

# VALUE ADDITION ACTIVITIES AND CHALLENGES OF AFRICAN YAM BEAN (*SPHENOSTYLIS STENOCARPA*) FARMERS IN ENUGU STATE, NIGERIA.

## ACTIVIDADES ADICIONALES DE VALOR Y DESAFÍOS DE LOS GRANJEROS AFRICANOS DE YAM BEEN (*SPHENOSTYLIS STENOCARPA*) EN EL ESTADO DE ENUGU, NIGERIA.

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### ABSTRACT

The study examined the value addition practices and challenges of African yam bean (*Sphenostylis stenocarpa*) farmers in Enugu State of Nigeria. Multistage sampling technique was adopted in selecting a total of seventy-two (72) respondents used for the study. Results revealed that all (100%) of the respondents processed African yam bean through sun drying, husking/hulling and preservation/storage while about 88.9% of the respondents processed the crop through frying/baking while 87.5% and 70.8% of the respondents indicated they were involved in winnowing and grinding. Lack of basic physical infrastructure (M=2.39), lack/poor technology on processing, preservation etc (2.35), difficulty in accessing loan (M=2.28) and lack of technology/innovation on production of the crop (M=2.28) were among the constraining factors to value addition in African yam bean. It is recommended that policy makers should work towards

providing the necessary technology and basic infrastructure to farmers in order to increase their productivity, income and commercialization of this underutilized but important crop. Research efforts are also required to improve its agronomic characteristics and promote its cultivation.

Keywords: *Sphenostylis stenocarpa*, production, commercialization, crop.

## RESUMEN

El estudio examinó las prácticas y los desafíos de la adición de valor de los agricultores de frijol ñame africano (*Sphenostylis stenocarpa*) en el estado de Enugu en Nigeria. Se adoptó la técnica de muestreo de múltiples etapas para seleccionar un total de setenta y dos (72) encuestados utilizados para el estudio. Los resultados revelaron que todos (100%) de los encuestados procesaron frijol africano a través del secado al sol, descascarillado / preservación / almacenamiento mientras que aproximadamente el 88.9% de los encuestados procesaron el cultivo mediante fritura / horneado mientras el 87.5% y 70.8% de los encuestados indicaron estaban involucrados en aventamiento y molienda. Falta de infraestructura física básica (M = 2,39), falta / tecnología deficiente en el procesamiento, preservación, etc. (2,35), dificultad para acceder al préstamo (M = 2,28) y falta de tecnología / innovación en la producción del cultivo (M = 2,28) entre los factores que limitan la adición de valor en el frijol africano. Se recomienda que los responsables políticos trabajen para proporcionar la tecnología necesaria y la infraestructura básica a los agricultores a fin de aumentar su productividad, ingresos y comercialización de este cultivo subutilizado pero importante. También se requieren esfuerzos de investigación para mejorar sus características agronómicas y promover su cultivo.

Palabras clave: *Sphenostylis stenocarpa*, producción, comercialización, cultivo.

## INTRODUCTION

Grain legumes constitute the main source of protein in the diets of the average Nigerian home. The most important ones are cowpea (*Vigna unguiculata*), groundnut (*Arachis hypogaea*) and lima bean (*Phaseolus lunatus*). However, there are other pulses that could help meet dietary needs but are cultivated and perhaps consumed only in localized areas. They are therefore seen as neglected and under-exploited legumes. African yam bean (*Sphenostylis steocarpa*). Bambara groundnut (*Vigan subterranea*) and pigeon pea (*Cajanus cajan*) are some of the neglected and under-utilized legumes.

African yam bean (AYB) (*Sphenostylis stenocarpa*) belongs to the Kingdom; Plantae, Class; Magnoliopsida, in the order; Fabales, found in the Family; Fabaceae also known as Leguminosae which has a Subfamily and genus as; *Papilionoidae* and *Sphenostylis* spp. (specie) respectively (Guala and Skinner,2008).Bussson (2001) affirms that African yam bean originated in Ethiopia, but both wild and cultivated types are now occur in tropical Africa as far north as Egypt and also throughout West Africa. It is cultivated in Nigeria mainly for seed and also grown for tubers in Cote"dIvoire, Ghana, Togo, Cameroon, Gabon, Democratic Republic of Congo, Ethiopia, parts of east Africa, Malawi and Zimbabwe (Utter, 2007). There are many dialectical names for African yam bean in Nigeria such as: "Akidi", "Azima" (Ohafia, AbiaState), "uzaaku" or "ijiriji" (Nsukka, Enugu state) "Ewe" in (Ijesha, Osun state), "Otili" in (Ekiti, Ekiti state), "Ekulu" in (Ipe-Akoko, Ondo state), "Peu" in (Ijebu, Ogun state) "Sunmunu" in (Iseyin, Edo state), "Ahuma" in (Tiv, Benue State), "Nsama" in (Efik-Ibibio, Akwaibom and Cross River state) (Asoiro and Ani, 2011).

African yam bean tolerates wide geographical, climatic and edaphic ecologies and produces appreciable yield more than most of other pulses on poor soil and in hot climate. Its seed grains and tubers are two major organs of economic importance. Thus this indigenous crop has huge potentials for food security in Africa. The crop is rich in minerals such as phosphorus, potassium, magnesium, vitamin C, dietary fiber, vitamin B6, and manganese; while being low in saturated fat, sodium, copper, and cholesterol (Utter, 2007).

African yam bean plant, serves as a good source of leaf litter for improvement of soil characteristics. The crop also nodulates profusely and probably has very high ability to fix nitrogen (Oagile, 2005), thereby helping to replenish soil nitrogen. It is therefore an important crop which merits significant consideration for land reclamation. Naylor, Falcon, Goodman et al (2004) affirms that the plant also has some medicinal value, as the water drained after boiling the beans is used by lactating mothers to increase their milk production. Klu, et al., (2001) asserted that the dry pods are used in feeding goats and sheep. Since, high cost of protein and consequent low intake has drastically reduced the nutritional level of average Nigerian to a great detriment, substitution of costly and unavailable animal protein with legumes like African yam bean that is diversified in the quality and quantity of essential amino acid has been seen as a remedy to this bad nutritional standard.

Unfortunately, there is a decrease in agro-biodiversity (Hadgu, et al., 2009) of these species in many parts of the country like Nigeria probably due to lack of awareness of the potential of these neglected crops, poor methods of production, processing, marketing and consumption of the crops. Other factors include: characteristic hardness of the seed coat (Ene-obong & Okoye, 2007) which makes a high demand on the cost and time of cooking, agronomic demand for stakes and the long maturation period, presence of anti-nutritional factors (ANF) or secondary metabolites (Machuka & Okeola, 2000) as well as biotic factor like insect infestation. Scientific information on African yam bean is scanty when compared to other major food legumes such as cowpea, soy beans etc. due to its underutilization, low exploitation and cultivation (NRC, 2006). The crop has also undergone little or no genetic improvement to boost its agronomic and nutritional qualities (NRC, 2006). Hence the crop may be lost from the universe in near future.

Despite all these problems, many stakeholders especially farmers/rural households have been involved in several value chain/addition activities ranging from production to marketing of African yam bean. Some factors may be influencing these activities which include: lack of basic physical infrastructure, lack of appropriate technology and machinery for processing the products, difficulties in accessing credit facilities, weak linkages between agriculture and industry, poor market among others. Also, stages and methods of executing the value chain tasks may vary while some may not be ideal. These necessitate the need to investigate on value chain practices of African yam bean farmers, challenges they face and areas of information/capacity building needs of these farmers in order to boost output and conserve the crop.

The relevant questions are what are the socio-economic characteristics of the farmers?, what are the agronomic practices involved in the production of African yam bean?, what are the value chain activities of African yam bean?, what are the information needs of African yam bean farmers?, what are the factors that constrain addition of values to African yam bean in the area?.

The purpose of the study was to describe farmers' value chain practices on African yam bean in Enugu state. Specifically, the study sought first to describe Socio-economic characteristics of African yam bean farmers; second, to identify the agronomic practices of the farmers; third describe some major value addition activities with respect to the crop; four is ascertain information needs of these farmers on value chain activities; five is to ascertain factors that constrain addition of values to African yam bean in the area.

This research work will be an indispensable material to all farmers especially African yam bean farmers both at commercial and subsistence level, as it serves to increase their knowledge on value chain activities of African yam bean and agricultural products. It will also be of immense help to all facets of agricultural sector especially the agricultural development programme, agro-allied industries, non-governmental organization and stake holders in diasporas. This is because it will open more facts that may guide on production, processing, preservation, consumption, marketing and involvement of innovation on African yam bean.

Extension workers can also convey knowledge generated from this study to farmers in order to boost and consolidate their efforts on certain activities they are involved on this nutritional but under-utilized crop. Finally, continuity is a model for invention and invention yields innovation. Findings of this study will be published in both local and international journal to serve as reference materials for further research works.

## MATERIAL AND METHODS

The study area: the study was carried out in Enugu state. Enugu state is one of the South-eastern states that make up the thirty-six states in Nigeria and is located between Latitudes 5055' and 7010' North and 6050 and 7055' East. The state is bounded in the North by Kogi and Benue states, in the East by Ebonyi and Abia states and in the West by Anambra state. Her land mass is 8,022.95km<sup>2</sup> while the population is 3,257, 298 (NPC, 2006). The major occupation of people in this state is farming. Crops cultivated in the area include: cassava, yam, cocoyam, vegetables etc, while poultry, sheep and goat are livestock commonly reared in this area. Enugu state consists of seventeen local government areas (LGAs) and six agricultural zones. They include: Awgu, Agbani, Enugu, Nsukka, Enugu-Ezike and Udi agricultural zones.

Population and sampling procedure: producers of African yam bean in Enugu state constituted the population for the study. Three Agricultural zones namely: Nsukka, Enugu and Udi were purposively selected for the study because of the concentration of producers and processors of African yam bean in these areas. One block where the producers and processors dominated was purposively selected from each of the zones. These blocks are Nsukka from Nsukka zone, Isi-Uzor from Enugu zone and Udi from Udi zone. Two circles were also selected from each of the blocks as follows:

Zones	Blocks	circles
Nsukka	Nsukka	Edem and Eha-alumona
Enugu	Isi-uzor	Mbu-Amon and Mbu-Akpoti
Udi	Udi	Umulumgbe and Ukana

Thus, a total of three zones, three blocks and six circles were used for the study. Twelve producers of African yam bean were purposely selected from each circle which gave a total of seventy-two (72) respondents for the study.

Data collection: data for the study were gathered from the respondents through the use of structured interview schedule. This was administered by the researcher and other research assistants to the respondents. It contained information related to specific objectives of the study.

Measurement of variables: objective one was structured to elicit information on the socio-economic characteristics of the respondents. To achieve this, the following variables were examined: Age, Sex, marital status, educational level attained, household size, secondary occupation, years of farming experience, participation in social organization etc.

Objective two identified the agronomic practices of farmers on African yam bean. To achieve this, a list of agronomic practices (land preparation, planting, weeding, staking harvesting etc) were provided for the respondents to tick on the ones they practiced, while provisions were made for them to list and tick other ones they practiced that were not in the list.

Objective three described some major value addition activities of the respondents with respect of African yam bean (processing, sorting, packaging, etc). To achieve this, respondents were requested to indicate African yam bean value addition activities that they do.

Objective four ascertained the information need of African yam bean farmers. To achieve this, various sources of information were listed for them to indicate the ones that are valid to them and also to indicate the areas they need information on African yam bean. Opportunities were given for them to list other sources of information and their information needs on African yam bean that are not in the list.

Objective five ascertained factors that constrain addition of value to African yam bean in the area. A fourth point Likert-type scale of "to no extent, little extent, to a moderate extent and to a large extent" with nominal values of "0, 1, 2 and 3" respectively was used in collecting the data. The mean was 1.5. Variables with mean scores equal or greater than 1.5 were regarded as major constraints while variables with mean scores less than 1.5 were regarded as minor constraints to addition of values to African yam bean.

Some factors included in the list were: lack of basic physical infrastructure, lack of appropriate technology and machinery for processing of the products, difficulties in accessing credit facilities for investment, weak linkages between Agriculture and industry, poor market, among others.

Data analysis: objectives 1, 2, 3 and 4 were analyzed with percentage, while objective 5 was analyzed with mean score and factor analysis (10% overlapping variance, Comrey) where a variable with a loading of 0.4 and above is considered as having a high loading and may be used in naming a factor. These analyses were executed with the help of SPSS (Statistical Product and Service Solution) version 16.0.

## RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents: the socio-economic characteristics of respondents considered in this study include: age, sex, marital status, educational level, monthly income, social organization, extension agent visit, household size etc. Entries in Table 1 show that greater proportion (34.8%) of the respondents were within the age range of 51-60 years. The mean age of the respondents was 53 years. This shows that the respondents were in their active years. Age is considered as an important variable in agriculture because of its influence on farmers' productivity, attitude, skill, aspiration and adoption of technologies. Majority (51.4%) of the respondents were male while 48.6% were female. This implies that both men and women carry out the value addition activities of African yam bean. The implication is that the value chain/addition activities of African yam bean are not gender specific/stereotyped in the area. This finding is in conformity with Klu, et al., (2001) who reported that there is no gender bias in the cultivation of African yam bean. Majority (80.6%) of the respondents were married. This shows that producers of African yam bean are dominated by married people and the involvement of married people in value addition

will make the work easier. The implication of this is that the couple and other members of the family will render helping hands in the value chain activities and it is using the children will also help them to acquire some skills and in the proper utilization of their leisure time. It will also address the problem of protein deficiency in their family since the crop is rich in protein. About 34.7% accounted for respondents that had no formal education. The mean number of years spent in school was 8. This shows a low level of formal education among the respondents and this may have implication on the attitude of the respondents on improvement of value chain/addition activities due to the fact that cannot source information from reliable sources like internet, radio, printed media etc. This is because educated people are better equipped to source information (Idrisa, et al., 2012) and make positive changes easily when need arises. Data on table 1 further reveal that greater proportion (34.9%) of respondents had years of experience of between 11-20 years. The mean (M) years of farming experience was 28.7 years. This means that majority of the respondents had farmed long enough and should be able to provide necessary information on farming and other value chain/addition activities that they carry out.

Entries in Table 1 indicated that majority (84.9%) of the respondents had average monthly income of between N150,000 The mean (M) is N38,305. Majority (63.9%) of the respondents had household size of between 6-10 persons The mean household size was 6 persons. This showed an average number of persons in the households and the implication is that the household size is big; hence, majority of the respondents may tend to use their household labour for the value chain activities of African yam bean which minimizes cost of labour or production and makes African yam bean production encouraging in the area. Entries in Table 1 show that majority (68.2%) had between N1-N10,000 worth of African yam bean The mean is N10,800. This implies that they realize reasonable income from and it also help in food availability in the family despite the fact that it is not their major crop and this motivates them in producing it. Greater proportion (44.4%) of the respondents spent between N1- N2,000 in producing African yam bean in a season, The mean is N3,750.00. This may mean that the cost of production is not too high as to compare to its yield and value both nutritional and medicinal.



Table 1: percentage distribution of respondents according to their socio-economic characteristic.

Variables	Frequency	Percentage (%)	Mean(M)
<b>Age</b>			
20-30	2	2.8	53
31-40	10	13.9	
41-50	21	29.3	
51-60	25	34.8	
61 years and above	14	19.6	
<b>Sex</b>			
Male	37	51.4	
Female	35	48.6	
<b>Marital status</b>			
Single	2	2.8	
Married	58	80.6	
Widowed	11	15.3	
Separated	1	1.4	
<b>Educational qualification</b>			
No formal education	25	34.7	8
Primary education	16	22.2	
Secondary education	16	22.2	
Tertiary	15	20.8	
<b>Years of farming experience</b>			
1-10	22	30.7	28.7
11-20	25	34.9	
21-30	9	12.5	
31-40	11	15.3	
41 and above	5	7.0	
<b>Average monthly income (₦)</b>			
10,000-50,000	61	84.9	38,305
50,001-100,000	9	12.5	

Table 1. Continuation.

Variables	Frequency	Percentage (%)	Mean(M)
100,001-150,000	2	2.8	
Household size			
1-5	24	33.3	6
6-10	48	63.9	
11 and above	2	2.8	
Estimated worth of AYB produced in a season (₦)			
1,000-10,000	49	68.2	10,800
10,001-20,000	17	23.6	
20,001-30,000	5	7.0	
30,001-40,000	1	1.4	
Estimate cost of producing AYB in a season (₦)			
0-2,000	32	44.4	3,750
2,001-4,000	19	26.4	
4,001-6,000	9	12.5	
6,001 and above	6	8.4	

Source: Field work, 2014

Agronomic practices of African yam bean: entries in Table 2 revealed that all (100.0%) of the respondents undergo the agronomic practices of land clearing; ridge/mound making, planting, weeding, harvesting, sun drying and storage. While 93.1%, 84.7%, 43.1%, 25.0% and 23.6% carried out staking, selling/marketing, fertilization, thinning and pruning respectively. This implies that the major agronomic practices required for one to produce African yam bean are land clearing, ridge/mound making, planting, weeding, staking, harvesting and sun-drying.

This finding is in line with the work of Adewale and Odoh (2012) which reported that land clearing, mound making, planting of two or three seeds per hole at the base of the mound, staking with bamboo poles, weeding, harvesting and sun-drying are the agronomic practices of African yam bean. Okpara and Omaliko (2005) also revealed that

clearing of land, mound making, planting, weeding, staking (among other practices) are very importance cultural practices for harvesting optimum grain yield of African yam bean.

Table 2: Percentage distribution of the respondents according to their agronomic activities

Agronomic activities	Frequency	Percentage (%)n=72
Land clearing	72	100.0
Ridge/mound making	72	100.0
Planting	72	100.0
Fertilization	31	43.1
Thinning	18	25.0
Staking	67	93.1
Weeding	72	100.0
Pruning	17	23.6
Harvesting	72	100.0
Sun-drying	72	100.0
Storage	72	100.0
Selling/marketing	61	84.7

Source: field work, 2014

Data in Table 3 revealed that (100%) of the respondents processed African yam bean through sun drying, husking/hulling and preservation/storage. This could be because sun drying, husking/hulling, preservation/storage are processes which are necessary for a high quality product. Sun drying is one of the natural processes which is highly dependent on for processing and preservation. It is the cheap source of energy that readily available. It helps to reduce the moisture content in Africa yam bean and hence prolong the shelf life.

Husking/hulling is another process which is necessary in Africa yam bean processing. It helps to remove the hard cotyledon thereby making Africa yam bean appealing and edible. The seeds are also preserved/stored to reduce wastage and also enhance food security. About 88.9% of the respondents processed their own through frying/baking while 87.5% and 70.8% of the respondents indicated they were involved in winnowing and grinding, respectively during processing of African yam bean.

Winnowing and separation are also necessary to separate the husks and other unwanted materials from the seed.

This implies that sun drying, husking/hulling and preservation/storage are the major stages African yam bean passes through in the course of processing the product in the area. Other stages include separation, winnowing frying/baking and grinding.

In line with this finding is the work of Betsche et al., (2005), which reported that the unit operations involved in processing Africa yam bean are sun drying, husking, winnowing, separation and grinding.

Table 3: Percentage distribution of respondents according to stages of processing African yam bean

Stages of processing	Frequency	Percentage
Sun drying	72	100.0
Husking/hulling	72	100.0
Winnowing	63	87.5
Separation	68	94.4
Frying/baking	64	88.9
Grinding	51	70.8
Preservation/storage	72	100.0

Source: Field work, 2014

Marketing of African yam bean: entries in Table 4 showed that majority (86.1%) of the respondents undertook the process of bagging and packaging while 75.0% and 70.8% were involved in sorting/grading and transporting respectively in the course of marketing African yam bean. This implies that they sort/grade to remove unwanted ones like premature or rotten ones from wanted ones, to remove other contaminants and to separate them into various colors because they have the one that has brown and milk coat colours. In line with this finding, Klu et al (2001) which reported that the seeds are identified into several landraces by differences in seed coat colour: lighter and dark coloured types. They also bag or package to protect the crop from contamination (pests like weevil and diseases) and also to add more value to it. From the result, it also implies that many of them transport to get to where they will sell the produce. The implication

is that they help to distribute the crop from area of abundance to areas of scarcity where they will sell higher and realize more income.

Table 4: Percentage distribution of respondents according to marketing activities

Market activities	Frequency	Percentage
Sorting/grading	54	75.0
Bagging/packaging	62	86.1
Transporting	51	70.8

Source: Field work, 2014

Forms of consumption of African yam bean: all (100.0%) the respondents indicated that they consume African yam bean as food while 87.5% consume it as snacks. The implication of this finding is that the crop is consumed through few ways which may lead to its ineffective utilization. This is in line with Okafor and Usman (2004) who reported that African yam bean is traditionally consumed boiled or in the form of porridge or fried and eaten with coconut or kernel as snacks.

Table 5: percentage distribution of respondents according to form through which they consume African yam bean

Form of consumption	Frequency	percentage
Consumed as snacks	63	87.5
Consumed as food	72	100.0

Source: Field work, 2014

Information need of the respondents on African yam bean: table 6 shows that all (100.0%) respondents needed information on good varieties of African yam bean and modern methods of processing African yam bean. Other areas of information need as indicated by the respondents were: how to preserve and store African yam bean (91.7%), pest/disease management and how to process African yam bean (90.3%) each, good cropping/farming system on African yam bean (87.5%) fertilizer/manure application (86.1%), different methods of consuming African yam bean (83.3%), good soil/land for African yam bean production (79.2%), how to market African yam bean

(72.2%), when to plant African yam bean (70.8%), how to grow African yam bean (65.3%) and when to weed the farm (54.2%)

Table 6: percentage distribution of respondents according to information needs on African yam bean

Information needs	Frequency	percentages
Good varieties of African yam bean	72	100.0
Good cropping/farming system African yam bean	63	87.5
How to grow African yam bean	47	65.3
Good soil/land for African yam bean production	56	79.2
When to plant African yam bean	51	70.8
Fertilizer/manure application	62	86.1
How and when to weed the farm	39	54.2
Pest and disease management	65	90.3
When to harvest African yam bean	33	45.8
Different methods of consuming African yam bean	60	83.3
How to process African yam bean	65	90.3
Modern method of processing African yam bean	72	100.0
How to preserve/store African yam bean	66	91.7
How to market African yam bean	52	72.2

Source: Field work, 2014

However, less than half (45.8%) of the respondents indicated when to harvest African yam bean as area they need information on African yam bean.

Apart from consumption, another major aim of going into Africa yam bean production perhaps could be for income purposes. Farmers information needs on good variety, pests and disease management, good cropping/farming system, fertilizer/manure application, how to grow and when to plant Africa yam bean, how and when to weed the farm could be directly related to farmers quest for good yield which increases income in total wellbeing of the farm. Information need on consumption and marketing is necessary to help farmers explore other methods of consumption for effective utilization of the produce and as well marketing in order to maximize profits. Similarly, information on preservation/storage and processing are necessary to increase

the shelf life of Africa yam bean. One major way of increasing profits in agriculture can include selling during scarce period. Information on preservation/storage and processing of Africa yam bean can be useful in ensuring that the farmers sell during scarce period and this can as well increase profit.

Ozowa (1995) has grouped the information need of farmers into 5 headings as follows: Agricultural inputs, extension education, agricultural technology, agricultural credit and marketing. An implication of this finding is that the farmers may not be producing as they could have supposed. Thus, if all these information are provided to them they may be able to produce more and gain more income from the produce.

Constraints to value addition in African yam bean as perceived by the respondents: entries in table 7 indicated that lack of basic physical infrastructure (M=2.39), lack/poor technology on processing, preservation etc (2.35), difficulty in accessing loan (M=2.28) and lack of technology/innovation on production of the crop (M=2.28) were constraining factors to addition of value in African yam bean. Others included: weak linkages between agriculture and industry (M=2.04), poor and inadequate extension support (M=1.96), lack of improved species (M=1.94), high labour demand in adding value (M=1.68) and high demand for stakes (M=1.57). Low soil fertility (M=1.49), insect and disease infestation (M=1.33), poor market access (M=1.33), lack of knowledge on the potentials of the crop, (M=1.28), scarcity and unavailability of land (M=1.11), long maturation period (M=1.07), low price of the commodity (M=1.06), low demand for the crop (M=1.03), and undesirable smell/odour (M=0.46), were regarded as minor constraints to addition of values to African yam bean. Klu et al (2001) had reported that only limited quantities of African yam bean are offered for sale in local markets even though the price per unit of measure is comparable to that of other legumes and this is because of the constraints associated with its production. An implication of this finding is that the African yam bean farmers will not be able to produce it in large scale which would have led to increase in their family income. Thus, if there are basic physical infrastructure, technology/innovation on African yam bean, easy access of credit, appropriate technology and machines for processing, producers of African yam bean will be gaining more income from its production.

Factor analysis of constraints to value addition in African yam bean: the possible constraints were further subjected to factor analysis to draw policy implications. Results on table 8 represent factor analysis of perceived constraints to value addition in African yam bean.

Four constraints were extracted based on the item loadings. Factors 1, 2, 3, and 4 were named crop related factor, technological factor, market related factors and agronomic factors respectively. Factors that loaded high under crop related factors include insect and disease infestation (0.694), lack of awareness of the crop potentials (0.730), poor and inadequate extension support (0.713), weak linkages between agriculture and industry (0.715) and poor storage facilities (0.806).

Table 7: mean distribution of respondents according to constraints to value addition in African yam bean as perceived by the respondents

Constraints	Mean	Std. Deviation
Scarcity and unavailability of land	1.11	1.205
Difficulties in accessing credit	2.28	0.843
Lack of basic physical infrastructure	2.39	0.797
Low soil fertility	1.49	1.007
Lack of improved species	1.94	0.854
Long maturation period	1.07	0.998
Lack of technology/innovation on production of the crop	2.28	0.773
High demand for stakes	1.57	0.836
Insect and disease infestation	1.33	0.919
Lack of knowledge on the potentials of the crop	1.28	0.967
Undesirable smell/odour	0.46	0.749
High labour demand in adding value	1.68	0.784
Low demand for crop	1.03	0.919
Poor/inadequate extension support	1.96	0.911
Weak linkages between agriculture and industry	2.04	1.067
Poor storage facilities	1.72	1.078
Lack/poor technology on processing, preservation etc	2.35	0.715
Poor market access	1.33	1.088
Low price of commodities	1.06	1.019

Source: field survey, 2014

Similarly, factors that loaded high under technological factors were difficulties in accessing credit (0.544), lack of physical infrastructure (0.841), lack of



technology/innovation on production of the crop (0.710), high labour demand in adding value (0.635), and lack/poor technology on processing, preservation etc. (0.582).

Table 8: factor analysis of constraints to value addition in African yam bean

Constraints	Crop related factor	Technological factor	Market related factors	Agronomic factors
Scarcity and unavailability of land	0.325	0.132	-0.406	0.487
Difficulties in accessing credit	0.163	0.544	-0.289	0.199
Lack of basic physical infrastructure	-0.163	0.841	-0.129	0.118
Low soil fertility	0.494	0.047	0.340	0.523
Lack of improved species	0.043	0.312	-0.116	0.680
Long maturation period	0.471	-0.227	0.648	0.215
Lack of technology/innovation on production of the crop	0.013	0.710	-0.120	0.221
High demand for stake	-0.022	0.018	0.307	0.742
Insect and disease infestation	0.694	-0.043	0.139	0.097
Lack of knowledge on the potentials of the crop	0.730	-0.043	0.015	0.075
Undesirable smell/odor	0.370	-0.183	0.351	0.226
High labour demand in adding value	-0.246	0.635	0.085	-0.020
Low demand for the crop	0.138	-0.068	0.866	0.089
Poor and inadequate extension support	0.713	0.239	0.048	0.094
Weak linkages between agriculture and industry	0.715	0.148	0.249	-0.115
Poor storage facilities	0.806	-0.009	0.258	0.045
Lack/poor technology on processing, preservation etc	0.232	0.582	0.094	-0.095
Poor market access	0.236	-0.085	0.884	-0.041
Low price of the commodity	0.195	-0.124	0.860	0.009

Source: field survey, 2014. Extraction method: principal component analysis.

Factors that loaded under market related factors were low demand for the crop (0.866), poor access market (0.884) and low price commodity (0.860) while factors that loaded under agronomic factors were scarcity and unavailability of land (0.487), lack of improved species (0.860) and demand for stake (0.742). Daniel (2000) reported that constraints associated with crop production including African yam bean include unavailability of hybrid or improved seeds, lack of processing facilities, low prices, poor production inputs and low technology utilization.

This finding is in line with the findings of Enogor and Kristen (2001) which reported that farmers experience barriers such as insufficient and inadequate physical infrastructures, related processing and marketing facilities, lack of extension support and institutional barriers in marketing problems.

As conclusion, based on the findings, the following conclusions were drawn, that farmers were relatively middle aged, possessed some form of formal education, in addition to large household sizes. This shows that there are preponderance of able bodied young men and women who if provided with basic physical infrastructure, innovation/technology and other needed information will lead to an increase in addition of value to African yam bean which will result to higher yield and income. They add value to this crop through production, processing, marketing and consumption. The agronomic practices involved in African yam bean production were land clearing, ridge/mound making, planting, weeding, staking, fertilization, pruning, harvesting and sun-drying. They also process it through husking/hulling, winnowing, separation, preservation/storage, frying/baking and grinding. Also they consume it as food and snack. Despite the facts that the farmers engage in some activities in other to add value to this crop, they experience constraints such as lack of basic physical infrastructure, lack/poor technology on processing, preservation etc., difficulties in accessing credit among others.

Also, it suggests, to enhance the practices of farmers in adding value to African yam bean based on the findings of this work, the following recommendations were made, first, research and Government should try to provide the necessary technology and basic infrastructure to the farmers in other to increase their productivity, income and commercialization of this underutilized but important crop. Second, governmental and non-governmental agencies should be given the farmers access to credit facilities in order to boost their production because majority of the respondents find it difficult in accessing credit. Third, extension should also provide the farmers with the needed

information concerning this crop and, also educate the general public of its uses/importance and value both nutritional and medicinal. Fourth, research efforts are also required to improve its agronomic characteristics and promote its cultivation and use as a major crop.

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