1: Socio-economic characteristics of yam farmers

Variables	Frequency	Percentage	Mean
Sex			
Male	90	75.00	
Female	30	25.00	
Age			
20-25	13	10.83	
30-35	56	46.70	
40-45	20	16.70	39 years
50-53	20	16.70	
56 and above	11	9.20	
Marital status			
Married	80	66.70	
Single	10	8.33	
Widowed	20	16.70	

Variables	Frequency	Percentage	Mean
Devoiced	6	5.00	
Separated	4	3.33	
Educational level			
Primary school	69	57.50	
Secondary school	35	29.70	
OND/HND	10	8.33	
First degree and above	6	5.00	
Household size			
1-2	37	30.83	
3-4	57	47.50	3 persons
5 and above	26	21.67	
Farm size			
Less than 1ha	47	39.17	
1-2ha	60	50.00	1.3ha
3-4ha	10	8.33	
5 and above	3	2.50	
Farming experience			
1-3yrs	40	33.30	
5-7yrs	65	54.17	4yrs
9-10yrs	10	8.33	
11 and above	5	4.17	
Sources of farm labour			
Family labour	30	25.00	
Hired/paid labour	80	66.67	
Exchange labour	10	8.33	
Source of farm inputs			
Open market	15	12.50	
ESDAP	15	12.50	
Fellow farmers	52	43.33	
Friends/neighbours	30	25.00	
Extension agents	8	6.67	
Members of social organization			
Yes	80	66.67	
No	40	33.33	
Access to credit			
Yes	30	25.00	
No	90	75.00	
Access to extension services			
Yes	45	37.50	
No	75	62.50	

Source: Field survey, 2021

Source of information on yam production technologies

Table 2 shows that the majority (95%) of the farmers sourced information on yam technologies from fellow farmers, 66.7% sourced information from friends/ neighbors and 60.8% of the farmers sourced information from cooperatives. This agrees with that of [10] that Yam farmers obtain seed yam from three main sources such as own production, market and other farmers. Similarly, 41.7% and 37.5% the farmers sourced information on yam production from Edo state agricultural development programmer and research institute while 30% and 25% of the farmers sourced information on yam production activities from public gathering and extension agents. Other farmers, like 23.3%, 12.5% and 10% of them sourced information on yam farming from television, radio set and university around the area. The least source of information in the study area was internet. This may, imply that farmers may not be literate enough to access information from internet, or it could be the high cost of data bundle to handle such operation as to get relevant information needed in their daily farming. In view of this, most of them relied heavily on their fellow farmers to access information on yam production without cost. Since fellow farmers, friends/ neighbor, cooperatives and Edo state agricultural development programmer dominated the information sources used by the farmers in the area, it would be of important and appropriate to deliver new technologies to farmers in the State through them.

In terms of ranking, fellow farmers, friends/ neighbors, cooperatives and Edo state agricultural development programs were ranked as the first four major sources of information used by the farmers in the area. Other channels like research institute, public gathering television, extension agents and television were ranked 5th, 6th, 7th and 8th source of information used by the farmers respectively. Farmers relied heavily on the first four major sources of information; the reason could be their frequent contact with those sources at their own convenient time. However, such source of information may require that the farmers may relax and utilize the message that is relevant to their day-to-day farming activities on yam production. This finding is not in consonant with that majority of Irish potato farmers acquired information on Irish potato farming through extension agents and in the same vein, it disagrees with his finding that majority of the farmers sourced information on Irish potato farming from and research institute

Table 2: Sources of information on yam production technologies

Information source	Percentage
Radio set	12.500
Television	23.33
Public gathering	30.00
University	10.00
Friends/neighbours	66.67
Extension agents	25.00
Fellow farmers	95.00
Cooperatives	60.83
Print media	8.33
ESADP	41.67
NRCRI	37.50
Internet	9.12

Factor affecting application of fertilizer on yam production activities in Edo State, Nigeria.

Data in Table 3 show the perceived factors affecting application of fertilizer among yam farmers in the study area. The major factors include: level of soil fertility ($M=4.35$), farming experience ($M=4.20$), high cost of the technology ($M=3.60$), high rate of decay associated with the application of the technology (3.53), weed infestation ($M=2.32$) and farming practiced by the farmers ($M=2.11$).

Table 3: factors affecting fertilizer application on yam farming in Edo State

Variables	Mean	Rank
Levels of soil fertility	4.35	1 st
Farming experience	4.20	2 nd
High cost of fertilizer	3.60	3 rd
High rate of decaying associated with application of fertilizer on crop	3.53	4 th
Weed infestation with the technology	2.32	5 th
Type of farming practiced by the farmers	2.11	6 th
Income of the farmers	1.65	
Lack of awareness of the technology	1.53	
Age of the farmers	1,05	
Inadequate extension training on the technology	1.30	

Source: Field survey, 2021

Constraints to yam production in Edo State, Nigeria.

The constraints faced by farmers in yam production practices are presented in Table 4 below. Those constraints are bad road network (4.50), drought problems (M=4.23), high cost of the seedlings (M=3.80), weed infestation on the crops (M=2.70), inadequate supply of good quality seed (M=2.53) and disease/ pest infestation on the crop (M=2.25) respectively. This result is in line with that of (2) that pests and disease attack on yam tuber) constituted the major constraint to yam production in the study area

Table 4: Constraints to Yam Production in Edo State

Constraints	Mean	Rank
Bad road network	4.50	1 st
Drought problems	4.23	2 nd
High cost of seedlings	3.89	3 rd
Weed infestations on the crops	2.70	4 th
Inadequate supply of good quality seed	2.53	5 th
Disease/pest infestation on the crop	2.25	6 th
High perishability of the product	1.35	7 th
Lack of government help to farmers	1.29	8 th
Inadequate access to credit	1.26	9 th
Inadequate access to improved varieties	1.23	10 th
Inadequate extension service	1.22	11 th
Poor market outlet	1.12	12 th
Poor income from the crop	1.10	13 th
Low outputs from the crop	1.01	14 th

Source: Field survey, 2021

Conclusion and recommendations

The study was carried out to analyze factors affecting fertilizer application by yam farmers in Edo State, Nigeria. Findings showed that the majority (75%) of the farmers were male while the remaining proportions (25%) of them were female. The mean age of the farmers was 39yrs while the mean year of farming experience and the average farm size cultivated by the farmers were 4yrs and 1.3ha respectively. More so, the majority (95%) of the farmers sourced information on yam technologies from fellow farmers, 66.7% sourced information from friends/ neighbors and 60.8% of the farmers sourced information from cooperatives. The major factors affecting fertilizer application include: level of soil fertility, farming experience, high cost of the technology, high rate of the decay associated with the application of the technology to yam tuber, weed infestation and farming practiced by the farmers. Based on these, the following recommendations were suggested to improve fertilizer application in Edo State, Nigeria. It is recommended that policy that will encourage reduction in fertilizer and agrochemical price/ subsidies should be considered and implemented so that

farmers can afford it and reduce labour cost on weeding. More extension agents should be deployed to rural areas to help improve on farmers' productivity as regards to fertilizer usage. Those identified constraints (bad road network, drought problem, high cost of seedlings, weed infestations on the crops, inadequate supply of good quality seed and disease/pest infestation on the crop) that worked against yam production in the study area should be handled with proper attention. In order to improve yam production, government should provide enable environments and invest heavily in yam cultivation by providing farm inputs to smallholder farmers at subsidized rates. However, government should provide more loans to farmers at zero or low-interest rate to enable them increase their production. Those factors affecting fertilizer application on yam farming in Edo State should be properly addressed and be taken care of; in this case, extension agents may be called upon to address the issues. Federal and State governments should consider yam under the growth enhancement support scheme by providing highly subsidized seed yams to farmers. There is a need for proper funding of the National Root Crops Research Institute, Umudike that has mandate for yam breeding to enable it deliver on its mandate. Fertilizer producers/industries should research critically on the active ingredient that caused decay on yam tubers and correct the abnormality to make it acceptable by the farmers.

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