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# ANALYSIS OF FARMERS' ENVIRONMENTAL AWARENESS AND USAGE OF PRODUCTION TECHNOLOGY FOR SUSTAINABLE AGRICULTURE IN BAUCHI-NORTH, NIGERIA

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***Abstract***
*This study investigates environmental awareness and usage of NPFS production technology among farmers, to determine sustainable agriculture in Bauchi-North, Nigeria. The data was mainly derived from structured questionnaire survey of rice farmers and extension workers opinion, as well as from thesis, dissertations, published books and journals, proceedings of conferences, workshops and seminars. Multi-stage sampling technique was employed in the selection of respondents for questionnaire survey. Simple descriptive statistics including frequencies, percentages and cross tabulation were used in analysing farmers' awareness on NPFS extension services and usage of NPFS production technology. Chi-square test was applied in analysing association between farmers' awareness and usage of production technology in Bauchi-North. The results showed that there were appreciable farmers' awareness on NPFS extension services and usage of NPFS production technology in the region. Also, communication methods applied in NPFS affect farmers' awareness and adoption of production technology, to the extent that only 40% of the farmers utilized Harvesting method, Processing machines and storage devices and especially Governments' owned processing centres (15%), in their production technology. To achieve satisfactory production technology usage, it was recommended among others that government's owned processing centres should adequately be provided in all production regions to enhance rice production.*

***Key Words: Awareness, Usage, Production Technology and Sustainable Agriculture.***

## Introduction

In developing countries, extension work is the function of government and is supported by public fund. This fact is true of advanced countries, yet, in general technical and economic information reach farmers through such sources as professional consultant firms and agricultural services industries. The nature of extension work changes as agriculture change from traditional to progressive, success depends on the socio-economic and educational circumstances of the country concern (Francisand David, 2012). Further to that, Agriculture contributes immensely to economy in various ways, including provision of food for the increasing population, adequate raw materials supply to a growing industrial sector, source of employment, generation of foreign exchange and market provision for industrial sector.

Agricultural extension is a service or system which assists farmers through educational procedures in improving farming methods and strategies; farm production and income battering, farm methods and techniques, farm produce and restructure their level of living and uplifts the socio economic and educational standard of rural life (Ajieh, 2006).Agricultural extension agents are people who have been technically and professionally trained to carryout extension service, create improvement on agricultural production, depend farmers against workshop challenges and offer training and visit services. Furthermore, they help farmers to improve on their already acquired skills. On this note, Nwankwo(2010) pointed out that, extension agents are built for purpose of changing farmers' knowledge, skills, practice, and attitudinal behaviours of farmers.

From the foregoing, this work seeks to explore farmers' environmental awareness and usage of National Program for Food Security (NPFS) production technology for sustainable agriculture and food security in Bauchi-North, Nigeria

## The Study Problem

Bauchi State is one of the six states in Northeastern Nigeria ravaged by the Boko Haram insurgency since 2009. The state is located between latitudes $9^{o}$ 30' and $12^{o}$ 30' North, and Longitudes $8^{o}$ 45' and $11^{o}$ 03' East. It is estimated to cover an area of 49,259 sq. km. representing about 5.3% of Nigeria's total land mass. The landmass that makeup the state is bounded by Kano and Jigawa States on the north; Yobe and Gombe States on the east; Taraba and Plateau States on the south and Kaduna State on the west (Fig. 1)(Ajaebgu, 2000 and National Population Commission (NPC) 1994 and 2000). This location gives Bauchi a relatively more central location in north eastern Nigeria that makes it attractive for inflow of people including Internally Displaced Persons (IDP's) and businesses leading to rapid urban expansion and increased demand for food.Bauchi State was first created in 1976 along with Adamawa, Borno and Gongola States curved out of the former northeastern state.

Thus the state has experienced several years of self-administration, policy formulation and policy implementation on all spheres of development. One of such policies is that of the Agricultural Research Council of Nigeria (ARCN), (2017).

In spite of the existence and implementation of Government's agricultural policy, many towns in Bauchi state, particularlyBauchi-North still experience frequent changes or instability in agricultural practices and productivity. This instability may be resulted from changes in government or in the personality of the operators of the system. The questions we attempt to answer in this paper therefore are; why has there been a persistent change or instability in agricultural practices and productivity in many towns of Bauchi-North? What is the level of farmers' awareness and usage of NPFS production technology and the role of extension agents on educating rural farmers on agricultural production? Do the agricultural policies reflect fundamental values and goals of the aggregate society? The aim of this paper is to explore of farmers' environmental awareness and usage of production technology and its implications for sustainable agriculture and food security in Bauchi-North, Nigeria

**Historical Background**

Food security in a broader sense has to do with having adequate level of food products to meet increasing consumption demand (Adegbola,et al., 2011). National Program for Food

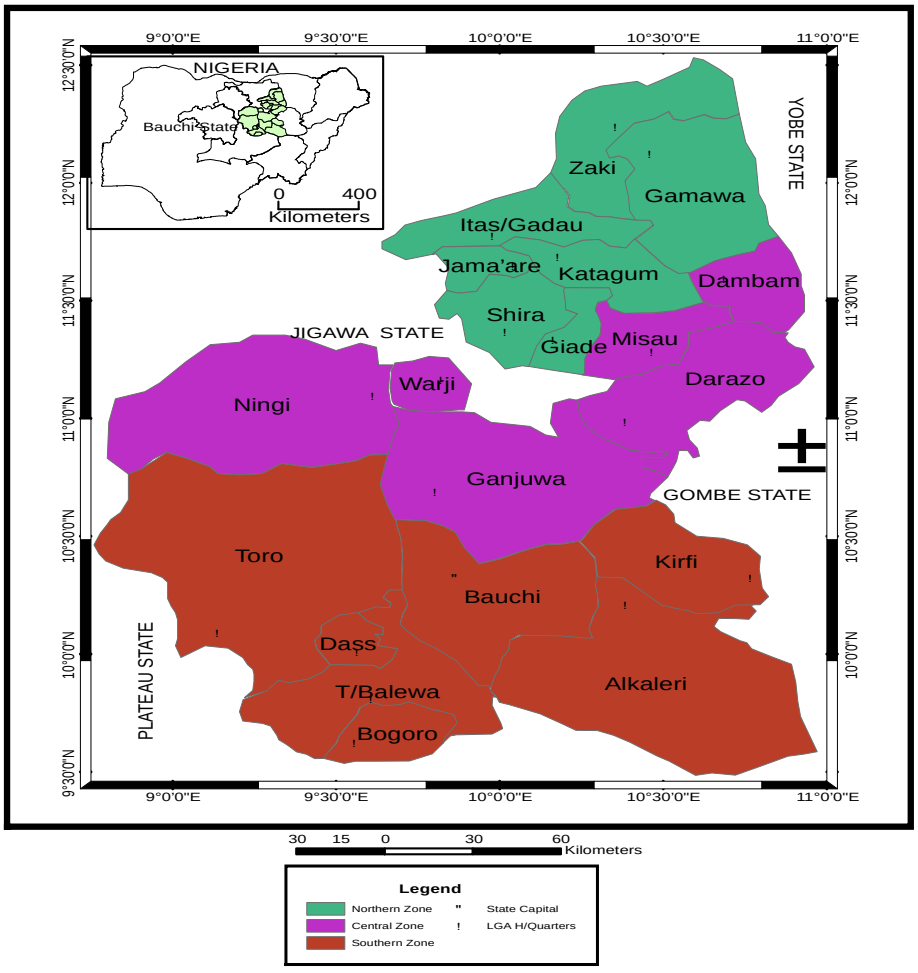


**Figure 1**: Location of the Study Area

Security (NPFS) focuses on a variety of interventions for the enhancement anddiversification of agricultural production, agro-processing, market development, ruralfinance, extension activities as well as the development and upgrading of infrastructural facilities such as road and portable water supply.

Agricultural Development Projects (ADPs) for instance, aimed at using an integrated approach to boost agricultural production in Nigeria. An integrated approach of the project involved combining all related aspects necessary for agricultural development such as crop, animal, agro forestry, agribusiness, and pest and disease control.Accordingly, Emmanuel(2017) reported that it has injected over $1.2 billion since inception of the programme designed to increase farm production and

welfare among small holder farmers in Nigeria.Further to that, the ADPs were established in order to sustain domestic food supply and reduce dependence on importation of food (especially rice). In the same vein, Sakuyama (2007) outline some of the objectives of setting up ADPs to include improving the traditional production system used by the Nigerian small scale farmers with the ultimate goal of increasing their productivity, income and standard of living. Among such ADPs are Commercial Agricultural Development Project, National Accelerated Food Production Program (1972), Green Revolution Program (1980), Rural Banking Programme (1977 to 1991), Family Economic Advancement Program (1997-2001) and National Poverty Eradication Program (1999-Date)

Agricultural scheme initiatives for achieving food security and financing agriculture encouraged banks for lending the sector despite the relatively higher inherent risk and uncertainty (Ezeet. al., 2010). This was done by providing the banks with low cost fund for lending and to cover their risk exposure to some extent. Promoting farmers' access to credit by the provision of concessionary terms was also part of the agricultural scheme initiatives. Among other initiatives are Agricultural Credit Guarantee Scheme Fund (1978-date), Small and Medium Enterprises Equity Investment Scheme (2001), Refinancing and Rediscounting Facility (2002-Date), Agricultural Credit Support Scheme (2006-Date), Large Scale Agricultural Credit Scheme (2009) and Supervised Agricultural Loan Board.

The Nigerian Agricultural Policy provided by the ARCN (2017) include: Attainment of self-sufficiency in basic food commodities with particular reference to those which consume considerable share of Nigeria's foreign exchange and for which the country has comparative advantage in local production; Increase in production of agricultural raw materials to meet the growth of an expanding industrial sector; Increase in production and processing of exportable commodities with a view to increasing their foreign exchange earning capacity and further diversifying the country's export base and sources of foreign exchange earnings; Modernization of agricultural production, processing, storage and distribution through the infusion of improved technologies and management that agriculture can be more responsive to the demand of other sector of the Nigerian economy; Location of more agricultural and rural employment opportunities to increase the income of farmers and rural dwellers and to productivity absorb an increasing labour force in the nation; Protection and improvement of agricultural land resources and preservation of the environment for sustainable agricultural production; and Establishment of appropriate institutions and creation of administrative organs to facilitate the integrated development and realization of the country's agricultural potentials.

The role of agricultural extension services in agricultural development is crucial. With resource limitations, a combination of methods and strategies is disseminating of messages and technologies help to make an impact. Working with small holder farmers who have low literarily levels necessitates diversity in methods and strategies to assist them get agricultural information and messages for improving livelihood. In this regard, Reddy (2012) maintained that extension and advisory services were designed to help farmers boost crops and livestock production. These services enable farmers to adopt new technologies for increase production and profitability. Furthermore, the specific roles of agricultural services were to: Provide advice to farmers on problems and opportunities in agricultural production, marketing, conservation and family livelihood; Facilitate development of local skills and organizations and to serve as link with other programmes and institutions; Transfer new technologies to farmers and rural people; and Address public interest issues in rural areas, resources, conservation, health and food security, monitoring food safety, nutrition and family education
as well as youth development.

As a system, extension facilitates the access of farmers, their organizations and other market actors to knowledge, information and technologies, facilitate their interaction with partners in research, education and other relevant institutions; and assist them to develop their own technical, organizational and managerial skills and practices (Codamon-Dugyon, 2013). The author further pointed out that in relation to its role in rural livelihoods, agricultural extension encompasses the entire set of organization that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improved their livelihood and wellbeing. Since a livelihood comprises the capabilities assets, and activities required for a means of living, it appears that agricultural extension intend not only to increase productivity and income (Morseet. al., 2009), but also to improve multifaceted aspects of rural life.

Information and Communication Technology (ICT) may be used effectively for not only normal weather forecast but also a warning system for disease/pest outbreak and other disasters before they occur. They can also be used for the provision of timely and sensitivity market information (use of Radio, TV and SMS). In fact, they ICTs are important for networking among and between the key stakeholders in Research-Extension-Farmers-Inputs-Linkage System (REFILS). The potentials applications of ICTs in extension are almost limitless and should be thereforeadopted in agricultural extension for transforming communications in rural areas. This will offer new options for communications management in diverse field and endeavour (Overseas Development Institute (ODI), 2008).

**Methodology**

Data for this research includes both quantitative and qualitative data, derived from both the primary and secondary sources. The secondary data was generated from the secondary sources which comprise maps of the state and the selected LGAs, obtained from the Bauchi State Urban Development Board office at Bauchi. Other details regarding Bauchi Northern Zone extension staff and rice farmers. as well as the study area were obtained from thesis, dissertations, published books and journals, conference proceedings, workshops, seminars internet and library sources. The primary data was generated using structured questionnaire instrument which provided data on awareness and usage of information. To this effect, the questionnaires were used in generating information from the farmers pertaining environmental awareness and usage of production technology.

Multi-stage sampling technique was employed in the in the selection of sample points and size. This way, purposive sampling technique was used in selecting all LGAs and 7 districts (Gamawa - Udubo, Giade–Jugudu,Itas/Gadau - Gadau, Jama'are - Jama'are, Katagum - Lafiya, Shira - Zigau and Zaki - Sakwa) with high concentration of rice farmers out of 14 districts in Bauchi North. Accidental sampling technique was employed in the selection of 30 sample size per district which yielded a total sample size of 210 across the study area. This selection was based on the assertion of Griffin and Hauser (2013) that a sample size of 20 is a reasonable starting point in a research. The data was collected by administering questionnaires to the rice farmers and extension workers from the selected districts across the study area. Finally, frequencies and percentages of the responses were used in analysing farmers' environmental awareness and usage of production technology in Bauchi-North.The respondents' opinions were further examined using Chi-square analysis to test for association among the districts in terms of farmers' awareness and usage of production technology in Bauchi-North.Statistical Package for Social Sciences (SPSS - Version 20) was used in analyzing the data for this research.

**Results and Discussion**

Frequencies of farmers' responses were measured and aggregated in respect of each item in the questionnaire. A summary assessment of farmers 'responses about awareness of NPFS production technology in Bauchi-Northis presented in Table 1. The table showed that 100% of the respondents were aware of improved seeds, application of insecticides and fertilizers as well as weed management and spraying method. Ninety nine percent them were aware of harvesting method, between 92% and 100% of the respondents were also aware of processing machine and storage, marketing and pest and disease management. On the other hand, mechanised land preparation, direct water pumping and small water scheme were within the awareness level of 94% and 99%. In the whole, only about 42% were aware of government owned processing centre, whereas 96% were aware of privately owned processing centre. The general low level of awareness of government owned processing centre can mainly be traced to its unavailability in almost all the districts of the study area. That notwithstanding, it can still be concluded that there were stable agricultural practices in Bauchi-North, farmers were aware of NPFS production technology as regards rice production and that the agricultural policy reflect fundamental values and goals of the aggregate society.

The utilization of NPFS production technology is shown in Table 2. The results showed that most of the production technologies were utilized by majority of the respondents in the study area. However, a number of the elements such as harvesting method, processing machine and storage (40% respectively) and government's owned processing centre(15%) were not adequately utilizedby the respondents. Based on the extent of utilization of each of the elements, majority (about 67%) used improve seed and insecticide respectively, 66% applied fertilizers and used weed management and that 65% used spray method. About 78% and 87% used pest and disease management as well as direct water pumping. In the whole, only a few used mechanised land preparation (54%) and small water scheme (60%), whilst 95% utilized privately owned processing centre. This therefore, allow for the conclusion that farmers in Bauchi-North utilized NPFS production technology in rice production which resulted from the stable agricultural practices, the policy of which reflects fundamental values and goals of the aggregate society.

These findings conform to Ajala and Gana (2015) who indicated the need of government intervention for improving the quality of indigenous rice to compete with foreign rice through selection and adaptation of modern rice technologies to ease labour in production and enhance nutritional qualities in rice processing and production. As such, government has a key role in forming strong policies that will favour production of local rice as it is being practiced in the advanced world. Furthermore, the results in Table 1 and 2 were subjected to Chi-Square in order to test for the association between NPFS extension service and its awareness among farmers, as well as NPFS extension service and usage of production technology and the results were presented in Table 3 and 4. Table 3 indicated that the calculated Chi-Square yielded a value of 1138.50 which is greater than the critical value of 23.68 at 95% level of significance. Hence the null hypothesis that "there is no association between farmers' awareness of production technology and NPFS extension service in Bauchi-North" is rejected. As such it can be concluded that farmers' level of awareness about production technology is associated to the NPFS

extension services in Bauchi-North. Furthermore, Table 4 indicated that the calculated Chi-Square yielded a value of 455.66 which is greater than the critical value of 23.68 at 95% level of significance. As such, the null

**Table 1: Farmers' Awareness about NPFS Production Technologyin Bauchi-North**

| | Awareness | | | | Total (%) |
|---|---|---|---|---|---|
| **Production technology** | **Yes** | **%** | **No** | **%** | |
| Use of improved seed | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Use and application of insecticides | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Use and application of fertilizers | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Weed management | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Spraying method | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Harvesting method | 192 | 99.48 | 1 | 0.52 | 100.00 |
| Processing machine and storage | 178 | 92.23 | 15 | 7.77 | 100.00 |
| Marketing | 190 | 98.45 | 3 | 1.55 | 100.00 |
| Pest management | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Disease management | 193 | 100.00 | 0 | 0.00 | 100.00 |
| Mechanised land preparation | 186 | 96.37 | 7 | 3.63 | 100.00 |
| Direct water pumping | 191 | 98.96 | 2 | 1.04 | 100.00 |
| Small water scheme | 182 | 94.30 | 11 | 5.70 | 100.00 |
| Government owned processing centre | 81 | 41.97 | 112 | 58.03 | 100.00 |
| Privately owned processing centre | 186 | 96.37 | 7 | 3.63 | 100.00 |

Source: Fieldwork, 2016

Table 2: Farmers' Usage of Production Technology in Bauchi-North

| | Usage | | | | Total (%) |
|---|---|---|---|---|---|
| **Production technology** | **Yes** | **%** | **No** | **%** | |
| Use of improved seed | 129 | 66.84 | 64 | 33.16 | 100.00 |
| Use and application of insecticides | 129 | 66.84 | 64 | 33.16 | 100.00 |
| Use and application of fertilizers | 127 | 65.80 | 66 | 34.20 | 100.00 |
| Weed management | 128 | 66.32 | 65 | 33.68 | 100.00 |
| Spraying method | 126 | 65.28 | 67 | 34.72 | 100.00 |
| Harvesting method | 77 | 39.90 | 116 | 60.10 | 100.00 |
| Processing machine and storage | 77 | 39.90 | 116 | 60.10 | 100.00 |
| Marketing | 132 | 68.39 | 61 | 31.61 | 100.00 |
| Pest management | 150 | 77.72 | 43 | 22.28 | 100.00 |
| Disease management | 148 | 76.68 | 45 | 23.32 | 100.00 |
| Mechanised land preparation | 105 | 54.40 | 88 | 45.60 | 100.00 |
| Direct water pumping | 167 | 86.53 | 26 | 13.47 | 100.00 |
| Small water scheme | 115 | 59.59 | 78 | 40.41 | 100.00 |
| Government's owned processing centres | 29 | 15.03 | 164 | 84.97 | 100.00 |
| Privately owned processing centre | 183 | 94.82 | 10 | 5.18 | 100.00 |

Source: Fieldwork, 2016

**Table 3: Association between Farmers' Production Technology Awareness Andnpfs Extension Services in Bauchi-North**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1138.503[a] | 14 | .000 |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.53. | | | |

**Table 4: Association between Farmers' Usages of Production Technology Andnpfs Extension Services in Bauchi-North**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 455.655[a] | 14 | .000 |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 71.53. | | | |

Hypothesis that "there is no association between farmers' usage of production technology and NPFS extension service in Bauchi-North" is rejected. Therefore, it can be deduced that farmers' usage of production technology is associated to the NPFS extension services in Bauchi-North.

**Conclusions**

Farmers' awareness and utilization of NPFS production technology was satisfactory in Bauchi-North. These were associated tothe appreciable farmers' production technology awareness on NPFS extension services and usage of NPFS production technology in the region. This therefore indicated that communication methods applied in NPFS affect farmers' awareness and adoption of production technology in the area. In fact, this is considered as an indication of stable agricultural practices in the region and that agricultural policy reflect fundamental values and goals of the people in Bauchi-North.

Further to that, irrespective of the level of farmers'NPFS production technology awareness in the zone, the usage of production technology appears very low in the aspect of Harvesting method, Processing machines and storage devices (40% respectively) and especially Governments' owned processing centres (15%). Despite these low level achievements, the general outcomes however, were concluded as positive indicators of assured and sustainable agricultural food productivity and food security in Bauchi-North.

**Recommendations**

In consideration of the findings of this research, the following recommendations were hereby offered with the view of achieving satisfactory production technology usage in Bauchi-North.

1. The NPFS elements that were achieved in terms of awareness and utilization need to be improved and maintained to sustain adequate agricultural food productivity and food security in Buchi-North, the State (Bauchi) and the Nation at large.
2. The State and Federal Ministry of Agriculture should enhance sustenance of food security by supporting and educating farmers in the aspects of usage of crop harvesting methods, processing machine/storage devices and especially provision of adequate government processing centers for farmers' utilization.
3. In the interest of general farmers, governments need to take appropriate measures for mobilise and educate the public in the control of land degradation across the Bauchi-North. This will vehemently help in protecting our fragile environmental resources, hence the achievement of promising food availability and security.
4. Governments need to ensure continuous carrying out inventory and assessment of land resourcesin the region so as to put them into their optimum use and monitor changes in their potentials for agriculture.

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