

Author Details: Fabiyi, E.F-

Department of Agricultural Economics and Extension, College of Agricultural Sciences, Landmark University, Omu Aran, Kwara State, Nigeria

Abstract:

This study was conducted to determine the impact of agricultural extension services on the adoption of improved soyabean processing and utilization technologies in Bauchi, Nigeria. Twenty improved soyabean processing and utilization technologies were used for the study. Four Local Government Areas (LGAs) were purposively selected and three villages were randomly selected from each LGA where many farmers were planting soyabean for consumption and sales. Random cluster sampling technique was used to select fifteen soyabean farmers from each village totaling (180) farmers. The result revealed that low level of education seemed to affect the level of adoption of the new technologies. Out of the twenty innovations involved in the study, only three were widely adopted. These were soya cheese ('wara'), soya daddawa (condiment) and soya milk, 14 were below 20% adoption, while 3 were at 0% adoption (soya yoghurt, soya puff-puff, soya pancake). Four information sources were involved in the study. These were extension contact, friends/neighbours, social participation and radio/television. The result revealed the level of significance of extension contact was highest in Bauchi LGA (chi-square ($X^2=112.37$) and lowest in Dass LGA ($X^2=58.95$). Extension contact had a considerable impact on adoption of processing and use of soyabean in the area. It was concluded that although some improved soyabean technologies have been adopted, it is gradually becoming a popular food in the area with extension activities exerting a considerable impact. Nevertheless, more awareness of processing knowledge and more government inducement are needed to lead to further adoption of improved soyabean technologies.

Keywords: soyabean, technologies, adoption, extension contact

1. Introduction

Agricultural extension has played a major role in agriculture, in the utilization of agricultural productions and products. The nature and scope of agricultural extension have undergone fundamental changes. The importance and contributions of agricultural extension in agricultural and human development cannot be over-emphasized.

There is a problem of dietary inadequacies in Africa countries including Nigeria. Soyabean fits many requirements of West African. The various roles that soyabean can play in the life of resource poor farmers are the target of agricultural extension as a source of protein to prevent malnutrition.

Soyabean (*Glycine Max (L) Merrill*) was first introduced to Nigeria in 1908 [1]. It was introduced into Ghana in 1909 [2] Cameroon in 1924 [3]. The three major world producer of soyabean were United States of America, Brazil and Argentina (FAOSTAT, 2004 cited by [4]).

The introduction of a project by the International Development Research Centre (IDRC) called "Soyabean utilization" introduced in 1986 had its greatest achievement in the development of foods which suited local diets improved the nutrition of local dishes and yet did not change the taste of these dishes nor increased their cost [5, 6].

Many processing methods have been developed [7]. These include a new method of processing of soya milk

to eliminate beany flavour which has been perfected and disseminated to local populace leading to an increased adoption of the technology. Substantial efforts have been made to promote utilization of technology among rural households. More than 90,000 people throughout Nigeria have been directly trained by extension workers in soyabean processing and utilization technologies as at 1995 [7]. These have in turn trained several thousands of other people [8]. While training programmes on the production, processing and utilization have been on the increase, the levels of adoption of those technologies have been discouraging [9].

Therefore, the major objective of this study is to assess the impact of agricultural extension services in the disseminating information about improved methods of soyabean processing and utilization. The specific objectives are:

1. To assess the educational level of the respondents
2. To identify the sources of information on adoption of improved method of soyabean processing and utilization
3. To assess the level of adoption of improved soyabean processing and utilization by the respondents.
4. To identify the sources of information on adoption of improved method of soyabean processing and utilization

Hypothesis of the Study

There is no significant difference in the use of information sources in the four LGAs on the adoption of improved soyabean technologies.

2. Materials and Methods

The study area was Western Zone of Bauchi State. Bauchi State comprises three Zones namely: Northern Zone (9 LGAs) Central Zone (4 LGAs) and Western Zone (7 LGAs) From Western Zone four Local Government Areas were selected purposively for this study because majority of farmers there produce soyabean. A simple random sampling technique was used to select three villages from each LGA. These include: Bayara, Miri and Tirum (Bauchi LGA) Baraza, Bundott and Wandu (Dass LGA); Boto, Bununu and Maryam (Tafawa Balewa LGA) and Gumau, Nabordo and Tilde (Toro LGA). A total of twelve villages were involved. Random cluster sampling technique was used to select 15 soyabean farmers from each village. A pilot survey was carried out by extension workers in order to have an insight into the questions that were really necessary for the study and as part of training programme for enumerators. With the assistance of enumerators under close supervision by extension workers, information for the study was collected from 180 respondents.

The Western Zone stretches from latitude $9^{\circ}30'$ to $10^{\circ}48'N$ and Longitude $8^{\circ}45'$ to $10^{\circ}15'E$. The Western Zone is the leading soyabean growing area of Bauchi State [10]. The study area enjoys a tropical climate with a long dry season period of seven months October to April and a short wet season of five months, May to September. The diurnal temperature varies from an average daily maximum of $31.6^{\circ}C$ to a daily minimum of $13.1^{\circ}C$ in January. In August, there is a daily mean maximum of $28.5^{\circ}C$ and a daily mean minimum of $19.9^{\circ}C$ in Bauchi State. The area has tropical soils of

alluvial and colluvial origin, tending to the heavier sandy clay loams and clay loams soil [11]. The total rainfall varies from 900-1100mm per annum in Tafawa Balewa LGA; 1000 – 1200mm in both Bauchi and Dass LGAs and 1000 – 1300mm per annum in Toro LGA [11].

The major crops grown include: rice, sorghum, soyabean, maize, millet cowpea and groundnuts. Carrots, tomato, pepper and other vegetables are also produced by the farmers. The main tribes are Hausa, Fulani and other tribes mainly Igbo and Yoruba. The population of the study area was estimated to be 950,583 people [12].

Data analysis was done using descriptive statistics involving frequencies percentages and means to reveal the extent of adoption of 20 selected soyabean improved technologies. It was also used to describe major problems affecting the adoption of the soyabean innovations in processing and utilization. The proportion index and chi square (X^2) were used to rank and compare the level of adoption of improved soyabean technologies and their information sources at 5% level of significance in the four LGAs used for the study.

3. Results

One hundred and eighty respondents were involved in this study from the study area (Western Zone of Bauchi State Agricultural Development Programme). The educational level described here are Quranic education, adult education, primary, secondary and tertiary education. The result revealed that those who had primary education had the highest percentage (32.8%) followed by Quranic education (24.4%), secondary education (22.2%), adult education with 15.0% and tertiary education had 5.6% (Table 1).

Table 1: Percentage distribution of respondents' educational levels

	Frequency	%
Quranic education	44	24.4
Adult Education	27	15.0
Primary education	59	32.8
Secondary Education	40	22.2
Tertiary Education	10	5.6

Major sources of information were four namely: extension contact, social group, friends/neighbours and radio/television in each of the 4 LGAs. The result revealed that the level of significance of the different information sources varies from LGA to another. The level of extension contact significance was highest in

Bauchi LGA ($X^2=112.37$) and lowest in Dass LGA ($X^2=58.95$) and in general (Western Zone) ($X^2=254.44$).The use of the different information sources varied from LGA to LGA with extension having the highest (69%), in Bauchi LGA, social group had the highest (71%), in Toro LGA friends/neighbours was also

the highest (75%), in Bauchi LGA, radio/television was the highest (42%), in Tafawa Balewa LGA, radio/television was the least used in all the four LGAs (Table 2).

Table 2: Percentage distribution and X² value for testing hypothesis of sources of information on the adoption of soyabean technologies.

Information Sources:	Bauchi (n = 45)		Dass (n= 45)		Tafawa Balewa (n = 45)		Toro (n = 45)		Total (n = 180)		Rank
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	
Social group	30	67	30	67	22	47	32	71	114	63	1 st
Extension Contact	31	69	20	44	25	55	29	64	105	58	2 nd
Friends/Neighbor	34	75	25	55	29	64	12	27	100	56	3 rd
Radio/Television	10	22	4	9	19	42	4	9	37	21	4 th
Chi Square (X ²)	112.37 ****		58.95***		59.69***		70.37***		254.44 ***		

*** Significant Rank: P<0.001

Rank: R

Table 3 shows twenty improved soyabean technologies in processing and utilization used for the study. The result from the study revealed that soya cheese had the highest percentage of 73% adoption by the respondents from the study area (Western Zone). Soya daddawa (soya condiment) had 62% adoption, soya milk had 21% adoption, 14 soyabean technologies were below 20% adoption, while three soyabean technologies had 0% adoption (Soya yoghurt, soya puff-puff and soya pan cake).

Table 3: The extent of adoption of the 20 selected improved soyabean technologies

Improved soyabean Technologies	Local Government Areas										Total
	Bauchi (n=45)		Dass (n=45)		Tafawa Balewa (n=45)		Toro		Total (n=180)		
Technologies	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	
1 soya cheese (awara)	33	73	27	60	30	67	41	91	131	73	
2 soya daddawa		16	36	33	73	35	78	27	60	111	62
3 soya milk	8	18	6	13	12	27	11	24	37	21	
4 soya Kunu	16	36	8	18	3	7	0	0	27	15	
5 soya yoghurt	0	0	0	0	0	0	0	0	0	0	
Utilization Technologies											
6 soya pap	1	2	0	0	10	22	18	40	29	16	
7 soya vegetable soup	11	24	11	24	2	4	1	2	25	14	
8 soya feed	0	0	6	13	0	0	17	38	23	13	
9 soya baby food		3	7	3	7	0	0	16	36	22	12
10 soya chin-chin		2	4	0	0	0	0	9	20	11	6
11 soya kossai	0	0	1	2	0	0	6	13	7	4	
12 soya bread	0	0	0	0	0	0	3	7	3	2	
13 soya tuwo	2	4	0	0	0	0	2	4	4	2	
14 soya amala	0	0	0	0	0	0	2	4	4	2	
15 soya moin-moin	1	2	0	0	0	0	2	4	3	2	
16 soya danwake		2	4	0	0	0	0	1	2	3	2
17 soya cake	2	4	0	0	0	0	1	2	3	2	
18 soya garri	1	2	0	0	0	0	1	2	2	1	
19 soya puff-puff		0	0	0	0	0	0	0	0	0	0
20 soya pancake		0	0	0	0	0	0	0	0	0	0

In general, some of the constraints in the adoption of soyabean processing and utilization were common to the four LGAs such as insufficient funds, lack of awareness, inadequate processing equipment. Other constrains included lack of fertilizer for planting the crop, lack of processing knowledge, lack of market, insect problems and others. (Table 4)

Table 4: Respondents constraints on the adoption of improved soyabean technologies in processing and utilization in the four LGAs.

Constraints	Frequency	Percentage	Ranking
Bauchi LGA (n =45)			
Inadequate market	9	20.00	1 st
Insufficient funds	7	16.00	2 nd
Lack of fertilizer	5	11.00	3 rd
Lack of awareness	5	11.00	3 rd
Insect problem	4	9.00	4 th
Inadequate processing equipment	3	7.00	5 th
Insufficient rain	3	7.00	5 th
No response	9	20.00	
Dass LGA (n=45)			
Inadequate processing equipment	5	11.00	1 st
Lack of awareness	4	9.00	2 nd
Insufficient funds	4	9.00	2 nd
No response	32	71.00	
Tafawa Balewa LGA (n=45)			
Lack of fertilizer	19	42.00	1 st
Inadequate processing equipment	15	33.00	2 nd
Insufficient funds	10	22.00	3 rd
Lack of processing knowledge	8	18.00	4 th
Lack of awareness	8	18.00	4 th
Toro LGA (n=45)			
Inadequate market	25	56.00	1 st
Lack of fertilizer	15	33.00	2 nd
Inadequate transportation	5	11.00	3 rd
Land Problem	5	11.00	3 rd
Insect problem	5	11.00	3 rd
Insufficient funds	4	9.00	4 th
Lack of labour	2	4.00	5 th
Multiple response			

4. Discussion

4.1 Western Agricultural Zone (Study Area)

The main focus on this study is on the impact of extension services on the adoption of improved soyabean processing and utilization. Both men and women were involved in soyabean processing and utilization in all the four LGAs (Western Zone of Bauchi). According to [8] adoption of soyabean has been found to be influenced either positively or negatively by several factors including educational status, social participation, awareness, village location and source of information.

The study revealed that the low level of education seemed to affect the level of the soyabean technologies adoption negatively (low adoption Table 1). In [13] it was reported that formal education enhances adoption of innovations and [14] also stated that the more education the person has, the more favourable attitude he/she has towards the adoption of improved technologies.

4.2 Sources of Information for Adoption of Improved Soyabean Processing and Utilization Technologies in the Study Area

In this study, sources of information were friends, neighbours and extension contact was statistically significant in the study area (the four LGAs). In general, extension ranked second among all the information sources used in the study. There are many factors that may influence adoption, but in this study social participation and extension contact as sources of information on improved soyabean processing and utilization were very significant.

Extension as a source information on soyabean innovations was highest in Bauchi LGA, ($X^2=112.37$) and lowest in Dass LGA ($X^2=58.95$) (Table 2). This is similar to the findings of [8] who stated that friends/neighbours contact and extension contact from the principal sources of information and seemed to be more effective. Farmer-to-farmer contact is very important in technology dissemination especially in small-scale farming system [15].

4.3 Adoption of Improved Soyabean Technologies by Respondents in Western Agricultural Zone of Bauchi State

Twenty improved soyabean technologies in processing and utilization were used for the study (Table 3). In the study area, most of the respondents interviewed had been processing and eating soyabean products before the introduction of the improved soyabean innovations, this includes soya cheese, soya daddawa and soya milk. Through observation and explanation from the respondents, the local method of soyabean processing and uses are different from the improved soyabean processing and utilization methods. Many processing methods have been developed which include a new method of processing of soya milk to eliminate beany flavor [7, 16]. Substantial efforts have been made to promote utilization technologies among rural and urban households. The persistence of high incidence of malnutrition and poverty among poor people especially the rural people has led to increasing research interest on malnutrition. There is a problem of dietary inadequacies in African countries including Nigeria. Protein-calorie-malnutrition is common among rural farmers especially infants, children, women and pregnant women [6, 9, 17].

There are several factors that may enhance adoption of certain innovations, these include: needs or wants of the people, level of awareness and level of income [18]. The higher the relative advantage the higher the rate of

adoption. But Nigerians have quickly realized the advantage of this grain, because meat consumption is costly, they found a great need for its use since soyabean has roughly the same amount of protein as dried fish, egg, beef, milk and several times cheaper [19, 20].

It has been discovered that soyabean maybe the most practical means of relief from the disease known as kwashiorkor (protein-calorie-malnutrition) which has been increasing among young children in the densely populated humid tropics [20, 21]. Soyabean on its own is not palatable and hence lacks wide appeal. Raw soyabean contain a number of anti-nutritional factors which not eliminated diminish nutritional value [22, 23]. Improved soyabean processing techniques go through a definite pattern, steps and processes to obtain desired products, these are called improved technologies [16, 20]. In processing soyabeans, factors which are considered in developing recipes include prevention of off-flavour and inactivation of anti-nutritional factors [20, 22].

According to [6, 24], soyabean use has reduced malnutrition in some parts of Kaduna State and Benue State. This study showed that many technologies in soybean innovation were adopted, few were highly adopted (soya cheese, soya milk and soya daddawa), while others had low and zero adoption. In this survey the low adoption in Tafawa Balewa LGA (30%) and in Dass LGA (40%) is in sharp contrast with high adoption (80%) in Toro LGA and 65% in Bauchi LGA in the same geographical zone with people of common traditions. Probably, the reason may be because of the high contact with extension services in those LGAs. Among the sources of information used in the study areas, extension contact in Bauchi LGA had 69%, Toro LGA had 64%, Dass LGA had 44%, while Tafawa Balewa LGA had 55% of extension services. This shows that extension contact or services increase adoption. In farmers' opinion, extension contact is the surest way of getting reliable information. In general, constraints in the adoption of soyabean processing and uses were common to most of the LGAs. These were lack of awareness, lack of funds, inadequate processing equipment and lack of fertilizer for planting the crop.

4.4 Assessment of Extension Services on Adoption of Soyabean Technologies in Processing and Utilization

The goal of agricultural extension is to disseminate agricultural technologies for improving productivity, farmers' welfare and household nutritional status [25]. In Nigeria, extension service provides farmers with information on all aspects of production, processing, utilization and nutrition [26, 27].

Recipe books have been made available to facilitate training and technology dissemination. Training on the use of soyabean in homes and villages was a practical approach. Training programmes were organized for medical doctors, industries, market women, government agencies, hospitals and many others. In all, more than 50000 people were trained [26, 27]. Using participatory methods, several demonstrations of soyabean production and utilization techniques were carried out in some rural and urban areas by extension workers, women groups and interested individuals [6].

As a result of the awareness drive and training activities by extension services, many hospitals have embraced the use of soyabean products for alleviating malnutrition in children. It has directly or indirectly helped save the lives of many malnourished children that probably would have died or impaired in their growth development. Information made available through extension contact or services has led to many innovations being adopted to the extent that soyabean is fast becoming a popular food in Nigeria.

In summary, the impact of extension services on adoption of soyabean production, processing and utilization technologies had a positive impact on household nutritional status, food security, income generation and distribution. Although, virtually all respondents interviewed were well aware that soyabean consumption is good, but do not know about the health benefits. This is similar to the findings of [28] who reported that the study in Oniyo community in Oyo State revealed that the respondents do not know about health benefits of soyabean. In the local diet, soyabean has been fairly incorporated into some local diets of the people in the study area. There are a number of soyabean menus or recipes which respondents were not aware of their existence for the people to be convinced to accept and use, such as soya cassava (“soya garri”), soya bean cake (“soya akara”), soya bread and soya snacks (cake and puff-puff etc.).

5. Conclusion and Recommendations

Agricultural extension in Nigeria has contributed immensely and effectively to agriculture and human development. In [29] it was reported that the degree of contact farmers had with extension agents was the most important explainer of innovation programme success in Eastern Nigeria. Contact with extension workers is an indicator of access to these services and inputs [30]. Although great efforts have been made over the years to develop and promote soyabean as a supplement to local diet in the area of study. There is still a great deal of efforts needed especially, in the area of adoption of

improved soyabean processing technologies before desired levels can be attained.

It was observed that those who process and use soyabean to make soya milk and local cheese (“wara”) do not soak overnight or for many hours (at least 15 – 18hours) as recommended. Soaking for few hours may not reduce the anti-nutritional factors in soyabean as desired. This is the area where more work is needed for agricultural extension workers. Anti-nutritional factors in soyabean need to be reduced or eliminated in order to make it useful to the body. Promotional activities for awareness of soyabean usefulness in the body will increase adoption of improved soyabean technologies. Adoption of improved soyabean processing technologies will reduce malnutrition and improve the health of the people. Home economics extension workers should create an avenue for regular teaching and practical demonstrations of how to prepare soyabean dishes using the new methods.

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