DOI: 10.22620/agrisci.2024.42.011

DETERMINANTS OF PROFIT AMONG MAIZE FARMERS IN OSOGBO ADP ZONE OF OSUN STATE, NIGERIA

Olaide K. Akintunde*, Lateef O. Jimoh, Kaothar M. Idris-Adeniyi, Olubunmi A. Bamiwuye

Osun State University, Osogbo, Nigeria
***Corresponding author's Email: olaide.akintunde@uniosun.edu.ng**

Abstract

Maize output in Nigeria is declining and worsening economic situations continue to afflict rural households increasing the level of food insecurity. This study examined the determinants of profit among maize farmers in Osogbo ADP zone of Osun State, Nigeria. Primary data were sourced using a well-structured questionnaire from a total of 120 maize farmers. A two-stage sampling procedure was employed to select the farmers. The analytical tools used were descriptive statistics, farm budgetary techniques and regression analysis. The results showed that maize cultivation was dominated by male farmers with an average age of 50 ± 9.4 years. Additionally, less than 30.8% of the maize farmers had formal education above secondary school. The farming experience of the maize farmers was 14.7 ± 5.3 years and the average farm size was estimated at 7.85 ± 2.15 acres. The average farm income was ₦207 314.40 ± 23 290.95 with the Benefit-Cost Ratio (BCR) of 2.24. The major constraints of maize production, ranked based on their higher values of WMS, were the high labour costs, expenditures for pest and disease control, and the high costs of fertilizers The determinants of farm income that had positive relationship and were significant at 1% level of significance include years of formal education, expenditure on fertilizer while age of the framers negatively influenced the farm income. Also, the farm size and years of farming experience were positive and statistically significant to farm income at 5%. The study suggests a policy focus of training farmers in modern farming system and implement sustainable farm inputs subsidy programs.

Keywords: determinants, profit, maize, farmers, Nigeria

INTRODUCTION

In Nigeria, about 35% of the entire population is engaged in agriculture which is crucial in its contribution to the economy in employment creation, food security and raw materials to the industries as of the year 2020 World Bank, 2020). According to FAO (2020), despite the existence of oil in the country, agriculture continues to be the foundation of the Nigerian economy. Especially in developing countries like Nigeria, agriculture plays an important role in economic growth, development and industrialization (Pawlak & Koodziejczak 2020). Nigeria has a total of 70.8 million hectares of agricultural land with 30.3 million hectares of grasslands and pastures, 6.5 million hectares of perennial crops and 34 million hectares of arable land (Mahmud, 2023). The main crops grown by Nigerian households are maize, cassava, guinea corn and yams, and 70% of households grow agricultural crops. 7.3% of households in South-South Nigeria engage in fishing, compared to 69.3% of households in Northwest Nigeria who own or keep animals (Olakojo, 2017).

Maize is an important crop for Nigeria, as it forms larger percentage of West African grain culture, providing sources of protein, carbohydrates, B vitamins, iron, and minerals (Abdulaleem et al., 2017) and a calorie intake of about 19.5% (Abdullahi et al., 2020). Among

cereal crops, rice is the leading consumable food for Nigerian households, while maize is the second most consumed food item. Maize is high-yield crop with many applications, including food source for humans, a key ingredient in animal feed, raw material for many food industries. In addition, maize is also used to produce starch and beer (Oke et al., 2022). With an expected production of 9 180 270 tons, it ranks the second most produced crop in Nigeria. With a per capita consumption of 40 kg year in sub-Saharan African countries, including Nigeria, this crop has a significant impact on the economies of rich and developing countries (Abubakar et al., 2021). In 2018, African countries produced 96% of the maize total production. According to FAOSTAT data, maize is produced on the continent, with Nigeria leading with 15% or 10.4 million tons of production (FAO 2018). In 2020, Nigeria produced 12 million tons of maize. The largest quantity accounts for 12.7 million tons (Alabi & Safugha, 2022).

In Nigeria, smallholder farmers make up the larger percentage of the farming community and produce the majority of the country's food needs. According to FAO classification in Nigeria, farmers who cultivate land that are less than 5 acres of land are smallholder farmers These are the poorest groups in the country, but they make up about 80% of Nigeria's agricultural population and produce 80-90% of the country s food (Mgbenka & Mbah 2016). Olayide et al. (2016) argued that overall, the Nigerian agricultural sector also faces a number of challenges, including an outdated land tenure system that limits access to land (1.8 hectares/farmer household). The level of irrigation development is very low (less than 1% of cultivated area is irrigated land), limited application of research and technology results, high input costs and low access to credit due to poor management of specialized institutions established to develop industry development. In addition, poor economic conditions continue to cause hardship for rural households, reducing their living standards and maize production. In areas, where population is growing and housing and industrialization competes for land use, productive returns to land have declined (Girei et al., 2018). Additionally, in 2019, Nigeria was the 14th-largest producer of maize worldwide and the second-largest producer in Africa after South Africa However, the country`s domestic corn consumption continues to exceed supply, resulting in an annual demand gap of approximately 4 million tons (Abubakar et al., 2021). Therefore, it is important for the maize sub-sector in Nigeria to assess its current profitability (Alabi & Abdulafeez 2018).

The study aimed to measure the profitability of maize production in Osogbo ADP Zone of Osun State, Nigeria and to identify the factors influencing profit.

MATERIALS AND METHODS

Description of the study area

The study was conducted in the Osogbo Agricultural Development Project (ADP) Area of Osun State, Nigeria. There are three ADPs in Osun State including Ife-Ijesa, Iwo and Osogbo. The study area lies between latitudes 7.0° and 9.0° north of the Equator and longitudes 2.8° and 6.8° east of the meridian, in the equatorial rainforest agro-ecological zone of Nigeria (Akintunde et al., 2023). It has an undulating landscape covering 9 251 square kilometers and is bordered by Ondo and Oyo States to the east and west, respectively, while Kwara and Ogun States form its northern and southern boundaries. The region's vegetation includes native tropical forests and savannas. Farmers in the area are engaged in growing industrial and food crops as well as in poultry and livestock farming. Average rainfall varies from 1 125 mm in the savannah to 1 475 mm per year in the tropical forest belt. The average annual temperature varies from 27.2 °C in June to 39.0 °C in December.

Source and type of data

Primary data in the study was collected by structured questionnaire and unstructured interviews. The questionnaire was structured to collect information on the socio-economic characteristics of corn producers and farm size. It also includes information on input quantities and costs; price and quantity of corn produced.

Sampling procedure and data collection

The study applied a two-stage sampling procedure. The first stage involved the purposive selection of the Osogbo ADP area from the three study areas, based on the highest maize production among the three ADPs in Osun State. The second phase included the random selection of six (6) blocks (Osogbo North, Osogbo South, Ede south, Orolu, Egbedore and Ede North Local Government Area) from the twelve (12) blocks of Osogbo ADP zone due to high production of maize. Finally, twenty 20 farmers were randomly selected from each block to obtain a total of one hundred and twenty sample population. The sampling frame was consisted of farmers registered in the All Farmers' Association of Nigeria.

Methods of data analysis and models

The study used descriptive statistics and inferential statistics as analytical tools. The descriptive statistics includes mean, standard deviation, frequency counts, and percentages were used to analyze socio-economic characteristics of corn producers and farm income. Ordinary least squares multiple regression was used to analyze the determinants of farm profit.

Budgetary techniques

The average farm income is derived from the Budgetary Techniques calculated from two measures of revenue derivatives which include: profit and gross margin (GM). Budgetary analytical approach was used to estimate the cost and return of maize necessary for the estimation of the net profit of maize farmers.

Profit (π) = TR – TC, where TR (Pq) is the total revenue realized from maize farming and TC is the total cost of production which is further divided into TFC + TVC. TFC is the total fixed cost after depreciation and TVC is the total cost of the variables used.

The Gross Margin (GM) equation is given as: GM = TR – TVC = P ×Q – TVC, where: GM = Gross Margin (in Naira), Q = quantity of selected maize produced (kg), P = Price per kg/bag (in Naira).

Model specification

The average farm income of the maize farmers was the dependent variable fitted with explanatory variables which included socioeconomic variables and other variables which were fitted into four functional forms. The lead equation was selected based on the model that has larger adjusted and predicted R-squared values, following Mohammed et al. (2018).

These models were explicitly specified as follows:

Linear function:

$$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9+e$$

Exponential function:

$$LnY= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9+e$$

Semi-log function:

$$Y= \beta_0 + \beta_1LnX_1 + \beta_2LnX_2 + \beta_3LnX_3 + \beta_4LnX_4 + \beta_5LnX_5 + \beta_6LnX_6 + \beta_7LnX_7 + \beta_8LnX_8 + \beta_9LnX_9 + e$$

Double-log function:

$$LnY= Ln\beta_0 + \beta_1LnX_1 + \beta_2LnX_2 + \beta_3LnX_3 + \beta_4LnX_4 + \beta_5LnX_5 + \beta_6LnX_6 + \beta_7LnX_7 + \beta_8LnX_8 + \beta_9LnX_9 + e$$

Where,

Y = profit (₦)

X_1 = Age (years)

X_2 = Years of formal education (years)

X_3 = Household size (number of persons)

X_4 = Farm size (hectares)

X_5 = Years of Farming Experience (years)

X_6 = Expenditure on fertilizer (₦)
X_7 = Labour expenses (₦)
X_8 = Expenses on agrochemicals (₦)
X_9 = Expenses on produce transportation
et = error term

RESULTS AND DISCUSSION

Socio-economic characteristics of the maize farmers

Table 1 presents socio-economic characteristics of the maize farmers in the study area. The results showed that few (14%) of the maize farmers were of age forty or less. More than half (54%) of the maize farmers were between the age of 41 and 50 years while a quarter (25.0%) of them were between the ages of 51 and 60 years. On an average, the age of the maize farmers in the study area was 50 ±9.4 years. It implies that the age might negatively affect the productivity and farm income as older farmers are less energetic and productive unlike young farmers. This finding of the study is not in line with the finding of Alabi & Abdulazeez (2018) who reported maize farmers were young. It was revealed from the results in Table 1 that all (100.0%) of the maize farmers were male and almost all (96.7%) of them were married while very few (3.3%) of them were single. The dominance of male is expected due to the fact that maize cultivation may be less attractive to women due to its labour intensive and task driven in production. This finding is similar with the work of Alabi & Abdulazeez (2018) and Oke et al. (2022) who reported that maize production is male dominated.

The results in Table 1 revealed lower proportion (39.2%) of the maize farmers had between 7 and 8 persons in their household, 30.0% had between 5 and 6 persons, 25.0% of the maize farmers had between 9 and 10 persons, while few (5.8%) had between 3 and 4 persons. The mean household size of the maize farmers was 7±2 persons. The result showed that farmers have family labour that they may engage in planting processes, which will in turn reduce production cost and increase profit. Table 1 showed that 42.5 percent of the maize farmers in the study area had primary education, 26.7% had no formal education, and 25.8% had secondary education while 5.0% had tertiary education. This finding on level education implies that low share 30.8%) of the maize farmers had above secondary education, which might have negative impacts on their farm management. Education impacts positively on farm management in the reason that an educated farmer could easily adopt new innovation that can assist in cost reduction, increased in farm output, and consequently increase farm income. This is affirmed by O'Donoghue & Heanue (2018) who observed that formal education impact positively on farm returns.

It is revealed in the results in Table 1 that 5.0% had less than 4 acres of land, 18.3% had between 4 and 6 acres, above half (52.5%) of the maize farmers had a farm size of between 7 and 9 acres, 23.3% had between 10 and 12 acres, and 0.8% cultivated more than 12 acres. The average farm size was 7.85±2.15. This implies that the maize farmers in the study area had access to land for production which is above average of farm size of 1-3 ha of small-holders farmers in Nigeria as reported by Chiaka et al. (2022). The large farm size will be a factor for more income as the farm size is directly proportional to farm income as reported by Gollin (2019). Results in Table 1 depicts the farming experience of the farmers which indicates that one-quarter (25.0%) had between 6 and 10 years of experience in maize farming, 32.5% of them had farming experience of 11 - 15 years, 30.0% had the range of farming experience between 16 and 20 years, 8.3% had their range of farming experience between 21 and 25 years, 3.3% had more than 25 years of farming experience. The mean farming experience of the producers was 14.7 ± 5.3 years which implies that most of the respondents were well experienced in maize farming Adelekan & Omotayo (2017) asserted that as farmers advance in age, their increased

years of farming experience will translate to higher output and farm earnings.

Table 1. Socioeconomic characteristics of the maize farmers

Characteristics	Frequency	Percentage (%)
Age		
≤ 40	14	11.7
41-50	54	45.0
51-60	30	25.0
> 60	22	18.3
Mean = 50.26	S.D = 9.4	
Sex		
Male	120	100
Marital Status		
Single	4	3.3
Married	116	96.7
Household Size		
< 5	7	5.8
5-6	36	30.0
7-8	47	39.2
> 8	30	25.0
Mean = 7	S.D = 2	
Level of Education		
No formal	32	26.7
Primary	51	42.5
Secondary	31	25.8
Tertiary	8	5.0
Farm Size		
< 4	6	5.0
4-6	22	18.3
7-9	63	52.5
10-12	28	23.3
> 12	1	0.8
Mean = 7.85	S.D = 2.15	
Farming Experience		
< 6	1	0.8
6-10	30	25.0
11-15	39	32.5
16-20	36	30.0
21-25	10	8.3
> 25	4	3.3
Mean = 14.7	S.D = 5.3	

Source: Field Survey Data, 2023.

Profit analysis of maize production in the study area

Table 2 presents the costs and returns of maize production. The cost and return analysis of maize production consists of the total revenue (TR) and the total costs (TC). The total revenue (TR) of maize production is ₦374 368.3 (1871.8kg), which includes sold items with a mean value of ₦342 666.7 (1713.3kg), mean value for consumed is ₦16100.0 (80.5 kg), while the mean value for gift is ₦15 601.7 (78.0kg). The total variable costs accounts for 91.1 percent with a mean value of ₦152 209.2 of the total costs which includes fertilizer (59.2%), herbicides (liters) (2.7%), seeds (kg) (0.7%), labour (man-day) (12.0%), transportation (4.6%) and tractor operation (12.0%). The profit analysis as shown in Table 2 revealed the difference between the Total Revenue (TR) and Total Cost (TC) estimated at ₦207 314.4. Also, the benefit cost ratio revealed that for every ₦ 1 invested there is a return of ₦1.24 which indicates a profitable venture. This result is similar with Alabi and Abdulazeez (2018) who reported that maize production is profitable with over ₦1/investment turn over.

Annual farm income

Results in Table 3 show that 26.7 percent of the maize farmers in the study area earned less than ₦50 001 annually, one-fifth (20%) of the maize farmer earned between ₦150 001 and ₦200 000 annually, 11.7% of the maize farmers earned between ₦200 001 and ₦250 000 annually, while 2.5% of them earned above ₦300 001 annually. On an average, the annual income of the maize farmers was ₦207 314.40 ±23 290.95 which was quite less compared to the value of ₦55545.91 reported by Haruna et al. (2023).

Determinants of farm income of maize production in the study area

Table 4 presents the multiple regression analysis on factors influencing the farm income among maize farmers in the study area. Linear, exponential, semi-log, and double log

functional models were adopted for the study in which semi-log model is selected as lead equation due to its high R^2 value. The R^2 value is 0.636 showing that the explanatory variables explained 63.6% of the total variation in the farm income. Also, the results in Table 4 shows the F-ratio (4.28) which was significant at 1% level and indicated that the model has a good fit.

Table 2. Cost and return analysis of maize production

Item	Average quantity	Average cost (N)	Mean (N)	%TC
Revenue				
Sold (kg)	1713.3	200.0	342,666.7	
Gift (kg)	78.0	200.0	15,601.7	
Consumed (kg)	80.5	200.0	16,100.0	
Total revenue (TR)	1871.8	200.0	374 368.3	
Variable				
Fertilizer (kg)	149.8	660.0	98,835.0	59.2
Herbicides (Litres)	2.0	2250.0	4 500.0	2.7
Seeds (kg)	6.0	200.0	1 200.0	0.7
Labour (man-day)	2.0	10000.0	2 0000.0	12.0
Transportation		7674.2	7 674.2	4.6
Tractor operation	1.0	20000.0	20 000.0	12.0
Total variable cost (TC)			152 209.2	91.1
Fixed cost after depreciation				
Sprayer		1500.0	1 500.0	0.9
Land		11904.8	11 904.8	7.1
Hoes, cutlass, file and wheelbarrow		1440.0	1 440.0	0.9
Total fixed cost (TFC)			14 844.8	8.9
Total cost (TC)			167 053.9	100.0
Gross margin (GM)			222 159.2	
Net farm income (NFI)			207 314.4	
Benefit cost ratio (BCR)			2.24	

Source: Data analysis, 2023.

Table 3. Distribution based on the annual income of the maize farmers in the study area

Monthly income (₦)	Frequency	Percentage
< 50 001	32	26.7
50 001- 100 000	14	11.7
100 001- 150 000	9	7.5
150 001- 200 000	20	16.7
200 001- 250000	14	11.7
250 001- 300 000	28	23.3
> 300 001	3	2.5
Mean = 207 314.40	SD = 23 290.95	

Source: Field survey, 2023.

The results in Table 4 indicates that the coefficients of age of the maize farmer, years of formal education, farm size, years of farming experience, and expenditure on fertilizer were statistically significant to farm income of the maize farmers. All of the coefficients of the variables were positive except the age of the maize farmers, which was negative. Farm size and years of farming experience were statistically significant to farm income at 5% level of significance while all other three variables were at 1% level of significance.

The coefficient of age of the maize farmers was negative and statistically significant to farm income at 1% level of significance, which implies every increase in the age of the maize farmers by a year will lead to a decrease in farm income by 0.244 units. The inverse relationship between the age of the maize farmers and farm income depicts a decrease in productivity and ability to make more farm income as young farmers are active than older framers as such they have tendency to expand their farm and explore available opportunities to make more farm earnings than the older farmers. This finding is similar with the finding of Rigg et al. (2020), who reported the older farmers have less income than younger ones irrespective of farm size and ageing farmers are less productive than younger farmers.

The results in Table 4 showed that the coefficient of years of formal education had a positive relation with the farm income and statistically significant to farm income at 1% level of significance which shows that for an increase in the years of education of the maize farmer by a year will increase farm income by 0.094 units. The implication of this finding is that there is a strong tendency of educated farmer to utilize education advantage to manage the farm efficiently in order to make more farm income unlike illiterate farmer. This finding is similar to the results of O'Donoghue & Heanue (2018), who pointed out that the formal education has a positive relationship with the farm income. The coefficient of the variable farm size has a direct relationship with the farm income, which implies that an increase in the acreage of farm land under cultivation by a unit will bring about 1.254 units an increase in the farm income. This finding premises on the economy of scale in production as more income are likely to be accrued to large scale production as supported by Beckman & Schimmelpfennig (2015) who confirmed that there is a direct relationship between the profit per acre and farm size.

Table 4. Factors that determined the farm income in the study area

Variables	**Coefficient**	**Std. Error**	**t - value**	**p-value**
(**Constant)**	2.637***	0.429	6.15	0. 000
Age (X_1)	- 0.244***	0.078	- 3.13	0.001
Years of Formal Education (X_2)	0.094***	0.034	2.76	0.002
Household size (X_3)	1.531	1.244	1.23	0.129
Farm size (X_4)	1.254**	0.589	2.13	0.023
Years of Farming Experience (X_5)	1.013**	0.499	2.03	0.032
Expenditure on fertilizer (X_6)	1.532***	0.371	4.13	0.000
Labour expenses (X_7)	-1.060	2.465	- 0.43	0.214
Expenses on agrochemicals (X_8)	- 0.196	0.327	0.60	0.451
Produce transportation (X_9)	0.278	0.267	1.04	0.131
F Statistics = 4.28				0.000
R^2 = 0.636				
Adj R-squared = 0.615				

*** Significant at 1%, ** Significant at 5%, * Significant at 10%. Source: Field Survey Data, 2023

The coefficient of years of farming experience exhibits a positive relationship with the farm income as the finding of the study indicates that an increase of the years of farming experience by a year will increase the farm income by 1.013 units. The implication of this finding is that a farmer with more years of farming practices will be more adequately enriched in knowledge about best farming practices, cost minimization techniques and cobweb pattern of agricultural production. It is expected that all these knowledge will translate

into more farm income which is supported by the similar research findings of Coster & Adeoti (2015) who asserted that the years of farming experience has a positive relation with the farm revenue. The coefficient of expenditure on fertilizer had a positive relationship with farm income in which the value from the output of study implies that an increase in the expenditure by a naira will bring an increase in the farm income by 1.532 units. This result indicates the need of increase in the cropping productivity through application of fertilizers since their usage is expected to increase the level of farm output and thus the sales and farm income. This disagrees with the results of Malaiarasan et al. (2021) who observed a positive relationship between the farm income and expenditure on fertilizers.

Constraints to maize production

The constraints to maize production in the study area are presented in Table 5. The constraints were ranked according to their weighted mean score (WMS). The results in Table 5 revealed that the first three constraints ranked based on their higher values in WMS include high costs of labour (2.0), pests and diseases (1.98), and high costs of fertilizer (1.97). Others constraints that are less important are inadequate capital (0.99), high costs of transportation (0.99), fluctuation in market price (0.99) and high interest on loans (0.99). This implies that most of the respondents indicated that the constraints that were very severe in the study area are pests and diseases, high costs of labour and high costs of fertilizer. This finding is in tandem with the study conducted by Girei et al. (2018) who confirmed that high cost of labour, pests and diseases were the constraints of maize production.

Table 5. Distribution based on constraints to maize production

Constraints	Very severe	Severe	Not severe	WMS	Rank
Inadequate capital	0 (0.0)	119 (99.2)	1 (0.8)	0.99	4th
Pests and diseases	119 (99.2)	0 (0.0)	1 (0.8)	1.98	2nd
High costs of labour	120 (100.0)	0(0.0)	0 (0.0)	2.00	1st
High costs of transportation	0(0.0)	119(99.2)	1(0.8)	0.99	4th
Fluctuation in market price	0(0.0)	119(99.2)	1(0.8)	0.99	4th
High interest on loans	0(0.0)	119(99.2)	1(0.8)	0.99	4th
High costs of fertilizer	117(97.5)	2(1.7)	1(0.8)	1.97	3rd

Legend: Values in parenthesis are percentages Source: Field survey, 2023.

CONCLUSION

The study examined the determinants of profit among maize farmers in Osogbo ADP zone of Osun State, Nigeria. The study found that maize cultivation in the area is predominantly managed by male farmers. These farmers are generally older and possess significant farming experience. The few maize farmers were educated above the secondary school level, which might have negative effect on income accrue to the farming. Maize production is profitable with low profit margin, but with good benefit cost ratio.

The study concluded that the farm income in maize production in the study area was not high as expected which might be due to socio-economic variables of the maize farmers such as age and the level of education. Other factors which might have negative impacts on the farm income include high costs of labour, high costs of fertilizer, pests and diseases. It is therefore suggested that policy framework should be formulated in addressing the national demand-supply gap of maize grain in Nigeria through boosting the current maize production by the peasant farmers. This can be achieved through assisting local farmer with training in

modern farming system. Also, inputs subsidy programs should be formulated and executed to be benefited by genuine farmers but not portfolio farmers. The outcome of the study revealed that maize production is dominated by the older farmers which will have negative impact on contribution of maize to nation's GDP. Hence, it is suggested that government should formulate policy that will attract youth to farming through incentives and rural infrastructure development. Low profit margin of maize production as it is revealed by the study can be improved through extensive and periodic training of farmers on optimal utilization of farm inputs in order to reduce the cost of production and wastage minimization.

ACKNOWLEDGMENTS

The authors appreciated the members of staff of Osogbo Agricultural Development Projects (ADP) zone, Osun State, Nigeria for their supports in the process of data collection and immense contributions in data collection. Also, we appreciate the administrative staff of All Farmers' Association of Nigeria in Osogbo for the useful information about the sampling frame of the study.

REFERENCES

Abdulaleem, M. A. Oluwatusin, FM, O. & Kolawole, A. O. (2017). Analysis of costs and returns on maize production among small-scale farmers in Osun State Nigeria. *Report and Opinion*, 9(5), 89-92.

Abdullahi, B. N. Yeboah, F. K. Ahmed, N. & Muhammad, I. U. (2020). Profitability of Small-Scale Maize Production in Nigeria: A Case Study of Bichi Local Government, Kano State-Nigeria. *European Journal of Agriculture and Food Sciences*, 2(5), 1-5. http://dx.doi.org/10.24018/ejfood.2020.2.5.101

Abubakar, S. Sule, B. A. & Emefesi, B. O. (2021). Profitability analysis and socio-economic determinants of maize output in Rijau Local Government area of Niger State, Nigeria. *Journal of Agripreneurship and Sustainable Development*, 4(1), 210-218.

Adelekan, Y. A. & Omotayo, A. O. (2017). Linkage between rural non-farm income and agricultural productivity in Nigeria: A Tobit-two-stage least square regression approach. *The Journal of Developing Areas*, 51(3), 317-333.

Akintunde, O. K. Olanrewaju, K. O. Agboola, T. O. & Busari, A. O. (2023). Gender disparity in livelihood diversification among rural households in Osogbo Agricultural Development Programme (ADP) Zone of Osun State, Nigeria. *African Journal of Science, Technology, Innovation and Development*, 15(6), 796-803. https://doi.org/10.1080/20421338.2023.2192630.

Alabi O. O. & Abdulazeez I. (2018). Economics of Maize (Zea mays) Production In Igabi Local Government Area, Kaduna State, Nigeria. *Journal of Agricultural Faculty of Gaziosmanpasa University*, 35(3), 248-257.

Alabi, O. & Safugha, G. F. (2022). Efficiency of resource-use and marginal value productivity analysis among maize farmers, Abuja, Nigeria. *International Journal of Agriculture Forestry and Life Sciences*, 6(2), 28-33.

Beckman, J. & Schimmelpfennig, D. (2015). Determinants of farm income. *Agricultural Finance Review*, 75(3), 385-402.

Chiaka, J. C. Zhen, L., Yunfeng, H. Xiao, Y., Muhirwa, F. & Lang, T. (2022). Smallholder Farmers Contribution to Food Production in Nigeria. *Frontiers in Nutrition*, 9, 916678.

Coster, A. S. & Adeoti, A. I. (2015). Economic effects of climate change on maize production and farmers' adaptation strategies in Nigeria: a Ricardian approach. *Journal of Agricultural Science*, 7(5), 67-84 https://doi.org/10.5539/jas.v7n5p67

FAO (2020). Nigeria at a glance. Food and Agriculture Organization of the United Nations". www.fao.org. Retrieved 2020-11-24.

FAOSTAT (2018). FAO Statistical Database (online). Food and Agricultural Organization of the United Nations. Rome. http://faostat.fao.org.

Girei, A. A. Saingbe, N. D. Ohen, S. B. & Umar, K. O. (2018). Economics of small-scale maize production in Toto local government area, Nasarawa state, Nigeria. *AgResearch*, 18 (1), 90-104.

Gollin, D. (2019). Farm size and productivity: Lessons from recent literature. *IFAD Research Series*, (34), 1-35.

Haruna, L. Z. Sennuga, S. O. Bamidele, J. Bankole, O. L. Alabuja, F. O. Preyor, T. J. & Barnabas, T. M. (2023). Factors Influencing Farmers' Adoption of Improved Technologies in Maize Production in Kuje Area Council of FCT-Abuja, Nigeria. *GPH-International Journal of Agriculture and Research E-ISSN 2805-4362 P-ISSN 2805-4340*, 6 (04), 25-41.

Malaiarasan, U. Paramasivam, R. & Felix, K. T. (2021). Crop diversification: determinants and effects under paddy-dominated cropping system. *Paddy and Water Environment*, 19, 417-432.

Mgbenka, R. N. & Mbah, E.N. (2016). A Review of Smallholder farming in Nigeria: need for Transformation. *International Journal of Agricultural Extension and Rural Development Studies*, 3(2), 43–54.

Mohammed, B. S. Khed, V. C. & Nuruddin, M. F. (2018). Rubbercrete mixture optimization using response surface methodology. *Journal of Cleaner Production*, 171, 1605-1621.

O'Donoghue, C., & Heanue, K. (2018). The impact of formal agricultural education on farm level innovation and management practices. *The Journal of Technology Transfer*, 43, 844-863.

Oke, F. O. Kareem, I.A. Bamigbade-Sanni, S.A. Oose, M.O & Olayode, A.K (2022). Economic Analysis and Determinants of Maize Production in Oyo State, Nigeria. *Nigerian Agricultural Journal*, 53(1), 60-66.

Olakojo, S. A. (2017). Gender gap in agricultural productivity in Nigeria: a commodity level analysis. *Economics of Agriculture*, 64(2), 415-435.

Olayide, O. E. Tetteh, I. K & Popoola, L. (2016). Differential impacts of rainfall and irrigation on agricultural production in Nigeria: Any lessons for climate-smart agriculture?. *Agricultural Water Management*, 178, 30-36.

Pawlak, K. & kołodziejczak, M. (2020). The role of agriculture in ensuring food security in developing countries: Considerations in the context of the problem of sustainable food production. *Sustainability*, 12, 54-88.

Rigg, J. Phongsiri, M. Promphakping, B. Salamanca, A. & Sripun, M. (2020). Who will tend the farm? Interrogating the ageing Asian farmer. *The Journal of Peasant Studies*, 47(2), 306-325.

World Bank (2020). Employment in agriculture (% of total employment) (modeled ILO estimate) - Nigeria. Work Bank Data.