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ASSESSMENT OF ADOPTION OF AGROCHEMICALS AMONG SMALL-SCALE FARMERS IN BENUE STATE, NIGERIA

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Abstract
A survey was conducted to assess adoption of agrochemicals among small-scale farmers in Benue State, Nigeria. The population of this study consisted of all small-scale farmers in the three Agricultural Zones of Benue State. A total of 210 respondents were selected as sample size for the study, using stratified, purposive and simple random sampling techniques. Data for this study were collected from primary sources, with the use of well-structured questionnaire. The Data collected were analyzed using descriptive and inferential statistics such as Kruskal-Wallis and Factor analysis. The Results showed that most (41.1%) of the respondents fell within the age of 20-35 years. Majority (81.8 %) of the respondents were males and 63.5% of the respondents were married, while 19.7% had farm sizes of 5-6 hectares. It was also found that, 36.5% of the respondents had farming experience of 6-10 years, 85.2% did not have frequent contact with extension agents; 29.6% had annual income ranging from N100, 000- N200, 000. The results further revealed that most (59.6%) of the respondents used agrochemicals very frequently in their farming activities. It was found that there were three major categories of constraints to adoption of agrochemicals in Benue State, namely: Environmental, politico, technical know-how cum cultural constraints. It was concluded from the study that agrochemicals were widely adopted among rural farmers across the three Agricultural Zones and they found them to be beneficial. It was therefore recommended that the ratio of extension agents to farmers in the study area be increased for more coverage and effectiveness, and government agencies and agricultural input dealers responsible for the procurement and distribution of agrochemicals should ensure adequate, proper and timely distribution to the target end users at subsidized prices.
***Keywords**: Assessment, adoption, agro-chemicals, small-scale, farmers.*

1.0 Introduction

Development in third world countries is related to increased agricultural production. Agricultural production is one of the crucial requirements for overall economic growth in developing countries (Olatunbode, 2001).Ojo and Imoudu (2000) stated that agriculture in Nigeria seems to exhibit feature of underdevelopment. It is

characterized by the dominance of small-scale farmers, who are mostly low- income earners due to low savings and subsequent low investments. Small-scale farmers, each working in a tiny parcel of land with crude implements are responsible for about 90 percent of production. In an attempt to encourage agricultural production and alleviate poverty level of farmers, there is need for adoption of agrochemical technologies.

Agrochemicals are chemicals which are used in agriculture, to aid plants, crops growth and safety. They are manufactured to protect agricultural crops from pests and for augmenting crop yields. Sekhotha *et al.(*2016) and Onugba (2006) stated that agro chemicals were developed to control working organisms that became pests as a result of the cultivation of wild plants and rearing of animals and to make farming practices more efficient. In Nigeria, agricultural productivity has witnessed a declining trend since the discovery of oil in the 1970s, which gave birth to oil boom.

Some of the reasons attributed to low productivity of farmers' plots include, the non-adoption of improved technologies such as agrochemicals, improved varieties of seeds, tools and modern management skills (Salau*et al.,* 2008).Adesina*et al.* (2003) stated that the use of appropriate land improvement technologies seems to offer an opportunity to substantially increase farm production and income level of small-scale farmers, since many existing improved technologies are based on an adequate supply of plant nutrients. According to Guy *et al*. (2007), the use of agrochemicals has played a significant role in increasing agricultural production in the developing world over the past four decades.

In the early 1960s, development in agricultural production led to what came to be

known as Green Revolution. The technological package on which the Green Revolution was based included improved and high yielding seeds, mechanization and chemical inputs. However, low use of chemical inputs is still cited as a major factor limiting agricultural development in most African countries. Ugochukwu*et al*. (2002) noted that the use of agrochemicals is very rewarding due to its tremendous advantages such as reduction of farm drudgery. It ensures timeliness of farm operations, increased hectares under cultivation, increased yield and efficiency of operations, promotion of agro-allied industrial enterprises as well as encouraging specialization. He also opined that Agrochemicals are produced for different purposes, for instance, those that are developed to control weeds are known as herbicides, those that supply the soil nutrients required for plant growth are known as fertilizers, and those that kill insects are known as insecticides, while those that destroy rodents and fungi are known as rodenticides and fungicides respectively

2.0 Objectives of the Study

The broad objective of the study was to assess adoption of agrochemicals among small-scale farmers in Benue State. The specific objectives of this study were to:

i. describe the socio-economic characteristics of small-scale farmers who have adopted agrochemicals in the study area;
ii. identify factors influencing adoption of agrochemicals among small-scale farmers in the study area and
iii. identify major constraints to adoption of agrochemicals among small scale

farmers in the study area.

3.0 Methodology

3.1 The Study Area

This study was conducted in Benue State, Nigeria. The State is located in the Middle Belt, region which is a transition zone from the Northern and Southern Parts of Nigeria. It lies between longitude $6^0$31' E and 10^0E of the Greenwich Meridian, and latitudes $6^0$30'N and 8^0 10'N of the Equator (Benue State Agricultural and Rural Development Authority (BNARDA), 2005). Benue State shares boundaries with other States, namely; Nasarawa to the North, Taraba to the East, Kogi and Enugu to the West, Ebonyi and Cross River to the South. It also shares an international boundary with the Republic of Cameroun on the South-East (BNARDA, 2005).Benue State has a Landmass of about 33,955$km^2$with twenty-three (23) Local Government Areas. The State is divided into three Agricultural zones, namely: Zone A (Katsina-Ala, Ukum, Ushongo, Vandiekya, Logo, Kwande, and Konshisha Local Government Areas). Zone B (Gboko, Tarka, Buruku, Gwer-west, Gwer-East, Guma, and Makurdi Local Government Areas). And Zone C (Ado, Agatu, Apa, Otukpo, Ohimini, Ogbadibo, Obi, Okpokwu and Oju Local Government Areas). According to National Population Census (NPC) 2006. Benue State has a Population of 4.219 million.The estimated population of the State in 2017 was 5.84 million. The population of the study consists of 1050 small-scale farmers in the three Agricultural Zones of Benue State.Due to the largeness of the population of this study, a total of 210 respondents were selected as sample size for the study using stratified purposive and simple random sampling techniques. Firstly, the population of this study was stratified into three agro-ecological zones (A, B and C).Secondly, two Local

Government Areas (LGAs) were purposively selected from each of the three Zones due to high level of agrochemicals usage. In Zone A, Katsina- Ala and Ukum were selected. In Zone B, Markudi and Guma were selected, while in Zone, C Otukpo and Oju LGAs were selected. Thirdly, in each of the Local Government Areas, two rural communities noted for high as of agrochemicals were purposively selected. In Katsina-Ala LGA, Ikowe and Une were selected. In Ukum LGA, Zakibiam and Tine-nune were selected. In Makurdi LGA, Pila and Abagena were selected. In Guma LGA, Ukange and Dudu were selected. In Otukpo LGA, Egwanokwu and Ogobia were selected, while in Oju LGA, Ukpa and Ainu were purposively selected for the study.

Data for this study were collected from primary sources with the use of a structured questionnaire. The collected data were analysed using both descriptive and inferential statistics.

4.0 Results and Discussion

4.1 Socio-economic Characteristics

Table1 shows that most (41.1 %) of the respondents were within the age of 20 to 35 years, 36.0% were within 36-50 years; about 10.8 % were within 51-65 years, 6.4 % were within 66-75 years, while 5.4% were within 76 years and above with the mean of 40.6. This implies that large proportion of the farmers were young and active and are expected to be more prone to adopting improved farming innovations that can increase their production. The result is in agreement with Gailyson(2013), who reported that small scale farmers fell within the age range of 41-50 years.

With respect to sex, males constituted the majority (81.8%), while female were (18.2%), with the mean of 101.5. This is likely due to the cultural background of most African

communities where farming activities are mostly left to men as their job. The reason for this is the vigorous labours that accompany farming enterprise. This variation could be attributed to the fact that most farms in the study area are owned by men even though women also participate actively in farming activities. The result could also be attributed to the fact that women are controlled by their husbands or their fathers in the study area and they usually refer researchers to them to give information concerning their farms or farming activities. But the result contradicts the findings of Okonjo (1991) who posited that 70% of women in rural areas were also engaged in food production. The result further reveals that majority of the respondents (63.5%) were married, 5.5% were divorced, 4.9 % were widows and 4.9% were widowers with the mean of 40.6. Majority of the respondents were married. This implies that a sense of responsibility of married people is capable of prompting them to put more commitment to the business and towards meeting their family needs. It also implies that most of the farmers in the study area have access to family labour, who participated actively in farming activities.

The result on educational status of respondents reveals that many (36.0%) of the respondents had secondary education, 24.0% had tertiary education, and 19.0% had only primary education, while 21.0% of the respondents had non formal education, with the mean of 40.6. This means that majority of the respondents were literate with one form of formal education or the other and this also implies that they would be highly receptive to technological changes that could improve production and better adoption. This could serve as an incentive in adopting the use of agrochemicals. Education enables farmers to seek for and utilize useful information from print and electronic media, thereby increase the use of agrochemicals. The result is however in contrast to the findings of Agbamu*et*

al. (2006) who stressed that if a farmer has formal education but has no adequate knowledge of a recommended farm practice; he is not likely to adopt it. The obvious reason being that, the educated and literate farmer has the added advantage of learning with little promptings, the rules and application of production inputs in order to achieve optimum result.

Table 1 also shows that most (46.8%) of the respondents had household sizes of 6 to 10 persons, 36.9% of the farmers had between 1 to 5 persons, and 16.3% had household size larger than ten persons, having a mean of 67.7. Household size has a great role to play in family labour provision in agricultural sector. The implication is that, there is a tendency for cost of farming to be reduced, since large family size translates into ready supply of family labour. This result agrees with Gailyson (2013) that most (48.4%) of the farmers in the study area have large family sizes. Thus the large family size will provide more labour to the household. This finding is in line with Williams (2007) who posited that large household will provide labour requirement for the family.

Table 1 further shows that most (46.8%) of the respondents had farm size of 3 to 4 hectares, 33.5% had a farm size of 1 to 2 hectares, while 19.7% had a farm size of 5 to 6 hectares, with a mean of 67.7. This means that the respondents have relatively small farm size for production. The result is in disagreement with that of Gailyson (2013) who opined that majority (52.6%) of small scale farmers had farm size of less than one hectare (<1).Oladele (2005) noted that farm size is an indicator of wealth and perhaps a proxy for social status and influence within community that depends on agricultural production as a major occupation for source of income and is expected to be positively associated with the decision to adopt agro-chemicals as a source of increasing productivity. Olusi (2007)

reported that farm size had a close positive association with the ability to obtain credit as a major determinant of adopting farm practice.

Many (36.5%) of the farmers had between 6-10 years of farming experience, 10.3% had between 1- 5 years of farming experience, 17.7% had between 11 to 15 years of farming experience, 11.3% between 16 to 20 years of farming experience, 7.4% had between 21 to 25 years of farming experience, 8.4% had between 26 to 30 years of farming experience, 3.0% had between 31 to 35 years of farming experience, and 5.4% had more than 35 years of experience in farming, with a mean of 25.4. This implies that the respondents had more experience in farming business and hence the greater tendency to be technically efficient, as indicated by Gailyson, (2013). Farming experience of farmers is reported to increase their tendency of adopting improved techniques such as the use of agro-chemicals. Hailu (2008) reported that more experienced farmers are knowledgeable and more likely to adopt new techniques.

Table 1: Socio-economic characteristics of farmer (n=210)

Variables	Frequency	Percentage	Mean	Standard Deviation
Age (years)				
20-35	84	41.1		
36-50	73	36.0		
51-65	22	10.8		
61-75	13	6.4		
76-85	11	5.4		
Total	203	100.0	40.6	31.4
Sex				
Male	166	81.8		
Female	37	18.2		
Total	203	100.0	101.5	64.5
Marital Status				
Single	43	21.2		
Married	129	63.5		
Divorce	11	5.5		
Widow	10	4.9		
Widower	10	4.9		
Total	203	100.0	40.6	46.0
Level of Education				
Non Formal Education	25	12.3		
Primary	24	11.8		
Adult Education	10	4.9		
Secondary	68	33.5		
Tertiary	76	37.4		
Total	203	100.0	40.6	26.3
Household Size				
1-5	75	36.9		
6-10	95	46.8		
11-15	33	16.3		
Total	203	100	67.7	25.8
Farm Size (ha)				
1-2	68	33.5		
3-4	95	46.8		
5-6	40	19.7		
Total	203	100	67.7	22.5

Tale1 contd.

Farming Experience (years)				
1-5	21	10.3		
6-10	74	36.5		
11-15	36	17.7		
16-20	23	11.3		
21-25	15	7.4		
26-30	17	8.4		
31-35	6	3.0		
36-40	11	5.4		
Total	203	100	25.4	20.2
Contact with Extension Agent				
Not Frequent	173	85.2		
Moderate	22	10.8		
Frequent	8	3.9		
Total	203	100	67.7	74.7
Annual Income (N)				
100,000-200,000	60	29.6		
201,000-300,000	41	20.2		
301,000-400,000	40	19.7		
401,000-500,000	23	11.3		
501,000-600,00	39	19.2		
Total	203	100	40.6	11.7

Source: Field Survey (2021).

4.2 Factors Influencing adoption of agrochemicals

Table 2 shows the mean rank for adoption of agrochemicals among farmers in the three Agricultural zones were:$\sum Ri=125.5$, $\sum R_2=73.5$, $\sum R_3=179.0$ which further revealed that in zone A, the significant factors influencing adoption of agrochemicals among small-scale farmers in Benue State were: relative advantage (26.0), profitability (24.0), complexity (15.0), compatibility (13.0), observability (11.5), farm size (11.5), extension contact (10.0), triability (8.5) and level of education (6.5).

In zone B, the significant factors influencing adoption of agrochemicals among small-

scale farmers in Benue State were: relative advantage (23.0), profitability (20.0), compatibility (8.5), extention agent (7.0), complexity (5.0), triability (4.0), observability (2.5), farm size (2.5) and level of education (1.0).

In zone C, the significant factors influencing adoption of agrochemicals among small-scale farmers in Benue State were: relative advantage (27.0), profitability (25.0), complexity (22.0), triability (21.0), farm size (19.0), compatibility (18.0), level of education (16.5), observability (16.5) and extension contact (14.0). This implies that the factors influencing adoption of agrochemicals among farmers in the three Agricultural zones in the study vary from one zone to another.

Table2: Kruskal-Wallis Analysis of Factors Influencing Adoption of Agrochemical

	Zones					
	A		B		C	
Variables	Freq	R1	Freq	R2	Freq	R3
1.Relative advantage	189	26.0	170	23.0	191	27.0
2.Compatibility	142	13.0	136	8.0	150	18.0
3.Complexity	144	15.0	114	5.0	169	22.0
4.Triability	136	8.5	111	4.0	157	21.0
5.Observability	141	11.5*	110	2.5*	149	16.5
6.Level of education	125	6.0	83	1.0	149	16.5
7.Farm size	141	11.5	110	2.5	152	19.0
8.Extension Contact	137	10.0	126	7.0	143	14.0
9.Profitability	180	24.0	155	20.0	187	25.0
H.cal= 9.98 X^2-Tab=5.9915	? R_1=125.5		? R_2= 73.5		? R_3=179.0	

4.3 Constraints to adoption of agrochemicals

Table 3 shows that, there were three major constraints adoption of agrochemicals in Benue State, namely: Environmental sum, administrative constraints (Factor 1), Socioeconomic constraints (Factor 2) and characteristics of innovation constraints (Factor 3).

In Factor 1, the environmental, cum administrative constraints to adoption of agrochemicals in the area were: Climate change (0.719), nature of the soil (0.663), and poor policy implementation (0.526). This implies that farmers can readily adopt agrochemical if they are more cost effective than the existing traditional methods, if they are very easy to understand and use, if the results or impact could be felt. The result is in line with Satishkumar*et al*. (2013) who stated that farmers faced personal constraints such as low level of education and traditional belief, technical constraints, of climate change and lack of access of weather forecasting technologies and institutional constraint, such as lack of extension services.

In Factor 2, the Socioeconomic constraints that hindered farmer's adoption of agrochemicals in the study area were, cost of agrochemicals (0.555), poor financial sources (0.491), poor sources of information (0.479) and inadequate extension services (0.397). The implication of these findings is that high rate or spate of absolute extreme poverty inBenue State has hindered majority of the small-scale farmers from adopting agrochemicals considering the high cost of agrochemicals and initial capital required.

In Factor 3, the characteristics of innovation constraints that hindered adoption of agrochemicals in Benue State were: Compatibility (0.608), complexity 0.548, relative advantage (0.409) and triability (0.310). These imply that agrochemicals can easily be adopted if they are very easy to understand and use, if the results or impact could be felt and if they can be tried on a small-scale before adoption.

Table3: FactorAnalysis of Constraints to Adoption of Agrochemicals

Variables	Factors 1	2	3
Climate change (CC)	0.719*	0.143	-0.070
Nature of the soil(NS)	0.663*	-0.042	0.105
Poor policy implementation (PPI)	0.526*	0.118	0.129
Laborious activities (LA)	0.528 E-02	0.308	0.234
Complexity of application (CA)	0.131	0.110	0.548***
Level of education (LE)	-0.145	0.676**	-0.017
Poor sources of information (PSI)	0.046	0.479*	0.049
Cost of agrochemicals (CA)	-0.218	0.555**	-0.146
Inadequate extension service (IES)	0.160	0.397**	-0.102
Poor financial sources (PFS)	-0.042	0.491	-0.249
Relative advantage (RA)	-0.229	0.263	0.409***
Compatibility(C)	0.019	-0.095	0.608***
Triability (T)	-0.249	-0.173	0.310***
Complexity (CP)	-0.011	-0.140	0.448***
Observability (O)	0.078	-0.249	-0.152

*- Factor 1: Environmental, cum administrative constraints
**- Factor 2: Socioeconomic constraints
***- Factor 3: Characteristics of innovation

5.0 Conclusion and Recommendations

5.1 Conclusion

Agrochemicals are chemicals which are used in agriculture, to aid plants, crops growth and safety. Agrochemicals are manufactured to protect agricultural crops from pests and for augmenting crop yields. They were developed to control the working organisms that become pests as a result of the cultivation of wild plants and rearing of animals and to make farming practices more efficient. They are produced for different purposes, those

that are developed to control weeds are known as herbicides, those that supply the soil nutrients required for plant growth are known as fertilizers, and those that kill insects are known as insecticides, while those that destroy rodents and fungi are known as rodenticides and fungicides, respectively.

Farmers who used these agrochemicals in Benue State are small-scale farmers and they fell within the age of 20-30years, with average farm size of 2-3ha but with relatively large household size. They have inadequate extension services that cum disseminate sources and usage of the agrochemicals. Factors that influenced adoption of agrochemicals are relative advantage and profitability. It was therefore concluded from the study that agrochemicals are widely adopted among rural farmers across the three agricultural zones and they found them to be beneficial.

5.2 Recommendations

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

1. Provision of adequate extension services by increasing the extension- fairness ratio in the study area.
2. Adoption of agrochemical innovation could be increased through creation of massive awareness about profitability and relative advantage of the use of agrochemicals.
3. Re-invention associated with the use of agrochemicals should be check made by training the farmers on how to apply agrochemicals.

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