



FACTORS INFLUENCING ADOPTION OF RECOMMENDED SOYBEAN-MILK PROCESSING TECHNOLOGY AMONG WOMEN PROCESSORS IN ZARIA AND MAKARFI LGAs OF KADUNA STATE, NIGERIA

¹Saddiq, N. M., ¹Casmir, R. and ²Shehu, A.

¹Department of Agricultural Extension and Rural Development,
Ahmadu Bello University, Zaria.

²Agro-Meteorological Centre, Abubakar Tafawa Balewa University, Bauchi.

Corresponding Author's Email: saddiqnuhu@gmail.com, **GSM:** 08065307616

ABSTRACT

This paper assessed the socio-economic factors influencing the adoption of Soybean-milk processing technology and the level of adoption among women processors. A multi-stage sampling technique was adopted for this research. A total number of 170 women were trained from two LGAs and the same number was purposively selected as the sample size of the study. Data were collected through the use of a structured questionnaire and both descriptive and inferential statistics were used to analyse the data. The results indicated that most (91.8%) of the processors had adopted Soybean-milk processing practices. The result of the Tobit regression analysis showed that marital status ($\beta = 0.0266$), processing experience ($\beta = 0.0429$), number of extension contact ($\beta = 0.0265$), and membership of association ($\beta = 0.0286$) were positive and significant in influencing the adoption of Soybean processing technology at 10%, 1%, and 5% levels of probability respectively. Therefore, the null hypothesis (H_{0i}) was rejected. The study concluded that the adoption of Soybean-milk processing technology had a significant effect on the livelihood of women processors with increased income and change in their level of living. Therefore it was recommended that since there was significant effect on the livelihood of women processors government, non-governmental organizations and other relevant institutions should provide a more enabling environment; this could be done by providing a link to market for more production, more training and workshops for better packaging, as well as increased product's shelf life in order to motivate adopters' engagement and mobilize more processors all of which could ensure more rapid adoption of the technology among processors.

Keywords: Adoption, Milk, Processing, Soybean and Women

INTRODUCTION

Soybean's global production accounted for 1.62% of total Soybean production in 2016 and this increased by nearly 2% from 333,000,000 metric tons in 2016 to about 353,000,000 metric tons in 2018 (Voora, Larrea and Bermudez (2020)). This also increased to 363,570,000 metric tons in 2020 (USDA, 2021). Nigeria is the second highest producer of Soybean in Africa after South Africa (Ari *et al.*, 2017). Boluwade (2022) reported that Foreign Agricultural Services (FAS) Lagos, forecasts Nigeria's Soybean production in marketing year (MY) 2022/23 (October-September) to reach 1.35 million metric tons, up 20% above the USDA official MY 2021/22 estimate of 1.117 million metric tons. Soybean is among the major industrial and food crops grown on every continent. It is also a prime source of vegetable oil in the international market. The seed contains about 20% oil on a dry matter basis and this is 85% unsaturated and cholesterol-free (Omoigui *et al.*, 2020). The rapid growth of both the poultry and food processing industries in the past decade has also increased the demand for Soybean in Nigeria (Nwoye *et al.*, 2019). Consumption is strong due to growing demand in the food processing and feed use sectors. Food



processors use Soybean to produce soyamilk, soya cake, and soya yoghurt to fortify local carbohydrate-based Nigerian food staples (Boluwade, 2022).

The National Agricultural Extension Research and Liaison Services (NAERLS) have developed an improved method (packaged technology) of Soybean processing into powdered soya milk. These include washing, cooking, drying, roasting, grinding, sieving, packaging and storing (NAERLS, 2021).

The adoption of improved agricultural technologies is the tool for boosting production and productivity of the agricultural sector, poverty reduction, and ensuring food security in developing countries (Yokamo, 2020). Adoption is an integration of new technology into existing practice and is usually preceded by a period of 'trying' and some degree of adaptation (Udimal *et al.*, 2017). The process of adopting an idea or innovation does not happen as a single unit act, but rather as a mental process that consists of at least five stages namely; the awareness stage, the interest stage, the evaluation stage, the trial stage, and finally, the adoption stage (Cheteni *et al.*, 2014; Sennuga and Oyewole, 2020). The reason it is important to encourage the adoption of innovations is to exploit the inherent gains and values it adds to the processor's production process and livelihood (Ekong, 2010).

METHODOLOGY

Study Area

This study was conducted in Makarfi and Zaria Local Government Areas of Kaduna State. Makarfi Local Government Area is located in the Northern Senatorial Zone of Kaduna State. Makarfi LGA administratively comprises of 11 districts. The projected population of Markarfi LGA in 2020 as obtained by the Kaduna State Bureau of Statistics (KDBS) was 215,248 based on an annual growth rate of 3.0% (KDBS, 2018). Agriculture is the major economic activity in Makarfi LGA. Major crops produced are sugarcane, Soybean, maize, sorghum, rice, and vegetables. Zaria Local Government Area is also located in the Northern Senatorial Zone of Kaduna State. Zaria LGA administratively comprises six districts and thirteen wards. The projected population of Zaria LGA in 2020 as obtained by the Kaduna State Bureau of Statistics (KDBS) was 597,678 based on an annual growth rate of 3.0% (KSBS, 2018). Some of the crops cultivated in Zaria LGA are Soybean, sorghum, millet, maize, cowpea, tomato, and cabbage (KADA, 2020).

Sampling Procedure and Sample Size

The sample size for the study was obtained from 170 trained women processors on recommended techniques of Soybean processing into powdered milk by the National Agricultural Extension and Research Liaison Services (NAERLS) in the two selected LGAs. A multi-stage sampling procedure was adopted for this research. In the first stage, two Local Government Areas were purposively selected from the State (Zaria and Makarfi) being the two LGAs that were selected by NAERLS due to the high processing of Soybean among women in the areas, and the fact that NAERLS gave women processors in the two LGAs training on the recommended techniques of Soybean processing into powdered milk. In the second stage, four communities each from the two LGAs to which the trained processors belonged were randomly selected. Communities selected in Zaria LGA were; Dutse Aba, Bizara, Gyallesu, and Zaria, while the communities selected in Makarfi LGA were Dan Guzuri, Ungwan Rimi, Ungwan Kauran Dawa, and Makarfi. Therefore, all the women (170) who were trained were used to avoid bias.

Method of Data Collection

Primary data were collected through the use of a questionnaire instrument and were administered to the processors by well-trained enumerators. The questions were designed to meet the objectives of the study. Secondary information was obtained from agricultural journals and publications, books on agricultural activities, seminar papers, and meeting proceedings. The



internet was also explored for relevant secondary information. Fieldwork was carried out immediately after the proposal presentation. The pretest and validation test were carried out by experts from the department of Agricultural Extension and Rural Development.

Analytical Technique

Descriptive statistics was used to assess the level of adoption of recommended Soybean-milk processing technology among women processors which was based on the number of practices adopted by processors to the total number of recommended processing practices. Tobit regression analysis was used in estimating the contribution of each variable to the dependent variables. This was to determine the best variables that could best predict the adoption of the technologies by farmers.

Tobit Regression Model

The Tobit regression model is expressed as follows:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + U;$$

Where:

Y_i = Adoption index (total number of recommended Soybean-milk processing practices adopted)

X_1 = Age of the processors (in years)

X_2 = Marital status (Married= 1, Single = 2)

X_3 = Educational level (no formal education= 0, primary education= 1, secondary education= 2, tertiary education= 3)

X_4 = Household size (Number of persons)

X_5 = processing experience (number of years in Soybean processing)

X_6 = Access to credit (amount in naira ₦)

X_7 = Extension contact (Number of extension visits per year)

X_8 = Membership of association (years of membership)

β_0 = Constant

$\beta_1 - \beta_8$ = Regression coefficients

U = Error term

RESULT AND DISCUSSION

Level of Adoption of Recommended Soybean-milk Processing Technology among Women Processors

The result in Table 1 shows the level of adoption of recommended Soybean-milk processing technology among women processors. It was found that 99.4% of the women processors adopted the practice of washing Soybean properly under running water, 94.11% adopted the practice of boiling the Soybean for 15 minutes, and in addition, 91.8% adopted the practice of draining and washing the peel. Furthermore, the practice of cooking the Soybean for 30 minutes was adopted by 92.9% of the processors. It was also gathered that the practice of spreading the Soybean on a flat surface to dry and the practice of grinding and sieving were adopted by 95.9% of the processors respectively, while 96.5% adopted the practice of roasting on a low heat for 2 minutes. Lastly, 97.1% adopted the practice of packaging and storing in a clean dry place. The percentage of respondents with low, medium and high adoption of the processing practices was also discussed. Processors who adopted less than 20% of the practices were categorized as 'low adoption'. Also, respondents with 21%-65% practices adopted were categorized as medium while respondents who adopted 66% and above of the practices were categorized as high. In general, 91.8% of the processors had adopted most of the recommended Soybean-milk processing practices, while only a few (2.4 and 5.9%) had low and medium adoption respectively. This indicated that the adoption



level of recommended Soybean-milk processing practices was found to be high. This could be as a result of the simplicity of the technology. This had the same outcome as the findings of Muhammad *et al.* (2014), who revealed that a high proportion of women processors adopted the improved processing technologies.

Table 1: Level of adoption of recommended Soybean milk processing technology by women processors

Recommended Soybean-milk processing practice	Frequency**	Percentage (%)
1. Wash soya bean properly under running water	169	99.4
2. Boil the soya bean for 15 minutes	160	94.11
3. Drain and wash off the peel	156	91.8
4. Cook soya bean for 30 minutes	158	92.9
5. Spread soya bean on a flat surface to dry	163	95.9
6. Roast on a low heat for 2 minutes	164	96.5
7. Grind and sieve	163	95.9
8. Package and store in a clean dry place	165	97.1
Level of adoption		
Low	4	2.4
Medium	10	5.9
High	156	91.8
Total	170	100

Note: low (less than 20%), medium (2% to 65%), and high (66% and above)

** Multiple response choices allowed

Factors Influencing Adoption of Recommended Soybean-Milk Processing Technology among Women Processors

The result of Tobit regressions in Table 4.4 showed that some socio-economic characteristics were found to be significant in influencing the adoption of recommended Soybean-milk processing technology at 1%, 5%, and 10% levels of probability.

The result in Table 2 showed that marital status was positive and significant at a 10% level of probability, with a regression coefficient of 0.0266. This implies that marital status positively influenced the adoption of recommended Soybean-milk processing technology among women processors. The implication of this is that the adoption of recommended Soybean-milk processing technology would increase because women processors who are married have more household responsibilities.

The result also found that processing experience was positive and significant at a 1% level of probability, with a regression coefficient of 0.0429. This shows that processing experience has positively influenced the adoption of recommended Soybean-milk processing technology among women processors. This result is in agreement with that of Adebayo *et al.* (2020) and Adebayo *et al.* (2018) who found that processing experience has a significant and positive influence on the adoption of groundnut processing techniques used by the processors.

The result further showed that the number of extension contact and membership of an association was positive and significant predictors of the adoption of recommended Soybean-milk processing technology among women processors at a 5% level of probability, with regression coefficients of 0.0265 and 0.0286 respectively. This implies that extension contact and membership of an association positively influenced the adoption of recommended Soybean-milk processing technology among women processors. The implication is that the more there is contact and engagement in association the more likely the adoption of recommended Soybean-milk processing technology among women processors. This result is



in line with the findings of Ilesanmi and Afolabi (2020) and Abubakar *et al.* (2019) who found that the source of information and visits by extension agents had a positive and significant influence on the adoption of improved technologies. This result is also in line with the work by Bakut (2013) who found that membership in cooperative associations and extension contact were positively and significantly influential in the adoption of recommended cassava production practices.

Testing of Hypothesis Ho₁:

It was hypothesized that the socio-economic and institutional characteristics of women processors have no significant influence on the adoption of recommended Soybean-milk processing technology. The result in Table 4.4 showed that marital status, processing experience, extension contact and membership of an association were the socio-economic and institutional factors that positively and significantly influenced the adoption of recommended Soybean-milk processing technology among women processors at 10%, 1% and 5% level of probability respectively. Therefore, the null hypothesis was rejected.

Table 2: Factors influencing the adoption of recommended Soybean-milk processing technology among women processors

Variable	Coefficient	Standard error	T-value	Marginal effects
Constant	0.9488	0.1240	7.650	
Age	-0.0077	0.0141	-0.544	-0.0428
Marital status	0.0266*	0.0147	1.817	0.1487
Education	0.0065	0.0133	0.491	0.0364
Household size	-0.0124	0.0135	-0.914	-0.0690
Processing Experience	0.0429***	0.0131	3.265	0.2394
Amount of credit received	-0.0003	0.0134	-0.020	-0.0015
Number of extension contact	0.0265**	0.0129	2.051	0.1142
Membership of association	0.0286**	0.0142	2.022	0.1598
Sigma	0.0263***	0.0028		
LR chi ² (11)	33.060			
Prob>chi ²	0.001			
Log-likelihood	68.398			
Pseudo R ²	0.519			

Note: ***, ** and * represent significant at 1%, 5% and 10% levels of probability respectively.

CONCLUSION AND RECOMMENDATION

The study concluded that marital status, processing experience, number of extension contacts and membership of an association were significant factors influencing the adoption of recommended processing practices in the study area. In addition, adoption level of recommended processing practices was found to be high in the study area. Based on the findings of this study, the following recommendations were made: Since the adoption of recommended Soybean processing into powdered milk has a significant effect on the livelihood of women processors government and non-governmental organizations should make a more enabling environment available by providing a link to market for more production, more training and workshops for better packaging and increased product's shelf life. This would motivate better adopters' engagement and help mobilize more processors which could favour more rapid adoption of the technology among other processors.



REFERENCES

- Abubakar, H. N., Garba, Y., Gana A. K., and Jacob, I. A. (2019). Factors influencing the adoption of rice improved production practices by farmers in adopted villages, Niger state, Nigeria. *Advances in Plants & Agriculture Research*, **9**(1): 183–189.
- Adebayo, C. O., Coker, A. A. and Tsavhemba, S. (2018). Adoption of improved soybean production technologies in Benue State, Nigeria. *Nigerian Agricultural Journal*, **49**(1): 65-7.
- Adebayo, S. A., Olorunfemi, O. D., Siyanbola, F. I., and Malomo J. O. (2020). Groundnut processing techniques used by processors in Edu Local Government Area, Kwara State, Nigeria. *FUW Trends in Science and Technology Journal*, **5**(1): 117-121.
- Afolabi, A. (2020). Determinants of adoption of downy mildew resistant maize by small-scale farmers in Kwara State, Nigeria. *Global Journal of Science Frontier Research*, **10**: 23-41.
- Ari, M. M., Ayanwale, B. A., and Adama, T. Z. (2017). Evaluation of different processing methods of soya beans (*Glycine max*) on their nutritive value and the performance of broilers: A qualitative selection approach for extension. *International Journal of Livestock Production*, **8**(7): 113-124.
- Bakut, P. M. (2013). Factors influencing adoption of recommended cassava production practices by farmers in Bwari and Kuje Area Councils, Abuja, Federal Capital Territory. A published Thesis submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria, in partial fulfillment of the requirement for the award of a degree of Masters of Science in Agricultural Extension.
- Boluwade, E. (2022). Oilseeds and products annual. United States Department of Agriculture (USDA), foreign agricultural services in conjunction with global agricultural Information Network (GAIN) (Report).
- Cheteni, P., Mushunje, A., and Taruvinga, A. (2014). Barriers and incentives to potential adoption of biofuels crops by smallholder farmers in the Eastern Cape Province, South Africa, *Environmental Economics*, **5**(3): 71-78.
- Ekong, E. E., (2010) Rural Sociology: An introduction and analysis of rural Nigeria (3rd Edition). Uyo, Nigeria: Dove educational publishers.
- Kaduna State Bureau of Statistics, (2018). Kaduna State Statistical Year Book.
- Muhammad, H. U., Tyabo, I.S., Tsado, J.H., Adebayo, C.O., & Mohammed, U. (2014). Adoption of improved cassava processing technologies among rural women in Lapai Local Government Area, Niger State, Nigeria. *Journal of Sustainable Technology*, **5**(2): 100-105.
- NAERLS (2021). National Report of Wet Season Agricultural Performance in Nigeria. NAERLS Press, Zaria.
- Nwoye, I. I., Osegbue, E. G., & Okeke, M. N. (2019). Adoption of soybean products among women in Onitsha North Local Government Area of Anambra State, Nigeria. *International Journal of Agricultural Research Innovation Technology*, **9**(2): 30-34.
- Omoigui, L.O., Kamara, A.Y. Kamai, N., Dugje, I.Y., Ekeleme, F., Lava Kumar, P., Ademulegun, T. & Solomon, R. (2020). Guide to soybean production in northern Nigeria Published by the International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria Revised Edition, February 2020.
- Oyewole, M. F. (2017). Welfare status of rural women agro-processors participants in the development partnership in higher education project in Osun and Oyo States, Nigeria. *Journal of Agricultural Extension*, **21**(1): 39-51.



- Sennuga, S. O. & Oyewole, S. O. (2020): Exploring the effectiveness of agricultural technologies Training among smallholder farmers in sub-saharan african communities, *European Journal of Training and Development Studies*, 7(4): 1-15.
- Udimal, T. B., Jincai, Z., Mensah, O. S. & Caesar, A. E. (2017). Factors Influencing the Agricultural Technology Adoption: The Case of Improved Rice Varieties (Nerica) in the Northern Region, Ghana. *Journal of Economics and Sustainable Development*, 8(8): 137-148.
- United States Department of Agriculture, (2021). World agricultural production. Foreign agricultural service circular series WAP, 7-21.
- Voora, V., Larrea, C., & Bermudez, S. (2020). Global market report: Soybeans.
- Yokamo, S. (2020). Adoption of improved agricultural technologies in developing countries: literature review. *International Journal of the Science of Food and Agriculture*, 4(2): 45-52.