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Socioeconomic Determinants of African Yam Bean (*Sphenostylis stenocarpa*) Production among Smallholder Crop Farmers in Ekiti State, Nigeria

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BSO (50%) Developed the concept, gathered relevant materials, wrote the background, developed the objectives, designed methodology, designed questionnaire, involved in field survey for data collection, proofread the manuscript and ran language editing.
ATA (35%) Developed the topic and specific objectives, designed the methodology, coded the data, analyzed the data, interpreted and discussed the results, proofread the manuscript, revised and ran plagiarism check on the manuscript.
VS (15%) Designed questionnaire, involved in field survey for data collection.

Abstract
The study examined socioeconomic determinants of African yam bean production among smallholder crop farmers in Ekiti State. Using a structured questionnaire and interview schedule, data were collected from sampled 120 farmers. Data were analysed using percentages, charts and OLS multiple regression analysis. The results showed that agricultural extension agents (85.0%) and fellow farmers or cooperatives (61.7%) are the prominent sources of farm-related information on AYB production. The result of the regression analysis showed that sex, household size, primary occupation, farm size and extension contacts were significant and positively influenced AYB production while education was significant but negatively influenced AYB production. Challenges against AYB production include inadequate finance (78.3%), high cost of labour (72.5%), low yield of AYB per hectare (68.3%), pest and diseases (65.8%), inadequacy of AYB for planting (60.8%) and old age of most farmers (53.3%) among others. The use of insecticides (81.7%), pesticides (40.8%) and

use of traps (29.2%) constitute the highest pest and disease control measures used by the farmers. The study concludes that socioeconomic factors play significant roles in the AYB output of farmers. Efforts should be made to increase the capacity of the farmers through education and training to improve their efficiency and productivity.

Introduction

Many nutritionally rich crops that were once consumed by humans have become marginalized and their cultivation restricted to a confined region due to selection and domestication (Singh, et al, 2022), underutilization and neglect. Various studies reported that about 80,000 plants have been directly utilized by humans in time past for dietary, therapeutic, industrial, fibre and fodder purposes. Part of these was more than 25,000 edible plants and up to 7,000 plants have been collected from the wild or domesticated at different times in history (Muthamilarasan, et al. 2019). Currently, about thirty plant species are grown for food, with rice, maize, wheat, soybean, potato and sugar cane accounting for over 75% of the total plant-based energy intake. (Singh, et al. 2022)

The Green Revolution was greatly celebrated in time past as an event that was going to impact positively on food production systems, Hunter et al. (2021), however, noted that while the percentage of people hungry has been reduced by 50% since the emergence of Green Revolution, food insecurity and hunger trends, have consistently revealed a population of people in various countries have remained malnourished. They also noted that human diets have lacked diversity worldwide, dominated by rice, maize and wheat to the detriment of the indigenous crops that had been abandoned by the modern agricultural production systems. The reduction in crop diversity together with the sedentary lifestyles and the intake of highly processed foods have led to a double burden of food and nutritional problems with over 1.0 billion people being obese and close to 2 billion undergoing malnutrition (Tiozon, et al., 2021; Sreenivasula and Ferne, 2022). Therefore, there is an urgent need for agricultural production systems to explore the unexploited opportunities in indigenous, local, minor, and forgotten crops popularly referred to as neglected and underutilized crops for a sustainable and healthy dietary and nutrition diversification which is a major factor for both the physical and mental well-being of humans.

Africa and especially Nigeria is endowed with neglected and under-exploited crop species including indigenous pulses, fruits, vegetables, cereals and tuber crops with untapped potentials for diversified and improved human and livestock nutrition. These NUS have however been relegated to the background by researchers, funding agencies, extension agencies, industrialists, some farmers, consumers and even government policies.

African yam bean is one of these lesser-known and under-exploited tropical and sub-tropical pulses of African origin. African yam bean has been reported to be very rich in protein, energy, micronutrients and fibre but low in fats (Baiyeri, et al., 2018a). AYB is used for managing high blood pressure and diabetes in ethnomedicine. It is used in treating mumps in Benue State, Nigeria. This suggests that AYB has some antioxidants, minerals and other phytochemicals, and that have some pharmacological effects and positive physiological actions (Baiyeri, et al., 2018a). Michael, et al., (2018) found that AYB extract had an anti-diabetic effect that was similar to the reference drug glibenclamide. AYB produces root nodules that fix

atmospheric nitrogen and its leaves when decomposed improve soil fertility (Baiyeri, et al., 2018b). Ekiti State had been a major AYB-producing state and it was a major staple some decades back. But currently, high-premium pulses such as cowpea and soybean have taken the place of AYB in the State. AYB is gradually going into extinction in Ekiti State. Farmers, hardly include it in their cropping systems.

Empirical information on the socioeconomic factors influencing the production of AYB is still largely scarce in the literature. More challenging is the fact that there are few baseline surveys and evidence-based research on AYB in Ekiti State one of the major producing states in Nigeria. Singh, et al. (2022) affirmed that the underexploited crops have had limited attention from agricultural stakeholders including researchers because of low commercial value and poor awareness of the crops among consumers. To restore the desired utilization and production of AYB, it is important to investigate the socioeconomic factors that influence its production. It was based on this background that this study estimated socioeconomic determinants of AYB production among smallholder crop farmers in Ekiti State. Specifically, the study identified sources of farm-related information about AYB production, estimated socioeconomic factors influencing the production of AYB, identified challenges militating against the AYB farmers of Ekiti State, and pests and diseases control measures practised by the farmers

Methodology

The study was carried out in Ekiti State, Southwest, Nigeria. The State was made up of 16 Local Government Areas (LGAs) with headquarters in Ado Ekiti and divided into three agricultural zones (Zone I, II and III) with an estimated population of 3,270,798 people (1,668,107 males and 1,602,691 females (National Population Commission/National Bureau of Statistics, 2022). Geographically, the state is located between longitudes $4^{O}\ 45^{1}$ and $5^{O}\ 45^{1}$ East of the Greenwich Meridian and latitudes $7^{O}\ 15^{1}$ and $8^{0}\ 15^{1}$ North of the Equator. Ekiti State is one of the major producers of African yam bean (AYB) in Southern Nigeria.

Data for this study were collected through a multistage random sampling procedure using a structured questionnaire. The first stage of the sampling involved the random selection of two blocks from each of the three zones (Ado and Ijero blocks from Zone I, Ikere and Ise from Zone II while Ikole and Oye from Zone III) making six blocks. In the second stage, two circles were also randomly sampled from each of the six blocks earlier selected making a total of 12 circles. The 12 sampled circles are Ado-Ekiti metropolis and Ago from Ado; Iroko and Okeoro from Ijero; Ikere metropolis and Afao from Ikere; Ise and Temidire from Ise; Ayedun and Odo-oro from Ikole; and Oye and Ayegbaju from Oye. With the assistance of agricultural extension agents, the lists of arable crop farmers involved in African yam bean production in the selected circles were obtained. Hence, the fourth stage involved random sampling of 10 African yam bean farmers from each of the 12 circles giving a total sample of 120 African yam bean farmers that were used as respondents for the study.

The primary data collected with a structured questionnaire and an interview schedule focused on the socioeconomic characteristics of the AYB farmers, sources of farm-related information about AYB production, challenges militating against the farmers and pests and disease control measures adopted by the farmers. Data were analysed using both descriptive and inferential statistics such as charts, frequency, percentage,

mean, standard deviation and Ordinary Least Squares (OLS) multiple regression analysis.

To estimate socioeconomic factors influencing AYB production, the Ordinary Least Squares (OLS) multiple regression model was used. The implicit form of the regression model is as follows:

$$Y = f\ (X1, X2, X3, X4, X5, X6, X7, X8, U \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

Y = AYB production in kg.

X_1 = Sex (1 = if male, 0 = if female)

X_2 = Age (in years)

X_3 = Years of Education (Number of years spent in school)

X_4 = Household size (number of persons)

X_5 = Primary occupation (1 if farming, 0 if otherwise)

X_6 = Years of farming experience

X_7 = Farm Size

X_8 = Extension agents (number of visits in last cropping season)

e = error term.

Equation 1 was estimated in four different functional forms linear, exponential, semi-log and double-log from which the equation with the best fit was chosen as the lead model based on R^2 value, number and signs of significant variables, and levels of significance.

Results and Discussion

Sources of Farm-related Information about AYB Production

Figure 1 shows multiple responses of various channels of farm-related information about AYB production to the farmers. Hence, agricultural extension agent as a channel is responsible for about 85.0% of the sources of farm-related information, followed by information from other farmers or cooperatives (61.7%), farm household members (48.3%), researchers (21.7%), radio and television programmes are 18.3% and 15.8% respectively. This reveals that the bulk of agricultural-related information such as sources of planting materials, input prices, crop varieties, modern agricultural production practices and technologies are made known to the farmers through agricultural extension services. Akinnagbe and Akinbobola (2022) found that extension agents are responsible for about 72.0% of the sources of information to farmers on NERICA rice varieties in Ekiti State. Maulu, et al (2021) reported that agricultural extension as a major source of information to farmers plays a significant role in disseminating research-based agricultural knowledge and technology to farmers.

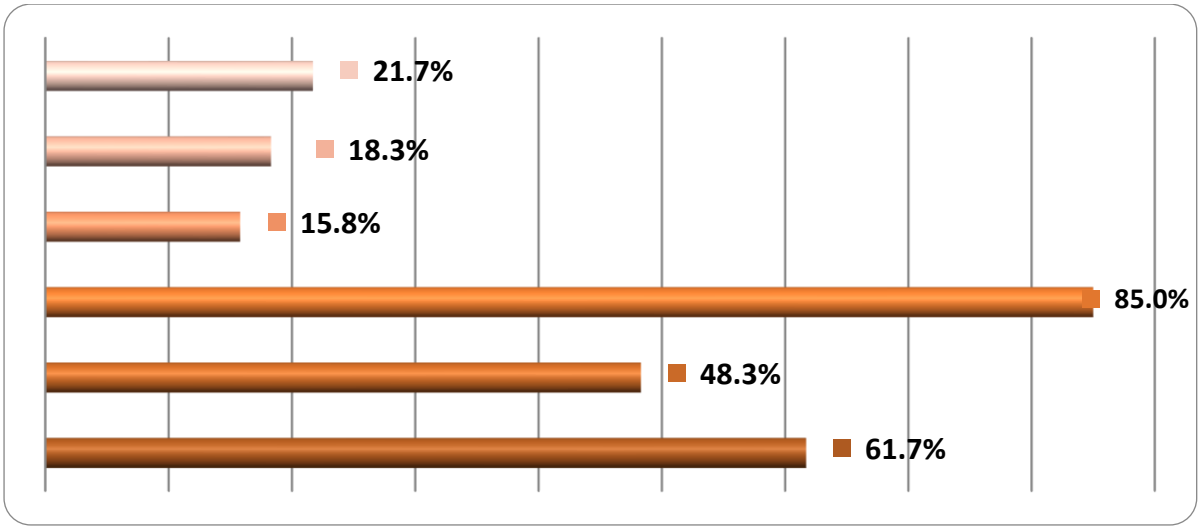

Figure 1: Sources of farm-related information on AYB production
Sources: Field Survey Data, 2022.

Socioeconomic Factors Influencing Production of African Yam Bean (AYB)

Table 1 shows that the double-log functional form had the best fit, based on the R^2 value of 0.9200, the number of significant variables, conformity of their signs with *a priori* expectation and levels of significance of the explanatory variables. The R^2 value of 0.9200 implied that about 92% variation in AYB production was accounted for by the explanatory variables in the model. Out of the eight explanatory variables hypothesized in the model, six variables (sex, education, household size, primary occupation, farm size and extension contacts) significantly influenced AYB production.

The sex of the farmers was significantly and positively related to the production of AYB indicating being male puts the farmers at a vantage position for increased production. This corroborated the result of Yisa, et al (2020) who found that male farmers are more efficient in rice production than their female counterparts. The coefficient of education was significant though negatively related to AYB production. The significant and negative relationship suggests that, as the years of education of the farmers increase, their production of AYB reduces. The result was not expected. Though, an increase in the level of education is likely to boost the chances of farmers getting engaged in off-farm jobs and hence reduced engagement in farming activities. The relationship between the household size of the farmers and AYB production was positive and highly significant. This implies that as the number of persons in the farm household increases, there is the likelihood of increased production. High farm households' size in some cases may translate to high family labour for improved production. Nuno and Baker (2021) found that an increase in the number of economically active members in farm households enhances the overall productivity of the household. Alabi and Safugha (2022) reported that labour input constitutes a significant factor influencing crop production and output.

Table 1: Factors influencing the production of AYB

Variables	Linear	Semi-Log	Double-Log	Exponential
Sex	0.0996877	0.3268557	0.1016651	0.1024488
	(0.0213628)***	(0.0982587)***	(0.0205809)***	(0.0329768)***
Age	-0.0001289	0.0050886	-0.0010411	-0.0019279
	(0.0007115)	(0.0032726)	(0.000651)	(0.0019983)
Education	-0.0052835	-0.0252375	-0.0069193	-0.0079486
	(0.0030503)*	(0.0208101)	(0.0029492)**	(0.003628)**
Household Size	0.0143487	0.0503375	0.0185326	0.0192272
	(0.003674)***	(0.0168987)***	(0.0036531)***	(0.0196714)
Primary	0.0997346	0.2012122	0.0987237	0.2102797
Occupation	(0.0159856)***	(0.0735262)**	(0.0150498)***	(0.0246763)***
Farming	0.0003191	0.0004218	0.002557	0.0012761
Experience	(0.0005999)	(0.0027591)	(0.0132388)	(0.000926)
Farm Size	0.0787558	0.2599995	0.0695293	0.1259978
	(0.0140302)***	(0.0645323)***	(0.0105399)***	(0.0216578)***
Extension contacts	0.0613736	0.1184269	0.061801	0.1160435
	(0.0035368)***	(0.0162677)***	(0.0034159)***	(0.0054596)***
(Constant)	0.1406051	-1.949281	0.1959236	1.135932
	(0.0158654)***	(0.210959)***	(0.0138069)***	(0.0708004)***
R^2	0.8580	0.8377	0.9200	0.8254
Adjusted R^2	0.8557	0.8289	0.9178	0.8236
F - Value	430.10	399.58	448.57	423.59
Prob>F	0.0000	0.0000	0.0000	0.0000
Observation	120	120	120	120

Note: Figures in parentheses are standard errors.
*** denotes 1%; ** denote 5%
Source: Field Survey, 2022

The coefficient of primary occupation was significant and positively related to AYB production. The relationship indicates that having farming as a primary occupation improves the propensity for higher production. Farm size was significant and positively signed with the production of AYB. This conforms with *a priori* expectation as farmers with larger farm sizes are expected to have higher outputs, all things being equal. Amusa and Esheya (2022) reported that farm size is an essential factor in crop production as a large farm size oftentimes translates to higher output. Chauke (2018) established a significant and positive relationship between farm size and the output of crop farmers. The coefficient of extension contacts was positive and significant at 1%. Farmers' exposure to extension agents enhances their rate of farm technology adoption and improved farm practices which also translate to higher yields. Danso-Abbeam, et al, (2018) confirmed that agricultural extension programme positively and significantly affects farmers' productivity and income.

Challenges Militating against African Yam Bean Farmers

The current production of AYB is challenged by the declining trend and obvious loss of interest of the younger generation of farmers in its production. The result of multiple responses in Table 2 identified some of the notable challenges militating against AYB production including inadequate finance by the farmers (78.3%), high cost of labour (72.5%), low yield of AYB per hectare (68.3%), pest and disease outbreak (65.8%), the inadequacy of AYB for planting (60.8%) and old age of most of the farmers (53.3%)

among others. Ndubuisi, et al (2022) in a study identified challenges confronting AYB farmers in southeast Nigeria as diseases and pests, unavailability of farm input, high labour cost, inadequate funds, lack of farm credit and literacy level of farmers which could be linked to their old age. According to the findings of Akinnagbe and Akinbobola (2022) pest infestation, climate change and inadequate capital for adopting the technology are some of the challenges facing food crop farmers.

Table 2: Challenges against African yam bean farmers.

Challenges against AYB farmers	Percentage
Inadequate finance by the farmers	78.3
High cost of labour	72.5
Low yield of African yam bean per hectare	68.3
Pest and disease outbreak	65.8
Inadequacy of AYB for planting	60.8
Old age of most of the farmers	53.3
Low market demand for AYB grains	49.2
Poor seed quality	28.3
Post harvest spoilage	27.5
Lack of staking materials	4.2

Sources: Field Survey Data, 2022.

Pests and Diseases Control Measures of AYB Farmers

Pests and disease attacks on crops and livestock are major challenges in agricultural production. The result in Figure 2 presents multiple responses to pest and disease control measures employed by AYB farmers. The use of insecticides (81.7%) constitutes the highest pest and disease control measures, the use of pesticides (40.8%), trapping pests (29.2%), the physical measure by hand picking and killing (14.2%) and quick harvesting (8.3%). Hence, spraying insecticides and pesticides is the major way of controlling pest and disease attacks by AYB farmers. Anjorin, et al (2020) noted that important measures for crop pest and disease control include the use of agrochemicals such as insecticides, pesticides and fungicides.

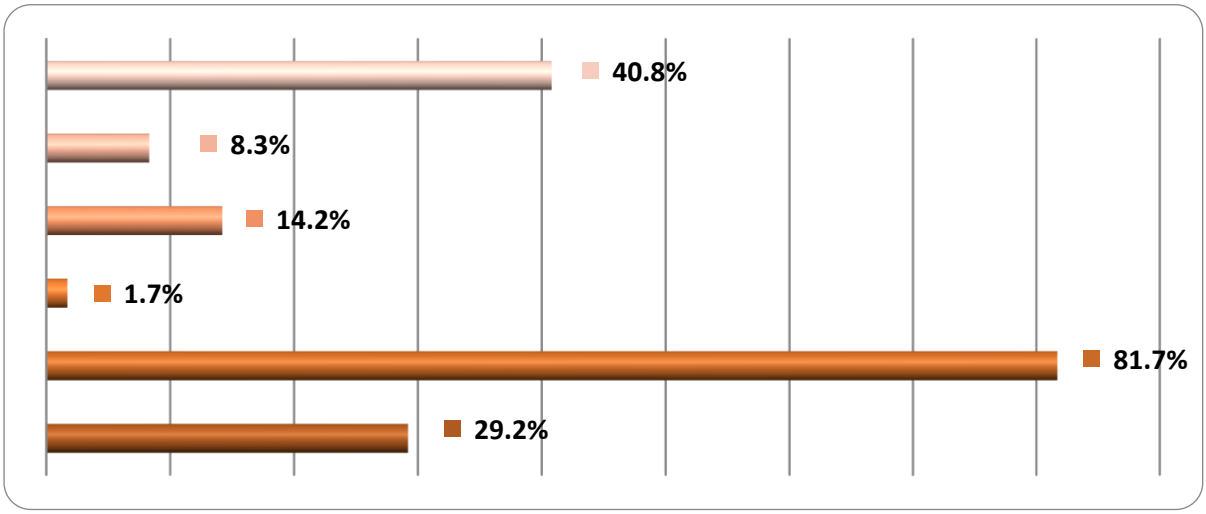

Figure 2: Pests and diseases control measures of AYB farmers
Sources: Field Survey Data, 2022.

Conclusion and Recommendations

Sex, education, household size, primary occupation, farm size and extension contacts significantly influenced AYB production. The study concludes that socioeconomic factors play significant roles in the AYB output of farmers. Efforts should be made to increase the capacity of the farmers through education and training. There should be a proactive approach to ensure increased extension contacts to the farmers for improved efficiency and productivity. In addition, there should be adequate production incentives to the farmers through the provision of soft loans, improved seeds and the provision of insecticides and pesticides for effective control of insects, pests and diseases of AYB to boost production.

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