An overview of Production, Processing, Marketing and Utilisation of Okra in Egbedore Local Government Area of Osun State, Nigeria

[1]Farinde, A.J.; [2]Owolarafe, O.K. and [1]Ogungbemi, O.I.

1- Department of Agricultural Extension and Rural Sociology, Obafemi Awolowo University, Ile-Ife, Nigeria.

2- Department of Agricultural Engineering, Obafemi Awolowo University, Ile-Ife, Nigeria

ABSTRACT

Investigation was made into the production, processing, marketing and utilization of okra in Egbedore local government of Osun State, Nigeria. Data was collected through the use of well-structured questionnaire and field observations from 100 okra farmers using simple random sampling technique. The data collected were analysed using descriptive and inferential statistics.

The results show that the mean age of the respondents was 57.56 years; mean years of okra production experience was 16.91 years; mean farm size cultivated by the respondents was 1.5 ha, they were all married with 49% literate. The mean person's day of family labour was 6.03 and that of hired labour was 1.25 persons day per month in three months.

Majority of the respondents planted okra on a small scale destined by land tenure system and probably due to the problem of unavailability of storage, processing, and preservation facilities. Processing and preservation are carried out using traditional techniques of slicing, sun-drying and grinding (using mortar and pestle). Sliced and dried okra are stored in gourd, baskets and clay-pots. Okra is consumed fresh and dried mostly to make draw soup.

Keywords: Assessment**,** okra, production-capability, processing, utilization, appropriate – technology and marketing, Nigeria.

1. INTRODUCTION

Okra is a vegetable crop that belongs to the genus *Abelmoschu*s, family *Malvaceae* and has two main species: *Abelmoschus esculentus* (L.) Moench. and *Abelmoschus caillei* (A. Chev.) Stevels (Siemonsma, 1982). It originates probably from East Africa and today is widely distributed in the tropics, subtropics and warmer portions of the temperate region (ECHO, 2003).

The economic importance of okra can not be overemphasized. Okra contains carbohydrate, proteins and vitamin C in large quantities (Adeboye and Oputa, 1996). The essential and non-essential amino acids that okra contains are comparable to that of soybean. Hence it plays a

A.J. Farinde, O.K. Owolarafe and O.I. Ogungbemi. "An overview of Production, Processing, Marketing and Utilisation of Okra in Egbedore Local Government Area of Osun State, Nigeria " Agricultural Engineering International : the CIGR Ejournal. Manuscript No. MES 07 002. Vol. IX. July , 2007**.**

vital role in human diet. For consumption, young immature fruits are important fresh fruit – vegetable that can be consumed in different forms. They could be boiled, fried or cooked. In Nigeria, okra is usually boiled in water resulting in slimy soups and sauces, which are relished. The fruits also serve as soup thickeners (Schippers, 2000). The leaves buds and flowers are also edible. Okra seed could be dried. The dried seed is a nutritious material that can be used to prepare vegetable curds, or roasted and ground to be used as coffee additive or substitute.

Okra leaves are considered good cattle feed, but this is seldom compatible with the primary use of the plant. Okra mucilage is suitable for medicinal and industrial applications. It has medically found application as a plasma replacement or blood volume expander. Industrially, okra mucilage is usually used in to glace certain papers and also useful in confectionery among other uses (Markose and Peter, 1990).

Worldwide production of okra as fruit vegetable is estimated at six million tonnes per year. In West Africa, it is estimated at 500,000 to 600,000 tonnes per year (Burkil, 1997). In Nigeria, there are two distinct seasons for okra, the peak and the lean seasons. During the lean season okra fruit are produced in low quantities, scarce and expensive to get (Bamire and Oke, 2003). In the peak season, it is produced in large quantities much more than what the local populace can consume. Proper processing, preservation, marketing and utilisation of okra is necessary to arrest the wastage being experienced during the peak season. Such efforts should involve the development of appropriate technologies for processing and preserving okra to produce products of high market value. This will enhance the standard of living of the farmers and processors. It is however important to assess the level of okra production processing and preservation to serve as a guide in selecting appropriate methods and techniques.

2. METHODOLOGY

The study was carried out in Egbedore local Government Area of Osun State, Nigeria. It is located around the North western part of Osun State. Osun State has humid climate with a temperature of between 21.1 and 31.1 ^{o}C and annual rainfall of about 1000mm (OSSADEP, !997). Egbedore is found in the transition zone of the derived savannah zone. The predominant occupation here is farming while other stable occupations among the people are mainly trading, craftwork, palm oil production etc. Major crops grown are maize, cowpea, yams and cash crops like cocoa and oil palm. Some of these farmers plant okra as mixed crop with these crops. The study area was chosen because the farmers here plant okra on a large scale and it is believed this will make a fairly true representation of the study area.

The target population for this study is okra farmers. The respondents are 100 in number and are chosen from the population of the okra farmer through random sampling techniques. Data collected includes background information of the respondents, level of okra production, methods of production, processing methods and utilisation. Data was collected through the use of a well structured questionnaire and field observations. The data collected was analysed

using descriptive statistics like mean, standard deviation and frequency distribution. Also inferential statistics like correlation and chi-square test were used to test the hypothesis.

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics of the Respondents

With regards to the age distribution of the respondents, 4.0% of the respondents were between the ages of 30 and 39 years, 11% were between 40 and 49 years, 40.0% were between 50 and 59 years , 38.0% were between 60 and 70 years and 7.0% were above 70 years. The mean age of the respondents was 57.56 years, with a standard deviation of 9.28 years. This result indicates that the larger percentage of the respondents were above 50 years but below 70 years. Most of the young able-bodied men and women had migrated to the urban centers in search of better life and the older generation is now left on the farm. The implication of this is that the future of agricultural production in the study area is uncertain and okra production may become a thing of the past.

All the respondents were males and were all married. Most women do not own their own farms, but they work with their husbands on the family farms. Women also participate in okra farming but they do so at the processing, preservation and marketing levels more than at the production level. About 49.0% of the respondents did not have any formal education, 45.0% attended primary school, while only 6.0% had secondary school education. Most of the educated farmers did not farm on full-time basis and they had better access to improved technology. This result showed very high level of illiteracy in the study area.

The solution to the above problem is for the government to embark on rural development. Rural development will prevent migration of the young ones to the cities. Provision of good road and other social amenities is very important in this respect. Development of appropriate technologies for okra processing taking into consideration gender-friendliness of such technologies will keep the women who occupy a major position at the processing stage.

Table 1 shows the distribution of years of okra production. It could be observed that 45.0% of the respondents had been in the practice of okra production for not more than 10 years, 24.0% of them had grown okra between 11 and 20 years, 19.0% had grown okra between 21 and 30 years, while 12.0% of the respondents had grown okra between 31 and 40 years. The mean years of okra production experience was 16.91 years with a standard deviation of 10.38 years. This result shows that okra production is an age long profession of the people in the study area.

Table 1. Distribution of the respondents according to okra production experience

Years of experience	Frequency	%	Cumulative %
1-10	45	45.0	45.0
11-20	24	24.0	69.0
21-30	19	19.0	88.0
31-40	12	12.0	100.0
Total	100	100.0	

About 83.0% of the farmers had less than 2.0 ha, 16.0% had between 2.0 and 4.0 ha and only 1% had more than 4.0 ha (Table 2). Seventy-six percent of the respondents had only one plot on which they intercropped with other crops, while 24.0% of the farmers had more than one plots and these were farmers who grew cash crops and some perennial food crops such as banana,

Table 2. Distribution of the respondents according to farm size and multiplicity of plots

Farm size (hectares	Frequency	%	Cumulative %
1-5	83	83.0	83.0
6-10	16	16.0	99.0
11-15	1	1.0	100.0
Total	100	100.0	
Multiple plots			
Yes	76	76.0	76.0
No	24	24.0	100.0
Total	100	100.0	

pineapples etc. The mean farm size cultivated by the respondents was 1.5 ha with a standard deviation of 1.0 ha. Food crops were largely cultivated unlike cash crops. Most of the farmers are either subsistent or small scaled in their production level.

3.2 Production of Okra

Land tillage is the preparation of land before planting is done. Land preparation for okra includes land clearing, ploughing, harrowing, and heaping or ridging. The farmers use different type of tillage implements depending on their ability. The data collected indicates that all the farmers use cutlass and hoe regularly, while 12.0% of them used tractor along side the crude implements. This high percentage of the use of crude implements is one of the main reasons for okra production at a subsistent level or small-scale level. Some of the farmers hired labour to till the ground, but the majority used family labour. The total amount of labour supplied for the production of okra among the respondents was measured in person's days. A person's day is the amount of work that an individual can do in a day. The total amount of labour consists of labour contributed by family and hired labour.

Table 3 shows that 35 respondents hired additional labour while the remaining 65 did not. Six of the respondents had no contribution to labour by the family members, 35 had between 1 and 5 person's day, 58 respondents had between 6 and 10 person's days , and one had more than 10 person's days. For hired labour, 30 of the respondents had between 1 and 5 person's days; while the remaining 5 respondents had between 6 and 10 person's days/ month in three months. The mean person's days of family labour was 6.03 with a standard deviation of 2.65

person's days while that of hired labour was 1.25 person's days with a standard deviation of 2.14 person's days per month in three months

Table 3. Distribution of the respondents according to labour supplied for okra production

Labour supplied (person's days/month in three months)	Frequency	%	Cumulative %
Family labour 0			
1-5	6	6.0	6.0
6-10	35	35.0	41.0
>10	58	58.0	99.0
	1	1.0	100.0
Total	100	100.0	
Hired labour			
0	65	65.0	65.0
1-5	30	30.0	95.0
6-10	5	5.0	100.0
Total	100	100.0	

.

There is the need for introduction of modern tillage equipment (tractor and implements) within the reach of these people. To ensure that the service is within the reach of the people there may be need to organise the farmers into cooperatives societies such that they can pool their resources together and hence be able to afford the cost of the equipment being introduced. This effort will enhance the production of okro in the area.

Extension and credit facilities were not enjoyed during the production of okra for the last season. Agricultural extension services had not reached majority of the farmers in the study area. Only ten of the respondents claimed that extension officers got to their village but they did not get any advisory services from them. The implication of this is that production of okra will always remain stagnant and will not be improved, since improved methods and practices taught by extension will not get to the farmers in the study area. The farmers will not have access to improved technologies involved in production, processing and preservation of okra, and this may cause them to continue production at small-scale level.

Table 4 shows that three of the farmers planted okra on 0.2 ha of land, 89 planted on farmland ranging between 0.4 and 1.6 ha of land, while 8 respondents planted on land between 2 and 3.2 ha. The mean planted area for okra production is 0.98 ha with a standard deviation of 0.53 ha

.

Table 4. Distribution of the respondents according to farm size

Farm size (hectares)	Frequency	%	Cumulative %
<1	3	3.0	3.0
1-4	89	89.0	92.0
1-5	8	8.0	100.0
Total	100	100.0	

Majority of these farmers planted okra on a small scale destined by land tenure system and probably due to the problem of unavailability of storage, processing, and preservation facilities.

Concerning the maintenance of the planted crop, none of the respondents uses fertilizer for okra production. This is due to the cultural belief that fertilizer reduces the quality of the okra fruit by making it black and prevents it from drawing when cooked. However, the farmers claimed they used fertilizer for other crops. Pesticide was used to kill the insects, which destroy the floral buds of okra. Some of these insects include the cricket, *Brachytrupes membranaceus* Drury, the bollworm, *Earias biplaga* Wlk., and the beetle, *Anomala denuda* Arrow. The common pesticide used by the farmers is Gammalin 20 (called "tari" by the respondents). Table 5 shows that 66.0% of the respondents did not use pesticides, 15.0% used between 0.10 and 0.30 litres of Gammalin 20, 15.0% used between 0.31 and 0.60 litres, while 6.0% used between 0.61 and 0.9 litres. The mean quantity of Gammalin 20 used was 0.17 litres with a standard deviation of 0.03 litres. The mean cost of purchasing pesticide was ₦525.00 with a standard deviation of ₦826.87. A litre of pesticide costs ₦3333, therefore 66.0% of the respondents did not spend any money on pesticide, 13.0% spent between ₦1 and ₦1000, 15.0% spent between ₦1001 and ₦2000, while 6.0% spent between ₦2001 and ₦3000 on pesticides.

Table 5. Distribution of the respondents according to amount and cost of pesticides used.

Amount (litres)	Cost (₦)	Frequency	%	Cumulative %
0	0	66	66.0	66.0
0.1-0.3	33.33-1000	13	13.0	79.0
0.31-0.60	1033.33-2000	15	15.0	94.0
0.61-0.90	2033.33-3000	6	6.0	100.0
Total		100	100.0	

All the respondents practiced mixed cropping i.e. planting of more than one crop on a piece of land. Okra was intercropped with other crops like yam, cassava, beans, maize, pineapples

and so on. Table 6 shows the types of crops planted with okra. Six percent planted only maize or yam, 3.0 % planted only cassava with okra, while 1.0% planted only pepper. Fifty-one percent planted okra with both cassava and maize, 16.0% planted okra with both yam and maize, 17.0% intercropped okra with pepper, yam, cassava, pineapples and beans in different mixtures.

Table 6. Distribution of the respondents according to crops intercropped with okra

Crops	Frequency	%	Cumulative %
Maize	6	6.0	6.0
Yam	6	6.0	12.0
Cassava	3	3.0	15.0
Pepper	1	1.0	16.0
Cassava and maize	51	51.0	67.0
Yam and maize	16	16.0	83.0
Yam and pepper	4	4.0	87.0
Cassava and pepper	7	7.0	94.0
Cassava and pineapples	2	2.0	96.0
Cassava and beans	2	2.0	98.0
Yam and beans	1	1.0	99.0
Beans and maize	1	1.0	100.0
Total	100	100.0	

Source: Field survey, 2003

Three types of local okra were produced in the study area. Improved okra called ‘Agric’ was also produced. The local okra produced include: ‘Yaya’ or ‘Kogboye’ planted during the dry season. This has long slender fruits and it has higher productivity than the other two types. The second type is called ‘Kudikan’ or ‘Ila-ojo’ and it is planted during the raining season. It has short thick fruits and it does not fruit for a long time. The third type is called ‘Ila-Iroko’. The plant grows very tall and it can sometimes reach a height of 2.0 m. It has thick and long fruits which most of the respondents claimed as unpalatable. The improved variety is not common and it has shorter length of maturity. Detailed analysis showed that 10of the respondents planted the improved variety of okra, 79planted Yaya and Kudikan, while only 11 respondents planted Iroko, Yaya, and Kudikan.

Table 7 shows that 34.0% of the respondents produced between 15 and 300 kg of okra in the last growing season, 43.0% produced between 21 and 40 baskets, 20.0% produced between 41 and 60 baskets, 2.0% produced between 60 and 80, while only 1.0% produced above 80 baskets of okra. The mean quantity of okra produced was 30.45 baskets with a standard deviation of 17.64 baskets. This result is an indication of the small-scale level of production of okra in the study area.

Table 7. Distribution of the respondents according to quantity of okra produced in the growing seasons.

Quantity of okra produced (Kg)	Frequency	%	Cumulative %
15 - 300	34	34.0	34.0
301 - 600	43	43.0	77.0
601 - 900	20	20.0	97.0
901 – 1,200	2	2.0	99.0
>1,200	1	1.0	100.0
Total	100	100.0	

Table 8 shows that 16 of the respondents made not more than ₦5000.00, 43made between ₦5001.00 and ₦10,000.00, 29 made between ₦10,001.00 and ₦15000.00, 8 made between ₦15,001.00 and ₦20,000, 4.0 made between ₦20,001.00 and ₦25,000 and 2.0 made above ₦25,000.00. The mean amount of money made from okra in the last growing season in the study area was ₦ 11,617.50 .

Table 8. Distribution of the respondents according to amount of money made from okra production in the last growing season.

Amount (₦)	Frequency	%	Cumulative %
1-5000	16	16.0	16.0
5001-10000	43	43.0	59.0
10001-15000	49	49.0	86.0
15001-20000	8	8.0	94.0
20001-25000	4	4.0	98.0
>25000	2	2.0	100.0
Total	100	100.0	

3.3 Harvesting of Okra

Frequency of harvest of okra is once in five days and the method used for harvest is manual. There were no facilities for mechanized method of harvesting in the study area. The farmers complained of blisters on their hands during harvest of okra. This leads to drudgery and the farmers may lose interest in production in large quantities. This situation calls for design and production of appropriate technologies for harvesting of okra. This is a more challenging area of processed okra production. Detail properties of the fruit will be required to develop appropriate machine for harvesting the fruit particularly at the small-scale level that is to be considered for the target area.

The mean quantity of local okra harvested per acre per day was 24.5 kg with a standard deviation of 12.0. For improved okra, the mean quantity was 29 kg with a standard deviation of 9.6 kg . Table 9 shows that, for local okra, 42 of the respondents harvested between 15 and 22.5 kg/0.4 ha/day, 30 respondents harvested between 22.5 and 30.0 kg/ 0.4 ha/day and 9 harvested between 31.5 and 37.5 kg /0.4 ha/day While 10 of the respondents harvested more than 37.5 kg of local Okra. For improved okra, One of the respondents produced between 15 and 22.5 kg/0.4 ha/day, 7harvested between 22.5 and 30 kg /0.4 ha/day, no respondent harvested between 31.5 and 37.5while just one harvested more than 37.5 kg of Okra /0.4 ha/day.

Table 9. Distribution of the respondents according to quantity of okra harvested per acre per day

Quantity of okra (Kg)	**Frequency**	**%**	**Cumulative %**
Local Okra			
1.0-1.5	42	42.0	42.0
1.6-2.0	30	30.0	72.0
2.1-2.5	9	9.0	81.0
>2.5	10	10.0	91.0
Improved okra			
1.0 – 1.5	1	1.0	92.0
1.6 - 2.0	7	7.0	99.0
2.1 – 2.5	0	0	0
> 2.5	1	1.0	100.0
Total	100	100.0	

3.4 Processing of Okra

Manual and semi-modern processing methods are still being used for both fresh and dried okra. The tools used for processing fresh okra are knife, grater, and mortar and pestle/ grinding stone respectively. There were no facilities for mechanized processing. This also called for the design and production of intermediate technologies for processing okra.
Table 10 shows that 37 of the respondents used only slicing method 15 used slicing and grating, 7used slicing and crushing and 41 respondents used slicing, grating, and crushing methods together.

Table 10. Distribution of the respondents according to methods of processing used

Processing methods	Frequency	%	Cumulative %
Slicing	37	37.0	37.0
Slicing and grating	15	15.0	52.0
Slicing and crushing	7	7.0	59.0
Slicing, crushing and grating	41	41.0	100.0
Total	100	100.0	

3.5 Preservation of Okra

Okra could be stored for future use. The problem of spoilage encountered during production could be overcome through proper preservation. Preservation is still done naturally in the study area. This is done by sun drying sliced okra for three days. There were no facilities for artificial drying. Dried okra is stored in baskets, clay pots and bags. The dried okra is ground and cooked when needed for consumption. Grinding is done manually, with the use of mortar and pestle or crushing stone in the study area. The mean quantity grounded by mortar and pestle per day is 7.95 kg with a standard deviation of 1.66 kg, while the mean quantity grounded by crushing stone per day was 3.91 kg with a standard deviation of 1.24 kg.

Table 11 shows that 64 of the respondents could grind between 1 and 4 kg of dried okra on a crushing stone per day, while the rest 36 respondents could grind between 5 and 8 kg per day. Using mortar and

Table 11. Distribution of the respondents according to capacity of dried okra ground pert day.

Capacity (kg/day)	**Frequency**	**%**	**Cumulative %**
Mortar and Pestle			
1 - 4	0	0.0	0.0
5-8	30	30.0	30.0
9 - 12	70	70.0	100.0
Total	100	100.0	
Crushing stone			
1-4	64	64.0	64.0
5-8	36	34.0	100.0
9-12	0	0.0	100.0
Total	100	100.0	

Pestle 30 respondents could grind between 5 and 8 kg per day, while 70 of the respondents could grind between 9 and 12 per day. Fresh okra was stored by putting fresh okra fruits in baskets for not more than 1 week and cooked okra was preserved by re-heating.

3.6 Marketing of Okra

Marketing includes selling, advertising and packaging (John, 1999). Production of okra, being a perishable crop, is affected by its marketing (Kemble et al, 1995). Channels of marketing in the study area include farm, local market and town. Table 12 shows that 41 of the respondents sell their produce on the farm, 43 transport the produce to local markets, 10 sell in towns while 6 sell both on the farm and local market.

Table 12. Distribution of the respondents according to marketing channels of okra

Marketing channels	Frequency	%	Cumulative %
Sales on farm	41	41.0	41.0
Transportation to local market	43	43.0	84.0
Sales in town	10	10.0	94.0
Sales on farm and local market	6	6.0	100.0
Total	100	100.0	

Small bowl (called *congo*) and baskets are used as measuring devices for sales of okra at retail and wholesales levels. Table 13 shows that only one of the respondents produced for consumption only, 6 produced for retail sales trade only, 84 produced for wholesales only while 4 of the respondents produced for consumption and retails. Detailed analysis showed that okra is packaged for sales in paper, cellophanes, and leaves. There were no facilities for mechanized packaging for either fresh or dried okra.

Table 13. Distribution of the respondents according to type of marketing

Marketing type	Frequency	%	Cumulative %
Consumption	1	1.0	1.0
Retail	6	6.0	7.0
Wholesales	84	84.0	91.0
Retail and consumption	1	1.0	92.0
Consumption and wholesale	4	4.0	96.0
Retail and wholesale	4	4.0	100.0
Total	100	100.0	

3.6 Utilization of Okra

Okra is basically used as food in the study area. It is sliced, grated, or crushed to make soup. Farmers use both dried and fresh okra. Detailed analysis showed that 81 of the respondents used both fresh and dried okra, 4used only dried okra, while 15 used only fresh okra. Sixty-two of the respondents preferred the taste of fresh okra, 37 preferred the taste of dried okra and only one liked both. Two of the respondents claimed that dried okra was more common than fresh okra, 15felt otherwise, and 83 felt both were used at the same rate.

4. TEST OF HYPOTHESES

Information on hypothesis testing is given in this section.
H_{o1}: There is no significant relationship between the demographic characteristics of farmers and okra production.

Data in Table 14 show positive and significant relationships between number of okra plots owned by farmers (r=0.267), cost of labour to till the land (r=0.452), number of family labour (r=0.234), number of hired labour (r=0.444), farm size for okra (r=0.922), farm size for other crops (r=0.550), farm size for local okra in dry and rainy season (r=0.789), yield of local okra in dry season (r=0.842), yield of improved Okra in dry season (r=0.815) and okra production. However the r-value for variable related to land preparation and operation are low, between r=0.234 and r=0.470. The r-value of variables related from farm size and output (yield) are very high between r=0.550 and r=0.922 which spelt out a situation tending towards a perfect relationship between these variables and okra production measured by the total yield of okra. There is also sharp difference in the r-value of farm size for okra (0.922) and other crops (0.550).

The magnitudes of contribution demonstrated by r^2 – value in percentages are equally high. Yield of okra ranges between 66.4% and 70.9%. Farm size for okra ranges between 62.3% and 85.0%, while contributions of variables related to land preparation and uses are between 5.5% and 22.1%. The implication of these findings is that size of the farm determines mostly what is produced in terms of yield.

Table 14. Correlation analysis showing linear relationship between farmers' personal and socio-economic characteristics and okra production.

Characteristics of farmers	**r**	**r^2**	**%**
No of plots	0.267	0.071	7.1
Cost of labour number of family labour	0.452	0.204	20.4
Number of family labour	0.234	0.055	5.5
Cost of hired labour	0.470	0.221	22.1
Farm size of okra	0.444	0.197	19.7
Farm size of other crops	0.922	0.850	85.0
Farm size for local okra in dry and	0.550	0.302	30.2
rainy season	0.789	0.623	62.3

Yield of local okra in dry season	0.842	0.709	70.9
Yield of improved in dry season	0.815	0.664	66.4

Significant at $p \leq 0.05$, r= coefficient of correlation, r^2=coefficient of determination

H_{o2}: There is no significant relationship between some personal characteristics of okra farmers and okra production.

Data in Table 17 show that X^2 calculated are greater than X^2 tabulated at $P \leq 0.05$ with high values of contingency coefficient between 0.5 and 1.0. This $P \leq 0.05$, S means that there is a significant relationship between level of education, crops intercropped with okra, frequency of

Table 17. Results of the Chi-square Analysis showing relationship between some personal characteristics of okra farmers and okra production

Variables	**X^2 calculated**	**df**	**X^2 tabulated**	**C**	**Remark**
Level of education	33.86	2	5.99	0.50	S
Marketing channels crops intercropped with okra	81.52	3	7.81	0.67	S
Frequency of harvest	261.68	11	19.70	0.85	S
Enjoyed taste	67.24	1	3.84	0.63	S
Type of processing for dry okra	37.04	3	7.81	0.52	S
	36.00	1	3.84	0.51	S
Measures used for retail	327.06	5	11.10	0.88	S
Measures used for wholesale	60.84	1	3.84	0.62	S
Marketing used for retail	70.56	1	3.84	0.64	S
Level of education	33.86	2	5.99	0.50	S
Marketing channels crops intercropped with okra	81.52	3	7.81	0.67	S
Frequency of harvest	261.68	11	19.70	0.85	S
Enjoyed taste	67.24	1	3.84	0.63	S
Type of processing for dry okra	37.04	3	7.81	0.52	S
	36.00	1	3.84	0.51	S
Measures used for retail	327.06	5	11.10	0.88	S
Measures used for wholesale	60.84	1	3.84	0.62	S
Marketing used for retail	70.56	1	3.84	0.64	S

significant, C=Contingency value, df=degree of freedom.

harvesting okra, types of processing methods, measures of retail and measures of wholesales operations and okra production. The high contingency coefficient values between 0.5-1.0 for all the variables listed above show the magnitude of the relationship or association between the variables and okra production, that is, there are strong relationship between the variables and okra production.

5. ENGINEERING IMPLICATION OF THE STUDY

Application of engineering to agricultural activities covers every aspect of agriculture starting from land preparation to production, processing and storage of the products. Farming activities and post-harvest operations are practiced at different scales depending on the available technology, farmer's financial capacity, natural endowment (e.g. land) and social – cultural belief among others. Adoption of technological innovations aimed at improving the production efficiency and standard of living of farmers also depends on how remote the technology is from their traditional method. It has become necessary to study farmers closely to be able to assess their needs. This is why engineers are sometimes involved in the collection of data on farmer's activities as they affect the provision of appropriate technologies for the farmers.

Jeon and Halos-Kim (1997) and Halos-Kim (2002) reported that observations on technology development and introduction into most developing countries suggest that technological development should be oriented to fully integrate the social, economic and technical aspects of the technology. She added that Agriculture in Africa has unique characteristics that necessitate careful planning and a strategic approach to technology development and that strategies that proved successful are holistic and participatory. Such strategies should be based on the knowledge of the farmers. Assessment of the production, processing, storage, marketing and utilisation of an agricultural crop in a particular area is therefore in the right direction to provide technological intervention to problems facing the people concerned. Such method has been used in the area of palm oil in certain part of Nigeria and has helped to develop appropriate processing technologies, which were adopted (Taiwo et al, 2000).

Considering the socio-economic characteristics of the farmers/processors in the area of study, it is evident that most of the farmers are in the small-scale category as indicated by the average output, though they are many. The production method may have to be in the traditional method of tillage operations, planting and post- planting operations owing to the land tenure system. While the farmers may be encouraged to form cooperative society in order to pool resources together and make mechanization possible, it is important to address the processing and storage operations so as to reduce the waste being experienced during the peak season. The processing technologies adopted are traditional and these impair the quality of the product.

From the study there is the potential for the production of dry okra if adequate technology is provided. Incidentally dry okra has been observed to have nutritive value close to the fresh one. Going by the traditional method, production of dry okra will involve slicing of the fresh pod into pieces, drying, grinding and packaging. Each of these operations will require a device to do that but based on the current study, the process line below (Fig. 1) is being suggested for a start for processing and preservation of okra in the area. The Department of Agricultural Engineering of Obafemi Awolowo University, Ile-Ife, Nigeria has already embarked on the development of appropriate technologies along the process lines suggested. On completing the research work, the farmers will have to be trained on the use of the technologies.

6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions could be drawn from the findings of this study:
i The mean age of the respondents was 57.56 years; mean years of okra production experience was 16.91 years; mean farm size cultivated by the respondents was 1.46 ha, they were all married with 49% literates. The mean person's day of family labour was 6.03 and that of hired labour was 1.25 persons day/month in three months.
Majority of the respondents planted okra on a small scale destined by land tenure system and probably due to the problem of unavailability of storage, processing, and preservation facilities. The mean planted area for okra production is 0.98.

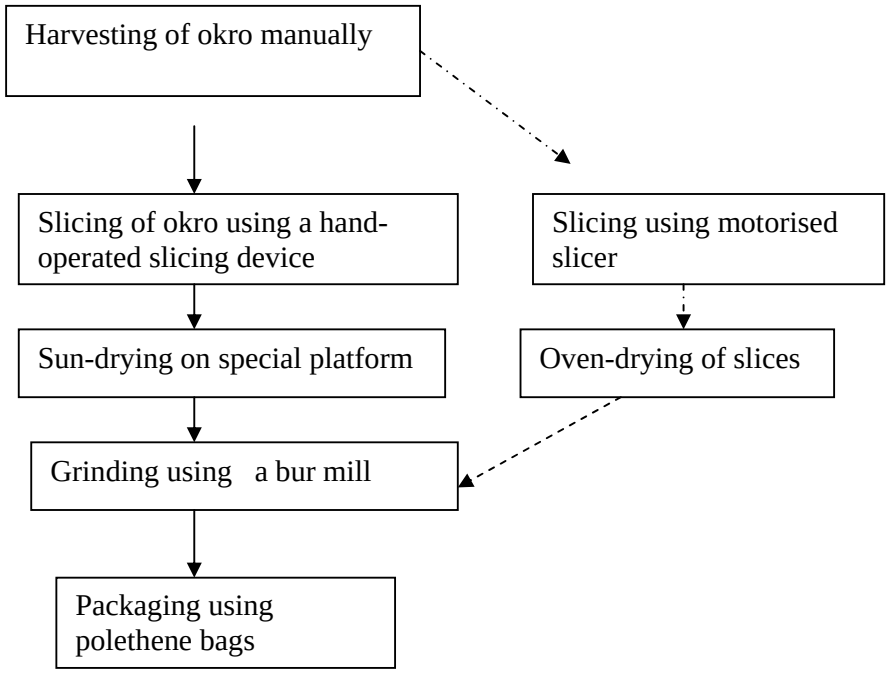

Fig. 1. Recommended flow chart for okro processing

⟶ small scale

⇢ medium scale

ii. Some personal, socio-economic characteristics of farmers such as level of education, marketing channels, crops intercropped with okra, frequency of harvest, enjoyed taste, type of

processing for dried okra, measures for retail and measures for wholesales influence okra production.

iii. The magnitudes of contribution demonstrated by r^2 –value in percentages are equally high. Yield of okra ranges between 66.4% and 70.9%. Farm size for okra ranges between 62.3% and 85.0%, while contributions of variables related to land preparation and uses are between 5.5% and 22.1%.

iv. Okra production had been observed to be at small-scale level. Also, processing and preservation were found to be at traditional local levels.

v Government assistance, financial aids, support from agencies, provision of basic infrastructure in the study area had been identified as factors that can improve okra production. Extension services had not reached majority of the farmers in the study area and advisory services were not given to the farmers reached.

The following recommendations were made for strategic planning in the study area:

i. More research on okra should be encouraged. This will facilitate the discovery of various methods of producing, processing, and preserving okra and the best methods could be chosen. Also this will lead to the fabrication of mechanized processing and preservation facilities such as mechanized canning, sealing, or bottling machines, mechanized dryers and so on. This will solve the problem of spoilage during the production season of okra and scarcity during the off-season.
ii. Farmers should be enlightened on the importance and diverse uses of okra. Female extension agents could teach different menus got from okra to the women through extension education. Medical and industrial usage of okra in the production of rope, paper, glazers, plasma expander and so on, should be taught to the local farmers so as to encourage them to produce on a large scale. This enlightenment could be got across to the farmers through the media and extension personal or group contact.

ii. Exportation of processed okra could be a source of foreign exchange earnings for the nation. Thus the governments, NGOs, farmers groups etc. should take interest in the production, processing, preservation, and marketing of okra with the ultimate aim of designing and producing appropriate intermediate technologies and plants.

iv. Necessary and adequate input should be provided to facilitate production on a large scale. Governmental and non-governmental bodies can provide these. Also farmers can come together and form cooperative groups that will generate adequate financial aids for the production of okra.

6. REFERENCES

Adeboye, O.C. and Oputa, C.O. (1996): Effects of galex on growth and fruit nutrient composition of okra (Abelnurschus esculentus). Ife Journal of Agriculture, 18 (1 & 2), 1-9

Bamire, A.S. and Oke, J.T. (2003): Profitability of vegetable farming under rainy and dry season production in SouthwesternNigeria. Journal of Vegetable Crop Prod., 9: 11-18.

Burkill, H.M. (1997). The useful plant of West Tropical Africa. 2nd Edition. Vol 4, families M-R, Royal Botanic Gardens, Kew. United Kingdom. 969 pp.

ECHO (2003): Plant information sheet, N. FT. Meyers, USA. http.www.echonet.org

Jeon, Y.W. and Halos-Kim, L. (1997). Improving postharvest technology development in Africa. In Women Agricultural Intensification and Household Food Security, p 133-144. Ed S.A Breth, Mexico City, Ssakawa Africa association.

Halos-Kim, L. (2002). Development and transfer of appropriate agro-processing technologies in Sub-Saharan Africa. Proceedings of the regional workshop on promotion of appropriate agro-processing technologies in West Africa, Ile-Ife, Nigeria, 23rd – 26th Oct. 2002., p 7-19

John F. (1999). Introduction to marketing. International Thompson on Business press. P5.

Kemble, J.M.; Sikora, E.J. ; Zehnder, G.W. and Patterson, M.G. (1995): Guide to commercial pkra production. File://E\ ANR-959. Guide to commercial okra production.htm.

Markose, B.L. and Peter. K.V (1990). Okra. Review of research on vegetable and Tuber crops. Technical Bulletin 16. Kerala Agricultural University Press Mannuthy, Kerala, 109 pp.

Osun State Agricultuarl Development Programme (OSSADEP, 1997). The report of 1996 crop area and yield survey conducted by planning, monitoring and evaluation Department, Osun State Press, Osogbo, Nigeria, pp 11.

Schippers, R.R. (2000). African indigenous vegetable an overview of the cultivated species. National Resources Institute (NRI), University of Greenwich, London, united Kingdom, 214 pp.

Siemonsma, J.S. (1982). The cultivation of okra (*Abelmoschus* spp.), tropical fruit]-vegetable (with special reference to the Ivory coast). D.H.O, thesis Wageningen Agricultural Wageningen, the Netherland. 297 pp.

Taiwo, K.A.; Owolarafe**,** O.K.; Sanni, L.A.; Jeje, J.O.; Adeloye, K. and Ajibola, O.O.(2000), Technological Assessment of Palm Oil Production in Osun and Ondo States of Nigeria, Technovation 20 (4): 215 - 223.