



ADOPTION OF IMPROVED SOYBEAN (*Glycine Max*) PRODUCTION TECHNOLOGIES AMONG FARMERS IN WESTERN AGRICULTURAL ZONE OF BAUCHI STATE

Sadiya, Y. U., Danwanka, H. M. and Abdurahman, S.

Department of Agricultural Economics, Faculty of Agriculture and Agricultural Technology,
Abubakar Tafawa Balewa University Bauchi, Bauchi State, Nigeria

Correspondence E-mail: sadiyayautukur@gmail.com, **GSM:** 07068208021

ABSTRACT

The study examined the adoption of improved soybean production technologies among farmers in Western Zone of Bauchi State. The Agricultural Programme comprises of seven (7) Local Government Areas of Alkaleri, Bauchi, Bogoro, Dass, Kirfi and Tafawa Balewa. Primary data were randomly collected from 164 respondents using questionnaire and were analyzed using descriptive statistics. The result revealed that substantial proportion (30.8%) of the respondents were within the age range of 30-39 years with average age of 40. The results also showed that majority (81.7%) of the respondents were male and 56.1% were married. The findings revealed that most (91.5%) of the respondents had one form of education or the other with 37.8% having farming experience of 11-20 years. The major attributes of improved soybean include drought tolerance ($x=3.64$), compatibility ($x= 3.61$) and disease resistant ($x= 3.51$). On the other hand, the findings revealed that respondents had high levels of adoption on recommended planting date (67.7%), recommended weeding interval (6.6%) and recommended harvesting time (57.3%). The study concludes that farmers were willing to adopt new technologies in the production of soybean so as to improve their living standards and levels of income, hence the need for the farmers to form cooperative societies and hire more extension officers to enlighten their members on recommended production practices in soybean production.

Keywords: Adoption, Improved, Production, Soybean and Technologies

INTRODUCTION

Soybean is generally considered as highly versatile grain which has about 365 Applicable use in the human and animal foods other industrial uses (Mahama *et al.*, 2020; Ugbabe *et al.*, 2017). Thus, the demand for soybean products is expected to be high in Nigeria especially among commercial consumers in the food, paint, pharmaceutical and confectionaries industries (Mahama *et al.*, 2020). According to FAOSTAT (2021), Nigeria is the second-largest producer of soybean in Africa after South Africa however their yield average of <1 ton/ha, is below the potential yield of over 3 tons/ha (Ronner *et al.*, 2016). Research efforts to improve the existing soybean varieties to expand and increase production in Nigeria were initiated in different research institutes from the mid-1970s to date (Vanlauwe *et al.*, 2019). Idrisa (2020) reported that, with the development of Soybean improved varieties (TGX1987-62F, TGX1987-10F, TGX1835-10E, TGX1448-2E and TGX1485-2E-ID), commercial production of soybean has expanded beyond its traditional home (Benue, Kaduna, Niger, and Plateau) states. It is now produced in other states, such as Bauchi, Borno, Jigawa, Kano, Kebbi, Lagos, Nasarawa, Oyo, Sokoto, Taraba, Zamfara, and Federal Capital Territory. Soybean is one of the most nutritious crop in the world. It contains at least 100% more proteins than any other common crop and yields 5-10 times more protein per unit area than other crops (Soybean Africa 2016). The protein in soybean is also balanced. It contains all the essential amino acids, which the body cannot manufacture. Various strategies have been implemented to accelerate the production of soybean in Nigeria (Biam and Aja, 2012). One of such projects is the USAID



MARKETS II, Soybean production project which was introduced in 2012 in Benue State, Nigeria by the United State Agency for International Development (USAID). MARKETS II is packaged with modern soybean production technologies aimed at teaching the relevant agronomic practices and empowering Benue State farmers to boost production of soybean.

The project is actually a system of innovation where USAID is responsible for the entire sponsorship of the project via Chemonics International, while Benue State Agricultural Development Programme (BNARDA) and Hule Nigeria Limited (HuleNig LTD) provide extension services and add value to the commodity by processing it into different soy products. This project concentrates on smallholder farmers, who are in groups of 20 – 35 persons trained on various agronomic technologies by the project (USAID, 2015). Some of these technologies include improved soybean varieties; line planting technology; rhizobium inoculation; use of poultry manure; crop rotation; improved marketing systems; seed treatment; pest and disease control; weed management using herbicides and record keeping (USAID MARKETS II Package of Practices (POP, 2013).

Food insecurity and malnutrition are among the major challenges faced by the developing countries which Nigeria is not an exception. These challenges are more serious in rural than urban areas mainly because of a low level of understanding about nutrition and lack of capacity to purchase animal source proteins. Soy bean can be an alternative source of protein to replace the animal protein. The crop supplies food for local consumption and raw materials for domestic manufacturing industries. Despite all these importance, its production is faced with a number of challenges. The major ones are: adverse climatic conditions, lack of appropriate land use system resulting soil and other natural resource degradation, limited use of agricultural technologies and the predominance of subsistence agriculture which is made up of smallholder farmers (ATA, 2014). Previous studies have shown that, there is little or no literature about adoption of soy bean production practices among small scale farmers in the study area, it is against this background that this study was conducted in Bauchi West zone of the Bauchi State Agricultural Development Programme. The outcome will be a useful tool for the policy makers on agriculture and specifically on soya beans. It will also suggest how the identified constraints can be addressed as well as how best the knowledge of the package can be enhanced so that significant uptake of the practices can be attained among farmers in the study area.

Objectives of the Study

- i. describe the socio-economic characteristics of farmers in the study area.
- ii. ascertain the attributes of improved soybean production technologies suitable for adoption by farmers
- iii. examine farmers' level of adoption of improved soybean production technologies

METHODOLOGY

The Study Area

The study was conducted in Western Zone of Bauchi State and the State has 20 Local Government Areas with land area of 49, 119Km² and estimated population of 8,308,800 at 3.7% annul population change (2006-2023) (NBS, 2022). About 90% of the populations are practicing farmers. Bauchi State is one of the states in Nigeria that span two distinctive vegetation zones (Sudan and Sahel Savannah). It lies between Latitudes 10° 30' North of the Equator and Longitudes 10° 00' East of Greenwich Meridian. The study was conducted in Bauchi Western zone of the State Agricultural Development Programme. Bauchi West is made up of seven (7) Local Government Areas, namely; Alkaleri, Bauchi, Bogoro, Dass, Kirfi and Tafawa Balewa. The wet season falls between the month of April and October while the dry



season falls between November and March. The rainfall in Bauchi state ranges between 1300mm per annum in the South and only 700mm per annum in the extreme North and temperature of 39.110°C – 40.550°C . Majority of the people in this study area engaged in the farming activities. Prominent among the crops grown include sorghum, rice, maize, cowpea, groundnut, cotton, soyabean and millet. Apart from crop farming, livestock are also reared such as sheep, goat, pig, duck, dog, and chicken.

Sampling Procedure and Sample Size

Multi-stage random sampling technique was employed in the selection of respondents for the study. The first stage involved purposive selection of the two (2) Local Government Areas due to their high population of farmers. Secondly five (5) villages were purposively selected from each of the two LGAs for their very high production of soybean. Soybean farmers were identified in collaboration with BSADP. Thirdly, 10% of the farmers were randomly selected to get the sample size of 164 respondents.

Method of Data analysis

Data were collected through the administration of structured questionnaire and analyze using descriptive statistics through frequency, percentage and means.

RESULTS AND DISCUSSION

The result in Table 1 shows that majority (76%) of the respondents were within the age range of 20 – 49 years of age with a mean of 40 years. This implies that majority of the respondents were within their active ages of production in agriculture. Education helps to facilitate adoption as it makes one to be more objective in evaluating innovations which would influence his/her production. The result further revealed that a proportion (48%) of the respondents had attended secondary, 24% tertiary, 15% primary, 9% non-formal, school education, 3% post-graduate levels of education. This implies that majority of farmers were literate. High level of literacy among the respondents may facilitate better adoption of improved technologies on soybeans production and better ability of impacting knowledge and skills for adoption of an innovation.

The results also show that majority (56%) of the respondents were married, about 35% were single while about 9% were either widows, widowers or divorced. The results also show that majority (82%) of the farmers were male while 18% of the respondents were female. This indicates that most of the improved technologies on soybean production may be more widely adopted by male farmers in the study area.

The results also revealed that 56.7% of the respondents had extension contact that ranges from 1 – 3 contacts while 31.7% had 4 – 6 contacts, only 11.6% of the respondents had no extension contact. Extension contact is expected to enhance respondents' ability to efficiently utilize their resources through the adoption of new and improved methods used in soybean production. The results further show that majority (60%) of the farmers have farm size ranging from 0.1-2.0 hectares, about 26% had farm size of between 2.1-4.0 hectares while 14% had farm size of more than 4 hectares (>4.1). This implies that majority of the farmers had small farms, which prevents them from enjoying economy of large-scale production. Similarly, small farm size is an impediment to agricultural mechanization because using farm machineries like tractors will be difficult. The small farm size might be as a result of the fact that most of the farmers got their land through inheritance, which is assisted with fragmenting and sharing land of deceased persons to their heirs.

Membership of cooperatives societies influences the adoption of improved technologies which may lead to higher farm productivity and poverty alleviation. The results show that 31.7%, 27.7% and 23.8% of the respondents had 1-5 years, 6-10 years and 11-15



years of cooperative membership respectively, while 16.6% of the respondents had 16 years and above in cooperative membership in the study area. The results further indicate that the majority about (55.5%) of the respondents had no access to credit, while 45% had access to credits.

Table 1: Socioeconomic Characteristics of the Respondents

| Variables (n=164) | Frequency | Percentage | Mean |
|---------------------------|-----------|------------|------|
| Age (Years) | | | |
| 20 – 29 | 31 | 19.1 | 40 |
| 30-39 | 54 | 30.8 | |
| 40-49 | 43 | 26.3 | |
| 50-59 | 24 | 14.6 | |
| 60-69 | 9 | 7.6 | |
| >70 | 3 | 1.5 | |
| Education | | | |
| No Formal Education | 14 | 8.5 | |
| Primary Education | 27 | 14.6 | |
| Secondary Education | 78 | 47.5 | |
| Tertiary Education | 40 | 24.4 | |
| Post Graduate Education | 5 | 3 | |
| Marital Status | | | |
| Married | 92 | 56.1 | |
| Single | 58 | 35.4 | |
| Widow | 11 | 6.7 | |
| Widower | 2 | 1.2 | |
| Divorced | 1 | 0.6 | |
| Sex | | | |
| Male | 134 | 81.7 | |
| Female | 30 | 18.3 | |
| Farming Experience | | | |
| 1 – 10 | 56 | 33.1 | |
| 11 – 20 | 62 | 37.8 | |
| 21 – 30 | 34 | 20.7 | |
| 31 – 40 | 11 | 6.7 | |
| ≥50 | 1 | 0.6 | |

Source: Field survey, 2022



Table 1: Socioeconomic Characteristics of the Respondents Cond't

| Variables (n=164) | Frequency | Percentage | Mean |
|-----------------------------------|-----------|------------|------|
| Extension Contact | | | |
| No contact | 19 | 11.6 | |
| 1 – 3 | 93 | 56.7 | |
| 4 – 6 | 52 | 31.7 | |
| Farm size | | | |
| 0.1 – 2.0 | 99 | 60.4 | |
| 2.1 – 4.0 | 42 | 25.6 | |
| ≥4.0 | 23 | 14.0 | |
| Membership of cooperatives | | | |
| 1 – 5 | 40 | 31.75 | |
| 6 – 10 | 35 | 27.78 | |
| 11 – 15 | 30 | 23.81 | |
| 16 and Above | 21 | 16.67 | |
| Access to Credit | | | |
| No | 91 | 55.5 | |
| Yes | 73 | 44.5 | |

Source: Field survey, 2022

The result in Table 2 shows that the drought resistance is the attribute most suitable for adoption of improve soybean packages by the responded in the study area with the highest mean sore of (3.64) followed by the compatibility of the technology with mean score of (3.61), disease resistance with mean score of (3.51), striga resistance (3.34), feasibility (3.03), cost effectiveness (2.92), flexibility (3.50) and the complexity is the most poor attribute suitable for improved soybean package adoption in the study area with the least mean score of (2.38).

Table 2: Attribute of improved Soybean Production Technologies suitable for adoption by farmers

| Attributes | Excellent (%) | Very Good (%) | Good (%) | Good (%) | Fair (%) | Poor (%) | Mean |
|--------------------|---------------|---------------|----------|-----------|----------|----------|------|
| Drought tolerance | 55(30.9) | 37(20.8) | | 67(37.6) | 6(3.4) | 13(7.3) | 3.64 |
| Compatibility | 37(20.8) | 55(30.9) | | 69(38.8) | 13(7.3) | 6(3.4) | 3.61 |
| Disease Resistance | 55(30.9) | 42(23.6) | | 37(20.8) | 26(14.6) | 18(10.1) | 3.51 |
| Striger Resistance | 42(23.6) | 33(18.5) | | 53((29.8) | 37(20.8) | 13(7.3) | 3.34 |
| Feasibility | 38(21.3) | 20(11.2) | | 67(37.6) | 16(9.0) | 37(20.8) | 3.03 |
| Cost effectiveness | 28(15.7) | 30(16.9) | | 53((29.8) | 37(20.8) | 30(16.8) | 2.92 |
| Flexibility | 52(29.2) | 28(15.7) | | 55(30.9) | 17(9.6) | 26(14.6) | 2.50 |
| Complexity | 20(11.2) | 28(15.7) | | 28(15.7) | 37(20.8) | 55(30.9) | 2.38 |

Source: Field survey, 2022

The results in Table 3 revealed that the planting of healthy/viable seeds had a high adoption (54.9%). Healthy and viable seeds help in improving the output of the farmers and that is probably why the adoption rate is high. The use of treated seeds is also a good practice



that leads to better crop growth and productivity. Seed treatment is known to enhance good germination and protect crop seedlings from mortality due to pest attack, root rot and fungal infection soon after emergence. Other practices with high adoption rate are, planting date, planting on the flat ground and recommended weeding. The results have further revealed that about 68% of the respondents planted their seeds from early June to early July which are the recommended dates for planting in the study area. Farmers' adherence to this planting date is high as revealed by the study. Planting on ridges however, recorded a low adoption rate (39%). This is due to extra labour involved on this farm operation.

The results further revealed that about 40% of the respondents have applied the plant spacing of 75cm between rows and 10cm between stands. The rate of adoption of planting spacing was therefore low. Maintaining appropriate spacing between plants enhances growth and development of soybean thus reduces the competition from other crops if intercropped, and reduces built up of pests and diseases. The level of adoption herbicides application by the farmers was very low (37%). In order to have a good yield of the crop and maintain the soil fertility under intensive and continuous cropping, it is important to have a proper fertilizer rates for soybean at different ecological zones. This would facilitate efficient fertilizer usage to enhance better development of soybean. The results also revealed that low percentage of the respondents applied fertilizer at recommended rate. This may be because of the high cost of fertilizer in the study area coupled with farmer's belief that soybean does not really need fertilizer. Planting on flat ground was another recommended production practice that recorded a high percentage of the respondents that adopted it. About 56% of the respondents had adopted planting soybeans on flat ground. This is due to the fact that ridges need harrowing which is labour and cost intensive.

The adoption of recommended weeding interval was high (61%) among the respondents. The type of weed control measures adopted should be based on the nature of the problem and the resources available to the farmers. A properly timed weed control programme can minimize the effects of weeds. Weed control in soybean could be manual or chemical or both. Soybean requires timely harvesting to check excessive yield losses due to shattering of its pods. Losses in yield may also occur from other sources if harvesting is delayed. The findings of the study also revealed that about 58% of the respondents harvested their soyabeans 3 – 4 months after planting when the pod is straw coloured or when 85% of the pods have turned brown for non-shattering varieties and 80% for shattering varieties. This helps in preventing losses.

The high adoption practices like planting date, planting on flat ground, recommended weeding interval and recommended harvesting date may be due to the simplicity of the practices and their attribute of not requiring too much money or labour to implement high adoption of their recommended practices could also be attributed to their contribution to profitability of the adoption. However, the low adoption of recommended practices like planting on ridges, herbicides application, recommended processing method and recommended soybean planter could be probably due to the fact that the practices are tedious and costly to carry out.



Table 3: Distribution of respondents according to level of adoption of improved soybeans production technologies

| Technology | Number of Adopters | Percentage | Level |
|---------------------------------|--------------------|------------|-------|
| Planting healthy/variable seeds | 90 | 54.9 | High |
| Recommended planting date | 111 | 67.7 | High |
| Planting on ridges | 64 | 39.0 | low |
| Herbicides application | 61 | 37.2 | low |
| Planting on flat ground | 92 | 56.1 | high |
| Recommended spacing | 65 | 39.6 | Low |
| Recommended weeding interval | 101 | 61.6 | High |
| Recommended processing method | 76 | 46.3 | Low |
| Recommended soybean planter | 80 | 48.8 | Low |
| Recommended harvesting time | 94 | 57.3 | high |

Source: Field survey, 2022

CONCLUSION AND RECOMMENDATIONS

The study indicated that the adoption level of soybean production technology was on the average in the study area.

Based on the findings of the study, the following recommendations were made:

- Government and other stakeholders need to invest more on extension service delivery to sensitize soybean on the recommended soybeans production practices. This strongly has the potential to increase level of awareness and adoption of the practices as well as raise farmers 'productivity, income, and level of living.
- Soybean farmers should form cooperatives/associations so as to acquire credit easily which will go a long way in improving their levels of adoption and productivity
- It is also recommended that government and non-governmental organization dealing with extension agent should therefore embark more on the facilitation techniques of extension delivery. This will enable the farmers to identify their problems, determine their needs, and discover their potential themselves rather than always feeding them with information and easy adoption of a technology.

REFERENCE

- FAOSTAT (2021). Food and agriculture organization of the United Nations. Production dataset. <http://faostat3.fao.org>.2021.
- Idrisa, Y. L. (2020). Adoption of Improved Maize Varieties in Northern Guinea Savannah of Borno State, Nigeria. *Journal of Agricultural Extension*, **24**(1):34-41.
- Mahama, A., Awuni, J. A., Mabe, F. N. and Azumah, S. B. (2020). *Modelling adoption intensity of improved soybean production technologies in Ghana: A generalized Poisson approach*. *Heliyon*, **6**(3) e03543. <https://doi.org/10.1016/j.heliyon.2020.e03543>
- NBS (2022), National Bureau of Statistics population projection statistics in Northeastern States Package of Practices (POP 2013).
- Ronner, E., Franke, A. C., Vanlauwe, B., Dianda, M., Edeh, E., Ukem, B. and Giller, K. V. (2016). Understanding variability in soybean yield and response to P-fertilizer and



rhizobium inoculants on farmers' fields in northern Nigeria. *Field Crops Research*, 186, 133-145.

- Ugbabe, O. O., Abdoulaye, T., Kamara, A., Mbaval, J. and Oyinbo, O. (2017). Profitability and technical efficiency of soybean production in Northern Nigeria. *Tropicultura*, 35(3):203-214
- Vanlauwe, B., Hungria, M., Kanampiu, F. and Giller, K. E. (2019). The role of legumes in the sustainable intensification of African smallholder agriculture: Lessons learnt and challenges for the future. *Agriculture, ecosystems & environment*, 284, 106583.