Original Research Article

Time-Series Analysis on Adoption of *Makka Kusa* Yam Variety in Bwari Area Council of Nigeria's Federal Capital Territory

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Abstract

A time series analysis of adoption of a certain variety of white yam (*Dioscorea rotundata*), known popularly as *Makka kusa*, was performed in the Bwari Area Council of Nigeria's federal Capital Territory to determine the time series in adoption of *Makka kusa* yam, and determine the forecast of adoption level in the next six years of *Makka kusa* yam. A three-stage sampling technique involving two of the four Agricultural Development Programme (ADP) blocks and five villages was employed to select 206 yam-farming respondents for this study. A structured questionnaire was used for data collection. Descriptive statistics such as frequencies and means, and the Additive Model for Time Series were employed to achieve the objectives of the study. Majority (83.5%) of farmers were male while 16.5% were female; and majority (68.5%) of the farmers were in their active farming ages (31-50 years; mean = 39 years). Mean years of farming experience was 12 years. The result showed that as income increased over the years, farmers' age, household size, and years of experience contributed significantly at 99% level. Farmers' adoption of the yam variety was at its peak in 2016 with adoption increasing by 18.4%. However, using the least squares linear regression method, it was predicted that adoption of *Makka kusa* yam in the study area would increase by 54% 2023.

Keywords: *Mekka Kusa* yam, adoption, farmers, forecast

Introduction

The Buhari's administration in Nigeria came when the oil market in the international market experienced a drop in price of the oil commodity. Nigeria's economy which largely depends on sales of petroleum products experienced difficulty in financing its budget. Realizing the danger of over-reliance on a single commodity, oil, the Nigerian government decided to return to the agricultural sector. The agricultural sector which used to contribute the highest to the country's Gross Domestic Product (GDP) during the British colonial era to the post-independent period before the discovery of oil, became the next alternative. The Buhari's administration came up with

a policy called "Green Alternative" geared towards increasing the people's participation in agricultural production, generating employment, increasing the country's GDP, improving the country's balance of trade and improving the income and livelihood of the rural poor. Yam (*Dioscorea spp)* became one of the crops Nigeria is willing to export. FMARD (2016) stated that the Ministry would prioritize for export markets the production of the crops which include yams.

The white yam (*Dioscorea rotundata)* known locally as "Makka kusa" (meaning Mecca is near in Hausa language) is a variety of yam that farmers believe would guarantee or make them realize their dream of travelling to Mecca on pilgrimage after one harvest. This is because it is a high yield variety, white and with a smooth surface and sweet taste. According to Ibrahim (2014) this variety is good, and can yield a five-kilo tuber, when planted. It produces big tubers, and consumers enjoy it in whatever form whether cooked, fried or pounded. The yam variety has high market demand as can be evident by the large inflow of people and passersby into Bwari to buy the produce for consumption. Asala and Ebukiba (2016) in their study of Profitability of yam production in Southern Guinea Savanna zone of Nigeria discovered that *Makka kusa* was, among other white yam varieties, highly preferred for its taste in Benue, Nassarawa, Abuja FCT and Niger, while Gbakumo (another white yam variety) was most preferred in Kwara and Kogi States.

The Nigerian government recently came up with the initiative of exporting yam (*Dioscorea* spp.) to Europe and the United States of America (USA). The yam exportation comes under the Green Alternative programme to generate income for farmers and to the nation in general. Lack of good yam seed and improved farm techniques by farmers often lead to poor quality of yam at harvest. There is a need to first look into the potential of Nigerian farmers to produce the required quality and quantity of yams for domestic and international markets. Research into yam production at this stage cannot be overemphasized to improve yam farming activities by farmers. It is against this background that this research was conducted to address the following questions:

1. What are the socioeconomic characteristics of *Makka kusa* yam farmers in Bwari Area Council?
2. What is the time series in adoption of *Makka kusa* yam in Bwari Area Council over the last seven years?
3. What is the forecast of adoption level in the next six years of *Makka kusa* yam by farmers in Bwari Area Council?

The broad objective of the study was to determine the adoption of *Makka kusa* yam variety over a period of time. The specific objectives were to:

1. identify the socioeconomic characteristics of *Makka kusa* yam farmers in Bwari Area Council
2. determine the time series in adoption of *Makka kusa* yam in Bwari Area Council over the last seven years

3. determine the forecast of adoption level in the next six years of *Makka kusa* yam by farmers in Bwari Area Council

Methodology

The Bwari Area Council is one of the six area councils under the Federal Capital Territory (FCT) Administration. Bwari Area Council has an area of 914 km² (Idoko and Bisong, 2010). Its estimated population is 305, 359.3 people based on the 2006 population census. The area council is rich in natural and mineral resources. The agricultural crops grown within the Bwari Area Council are guinea corn, beans, cotton, rice, maize, yams, cassava, potatoes, groundnuts and tree crops such as mango, cashew, guava and orange. Some of the villages and towns in Bwari Area Council are Shere, Igu, Kawu, Galuwyi, Tokulo, Kaima, Kubwa, Dei-dei, Dutse Alhaji, Mpape and Kuchiko. Some commercial organization such as banks, educational institutions and agricultural organizations are also located within the area council.

A three-stage sampling technique was employed for this study. In the first stage, two blocks were chosen randomly from the four extension blocks of the ADP in Bwari Area Council namely Bwari block and Mpape block.

In the second stage, two villages namely Gudupe and Nukuchi were purposively selected from Mpape blocks based on their involvement in yam production and three villages namely Sunpe, Kute and Shishipe were purposively selected from Bwari blocks based on their involvement in yam production.

A structured questionnaire was designed, and copies were administered as follows: 54 in Shishipe, 22 in Gudupe, 74 in Nukuchi, 41 in Sunpe, 41 and 15 in Kute, making a total sample size of 206.

The data obtained from administration of structured questionnaires were coded, analyzed and interpreted. Descriptive statistics such as frequencies and means were used to achieve objectives 1 and 2, while the Additive Model for a Time Series was used to achieve objective 3. Falk (2012) opined that additive model for a given time series $y_1, \ldots, y_n$ is the assumption that these data are realizations of random variables Y_t that are themselves sums of four components $Y_t = T_t + Z_t + S_t + R_t$, $t = 1, \ldots n$.

Results and Discussion

Characterization of farmers in the study area

The first objective, identifies the socio-economic characteristics of farmers in Bwari Area Council. The results (Table 1) revealed that majority (83.5%) of the farmers were male while 16.5% were female. The analysis also revealed that 34.5% of the farmers were between 31 and 40 years of age, while the ages of 34.0% of the farmers ranged from 41 – 50 years. This is an indication that majority (68.5%) of the farmers were in their active ages (31-50 years) with a mean age of 39 years. This is an indication that the farmers were young, energetic and able to cultivate yams.

Table 1: Socio-economic Characteristic of Yam Farmers (n = 206)

Variable	Frequency	Percent	Mean
Gender			
Male	172	83.5	
Female	34	16.5	
Marital Status			
Married	129	93.2	
Single	17	6.8	
Ages (Years)			
Less than 31	49	23.8	
31 – 40	70	34.0	39.07
41 – 50	71	34.5	
51 and above	16	7.8	
Educational Level of Farmers			
No Formal Education	29	12.1	
Koranic/Arabic Education	25	12.1	
Adult Education	29	14.1	
Primary Education	67	32.5	
Secondary Education	38	18.4	
Tertiary Education	18	8.7	
Size of Household			
1 – 6	39	27.7	
7 – 12	61	43.2	5.95
13 and above	21	14.9	
Income from 2017 *Makka-kusa* Yam Farming in Naira			
Less than 100,001	69	33.5	
100,001 – 200,000	40	19.4	
200,001 – 300,000	43	20.9	220,805
300,001 – 400,000	30	14.6	
400,001 and above	24	11.7	
Yam Farming Experience (Years)			
Less than 11	109	52.9	
11 – 20	62	30.1	12.79
21 – 30	25	12.1	
31 and above	10	4.9	
Farm Size (Hectares)			
Less than 1.1	139	67.5	
1.1 – 2.0	53	25.7	1.28
2.1 – 3.0	8	3.9	
3.1 and above	6	2.9	

Unlike in Edo state where Izekor and Olumese (2010) in their study on determinants of yam production and profitability in Edo state, reported that majority of the farmers were in the 51 – 60 years age group, constituting 55% of the total respondents, the average age of respondents in this study was 39 years. However, this study agreed with Izekor and Olumese (2010) that men were dominant in their study; they found out that 92% of the respondents were male while the female were 8%.

Most (93.2%) of the farmers were predominately married with 6.8% of them still single, while majority (43.2%) of the households had family sizes of 7-12 members. This indicates that farmers had additional labour from members of their households.

Cultivating yam is not new in Nigeria, because it is one of the staple foods in some parts of the country. The analysis showed that the farmers had considerable experience of farming yam of other varieties which include the *Mecca kusa* yam with a mean of 12 years' experience. Farmers engaged in yam farming generate income from their activities. In this study, the analysis revealed the mean income of the *Makka kusa* yam farmers at ₦200,000.00

The analysis showed that the cumulative percentages of farmers who attained formal education was 59.6% of the farmers. This result disagreed with Izekor and Olumese (2010) that majority (58%) of the respondents had no formal education, while 32% and 10% had primary and secondary education respectively.

Level of Adoption of Makka Kusa Yam

Makka kusa variety was adopted in Bwari Area Council in 2012 as shown in Table 2 below. The result revealed that 1% of farmers of *Makka kusa* yam variety were early adopters in 2012. In 2013 the adopters increased by 6.3%, while in 2014 there was stability in the level of adoption, as the adopters increased by the same margin as at 2013 with 6.3%. Farmers' adoption of the yam variety was at its peak in 2016 as was shown in Table 2, that adoption increased by 18.4%.

Table 2: Level of change in adoption of *Makka kusa* yam

Year of Adoption	Number of Adopters	Percentage Level of Adopters	Percentage Increase
2012	2	1.0	0
2013	15	7.3	6.3
2014	28	13.6	6.3
2015	66	32.0	18.4
2016	70	34.0	2.0
2017	25	12.1	-21.9

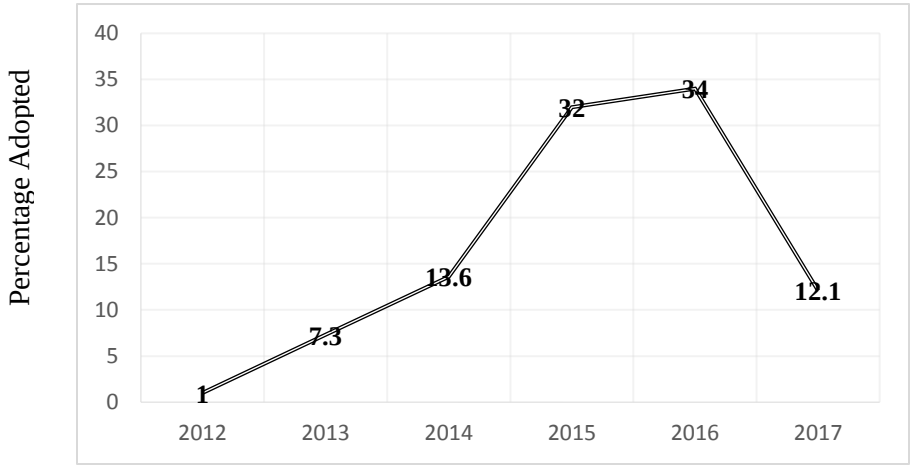

Figure 1: Percentage Level of Adoption

The data analysis also revealed a slight increase of 2% difference between 2015 and 2016 adoption. In 2017, there was a drop in the number of farmers who adopted the variety. Figure 1 shows the graphical representation of the adoption rate of farmers within the period under observation.

Forecast for the Adoption Level in the Next Six (6) years (2023)

Table 3 shows the number of *Makka kusa* yam farmers (Y) from 2012 (X =1) to 2017 (X = 6) in the study area. To make a projection or forecast of the expected level of adoption of *Makka kusa* by 2023 (X = 12), the least squares linear regression method was used. This gave the following prediction equation:

$$Y = 2.533 + 9.086X; R^2 = 37.8\%$$

So, assuming a linear relationship between X (years) and Y (number of adopters), there should be 112 adopters of the *Makka kusa* yam variety by 2023, although the proportion of variability in Y attributable to X is only about 38%. This will amount to about 58% increase over the 2016 number (70) of *Makka kusa* yam farmers in the study area.

Table 3. Forecasting Level of change in Adoption of *Makka kusa* yam

Year of Adoption	Y (No. of Adopters)	X	x^2	xy
2012	2	1	1	2
2013	15	2	4	30
2014	28	3	9	84
2015	66	4	16	264
2016	70	5	25	350
2017	25	6	36	150
2023	112	12	144	1,344

Conclusion

Yam farming is an activity mostly undertaken by farmers who are in their active ages of 31-50 years. Farmers' adoption of the yam variety was at its peak in 2016 as was shown in the analysis, that adoption increased by 18.4%. A projection indicates that there will be an increase of about 58% in the number of farmers who will adopt *Makka kusa* yam variety by 2023.

Female farmers should be encouraged to adopt production of *Makka kusa* yam variety thereby increasing adoption. Farmers should be encouraged to maximize their income (profit) through cultivating for international and domestic markets. The level of adoption needs to be increased by creating more awareness of the desirable qualities of the *Makka kusa* yam variety.

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