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ANALYSIS OF AGRO-CHEMICALS UTILIZATION AMONG SMALL-SCALE FARMERS OF ARGUNGU AGRICULTURAL DEVELOPMENT PROJECT ZONE OF KEBBI STATE, NIGERIA

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ABSTRACT

This study analyzed the utilization of Agro-chemicals among small-scale farmers of Argungu Agricultural Development Project (ADP) Zone of Kebbi State. Data were obtained, using interview schedule, from one hundred and ninety six farmers purposively selected. Data collected were analyzed using descriptive and inferential statistics. Linear regression analysis was used to determine the relationship between some selected farmers' socio-economic characteristics and utilization of agro-chemicals. Findings reveal that 28% of the farmers were within their active productive ages of 31-40 years. Majority (91%) were males, and married (73%) with a farm size of 1–5 hectares (88%). They had a farming experience of 11–20 years (89.80%). The most common agro-chemicals used by the farmers were inorganic fertilizers (36%), pre-emergence herbicides (41%) and pesticides (33%). About 35% of the farmers had training on agro-chemicals usage from the extension agents while only 29% had training from professional servicemen. Result of the linear regression analysis reveals that age, marital status, educational attainment, family size, farm size and farming experience were significantly ($P<0.05$) related to agro-chemicals utilization. The study concluded that farmers were conversant with agro-chemicals utilization but lack thorough training on the application of the agrochemicals. It was recommended that sensitization and trainings should be provided to the farmers especially on methods of application and dangers posed by agro-chemicals on health as well as on the environment.

Keywords: Agro-chemicals; Utilization; Small-scale Farmers; ADP Zone

INTRODUCTION

Agriculture is one of the most important sectors of the Nigerian economy; this is because it provides primary means of employment to about 67% of the rural populace and the sector total Gross Domestic Product (GDP) and labour force of the teeming population. There is consensus among Nigeria policy makers, her development partners, and experts in Nigeria agriculture sector that the wealth of the country can substantially be derived from

agricultural production (Opara, 2010). Unfortunately the sector was dominated by small scale-farmers who mostly reside in the rural areas and produce at subsistence level and the average Nigeria small-scale farmers are poor, non-literate, and lack access to most basic social amenities as well as improved varieties of inputs and modern farming implements. The consequence of these has been low production and productivity (Opara, 2010). Food and Agricultural Organization - FAO (2003) and World Bank, (2003) have further described the Nigeria small scale-farmers as a multitude of farmers scattered over wide expanse of land area, with small holdings ranging from 0.5 to3.0 hectares of farmland, using rudimentary farming systems and equipments and with low capital base and which constitute about 80.35% of all 29,800 million farm holdings in Nigeria (Ogunwale, 2005).

Moreover, the conventional methods of raising farm productivity since the World War II has centered on employing the use of external chemicals known as agro-chemicals to improve agricultural productivity, control pests and diseases and which encompasses the usage of fertilizers, pesticides, insecticides, fungicides and herbicides (Tekwa *et al.*,2010). These agro-chemicals were found to be ignorantly applied by the farmers (Avavand and Oluwatayo, 2006). The agro-chemicals contributed not only to healthy growth of crops and animals but also improve farm work efficiency and stable supply of tasty agricultural produce (Kughur, 2012). However, many agro-chemicals are known to be toxic and their bulk storage and usage may pose a significant environmental and health risks particularly in the event of accidental spills(Andrew, 2007).The use of agro-chemicals could also be dangerous to the health of both the soil and humans. As a result, their usage and storage in large quantities need to be managed and the users need to be educated (Alex, 2007).

Kebbi State is known as an agriculturally viable environment because it is endowed with good soil fertility, vast upland and lowland and economically viable rivers sheltered by fine tropical climate making it the backbone of the economy of the State and favour the cultivation of varieties of crops by the farmers. Due to drudgery involved in using manual labour, many farmers apply agro-chemicals for pre and post emergent weeds, chemical fertilizers and for, pests and diseases control. The practice of applying agro-chemicals helps farmers to cultivate large farm size when compared with application of laborious manual farm operations.

The issue of contention here is, are these farmers applying the agro-chemicals based on prescription and or trainings received? Are the agro-chemicals applied by the farmers based on the laid down rules and procedure? Do the farmers adhere strictly to the precautionary measures slated by the companies on the application of the chemicals? Are the agro-chemicals purchased by the farmers active or expired? Are such agro-chemicals environmentally friendly? These contentious issues need to be addressed by the farmers, government and agro-chemicals regulating agents before such agro-chemicals should be allowed to be put to use. Despite the growing interest for the use of agro-chemicals in the study area, the farmers' potentials for increased utilization of agro-chemicals remains questionable, due to purposely unexpected lack of required knowledge for handling of chemicals, wrong timing of application and prescribed dosage of using the chemicals.

In view of the above importance and problems associated with usage of the chemicals, this study in an attempt to provide solution to some of the aforementioned problems addressed the following objectives. These are to: (i) describe the socio-economic characteristics of the farmers (ii) describe the source of information on agro-chemicals by the farmers (iii) findout the different agro-chemicals used by the farmers and (iv) examine

the different types of training received on agro-chemicals usage by the farmers in the study area.

MATERIALS AND METHODS

Study Area

The study was conducted in Argungu zone of Kebbi State Agricultural Development Programme (ADP). The area is located between latitude $12^0$30'33"N to $12^0$40'54"N and longitude $4^0$20'54"E to $4^0$30'54"E covering an area of 428 square kilometers and elevation of 241 meters above sea level. Argungu is bounded by Yabo Local Government Area of Sokoto State to the North-East, to the South by Gwandu and Birnin Kebbi Local Government Areas, while to the North and West by Augie and Arewa Local Government Areas respectively (Lawal, 2013). The population of the area was projected to be 195,484 as at 2016 (NPC, 2006).

The vegetation of the study area falls within the Sudan savannah agro-ecological zone of Nigeria which is characterized by open woodlands; short, tender grasslands, stunted shrubs and most of the trees are deciduous (Asogwa *et al.,* 2012). The study area has two distinct seasons: the dry season from November to April and the rainy season from May to October. Harmattan period (November to January) is characterized by heavy fog and dust as well as extreme cold temperatures (Singh, 2015).

The people of the area are predominantly farmers; crops grown mostly in the area are millet, sorghum, rice and cowpea. The species of animals raised in the area are cattle, sheep, and goats. The famous fishing festival used to be an annual event in the area. The inhabitants of the area comprise of Kabawa (a subgroup of Hausa) and clusters of Arawa, Zabarma, Fulani, Barebari and other tribes.

Two soils types can be identified in the study area, the upland and Fadama soils. The Fadama consists of two distinct phases; wet and dry season operations. These two soil groups are generally characteristics of Sokoto Rima Basin. While the upland soil are generally sandy and well drained. The Fadama soils are generally clayey and hydromorphic which range from deep well drained soils, loamy sand, sandy loam, clay and clay loam (Lawal, 2013).

Sampling Procedure and Sample Size

The small scale-farmers of Argungu ADP zone of Kebbi State were the target population for this study. The exploratory survey carried out revealed that the zone comprises of four (4) Local Government Areas (LGAs) viz: Argungu, Dandi, Arewa and Augie LGAs. Purposive sampling technique was adopted to select three LGAs for the study based on predominance of agro-chemical users in the areas. The LGAs selected were Argungu, Dandi and Augie. From each LGA 65 farmers were randomly selected, making the sample size of the study to constitute 195 farmers.

Data Collection and Analysis

Data for this study were collected from primary sources, generated with the use of interview schedule. Secondary information was generated from internet, journals, official

records, books and other literature relevant to the study. Data obtained were analyzed using descriptive statistics which include: frequency distribution; percentages; means; and standard deviations; linear regression analysis was used to establish the relationship between agro-chemical utilization (dependent variable) and independent variables (socioeconomic characteristics, types of agro-chemicals used and trainings received).

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Farmers

The socio-economic characteristics of the farmers presented and discussed included: age, sex, marital status, household size, educational attainment, farm size, and farming experience of farmers.

The results in Table 1 shows that 28.6% of the farmers were within the age range of 31-40 years and 12.2% had 60 years and above. The findings implied that the farmers were within their active and productive ages. The mean of 41.5 and standard deviation of 15.5 indicated that the farmers were within their active years of productivity and hence could cope with rigors associated with agricultural activities. These findings are in agreement with Adubi, (1992); Olowogbon *et al.* (2013) and Ogunbameru *et al.* (2008) reported that age is a factor that determines the quality and quantity of work done and hence it is believed that tasks could be done better if handled by young and energetic people.

Sex of an individual has to do with being male or female. Generally, farmers require much energy in order to meet up with various activities in the farm. Men are more likely able to withstand stress than women. The results in Table 1 shows that majority (92.9%) of the farmers were male while few (7.1%) were female. This variation could be attributed to the fact that women are controlled by their husbands in the study area and this is because most of the farms in the study area are owned by men even though women also participate actively in some farming activities such as processing, harvesting and marketing. This finding is in line with Food and Agricultural Organization- FAO (2011) reported that men participated fully in farming activities whereas women engaged mostly in processing and selling of farm products in most part of the north-western Nigeria.

The results also revealed that majority (74.5%) of the farmers were married, 20.4% were single, and 4.1% of them were widows while few (1.0%) were divorced. The findings connotes that marriage is highly valued in the study area and this shows that increase in the size of family will in turn provides more family labour to the households in the area. The findings further indicated that most of the farmers participated in agricultural activities with the purpose of providing endneeds that help to cater for the entire family. These findings are in agreement with Bello *et al.* (2010) who reported that level of attainment of responsibility of men or women had been associated with marriage. Also, marriage institution is recognized as the key to generation and uniting individuals and groups of farm families.

Table 1: Distribution of farmers based on their socio-economic characteristics (n = 195)

Variables	Frequency	Percentage	Mean	Standard Deviation
Age (Years)				
< 20	10	5.10		
21 – 30	54	27.55		
31 – 40	56	28.57	41.50	15.52
41 – 50	16	8.16		
50 years and above	60	30.16		
Sex				
Male	182	92.86		
Female	14	7.14		
Marital Status				
Married	146	72.45		
Single	40	20.41		
Divorced	2	1.02		
Widow	8	4.08		
Household Size (persons)				
1-5	56	28.57		
6-10	64	32.65	10.21	5.91
11-15	50	25.51		
15 and above	26	13.27		
Educational Attainment				
Adult literacy education	8	4.08		
Qur'anic education	48	24.49		
Primary education	16	8.16		
Secondary education	42	21.43		
Tertiary education	82	41.84		
Major Occupation				
Farming	138	70.41		
Civil service	26	13.27		
Business	14	7.14		
Student	18	9. 18		
Farm size (hectares)				
<1	4	2. 04		
1-5	176		3.40	3.00
6-10	12			
10 hectares and above	4			
Farming Experience (years)				
<10	29	89.80		
11-20	31	15.82		
21-30	23	11.73	20.51	13.04
31 years and above	15	7.65		

Source: Field survey, 2015

Household size of farmers has to do with the total number of individual members of a household that eat on the same pot of food. It is measured by the total number of persons in a household. It is an important socio-economic characteristic of farmers in that it determines how much family labour is at disposal of the head of the family. The results in Table 1 show that 32.7% of the farmers had a household size of 6 - 10 persons and 6.1% had more than 20 persons in the household. The mean family members of 10.50 and standard deviation of 5.91 indicated that there were moderate to large family members in the study area and this implies that there were more people to serve as source of family labour for the farming activities in the study area. This finding is in agreement with Lawal, (2002) and Ogunbameru *et al.* (2008) who posited that moderate/large household will provide labour requirement for the family.

Educational attainment refers to the knowledge acquired through formal and informal trainings in an organized or institution of learning. It determines to what extent the farmers can accept new innovations in the course of agricultural production. The findings show that 41.8% of the farmers had tertiary education, 24.5% had Qur'anic education, 21.4% had secondary education, and 8.2% had primary education while 4.1% of the farmers' had Adult literacy education. These findings have great implication for agro-chemicals adoption in the study area since most of the farmers had attained appreciable level of education and education was considered as a crucial factor for technology adoption by many researchers and this might be the reason why many farmers adequately utilized the agrochemicals disseminated to them. These findings are in agreement with Oladele, (2005) and Ogunbameru *et al.* (2008), that educational background of farmers' accounts for their managerial ability and makes them to accept agro-chemicals as means of increasing soil fertility and production.

Sources of Agro-chemicals Information

As shown in Table 2, 41.18% of the farmers obtained information on agro-chemicals through extension workers, 39.21 obtained the information through the nongovernmental organizations while 19.61% of the farmers obtained the information on agro-chemicals usage from the open market. This implies that the farmers obtained information on agro-chemicals through extension workers as such the farmers are expected to be taught on how to apply the agro-chemicals disseminated to them in their agricultural activities. This finding is in concordance with Bello *et al.* (2010), who reported that average age of 10years of farming experience of farmers was old enough to make them understand the value of having contact with extension agents in adoption of improved farm practices.

Table 2: Distribution of farmers based on source of agro-chemicals information (n=195)

Variables	Frequency	Percentage
Source of Information		
Open Market	40	19.61
Extension Workers	84	41.18
Nongovernmental organizations	80	39.21
	*204	

Source: Field Survey, 2015; * Multiple response

Agro-chemicals Used by the Farmers

Result in Table 3 shows that 30.67% of the farmers used inorganic fertilizers, 27.33% used pre-emergence herbicides, 22% used pesticides, and 16.67% of the farmers used post-emergence herbicides while only 3.33% of them used biological means of improving their farm lands. These findings imply that most of the farmers used agro-chemicals in their farming activities in order to have maximum yield and that the inorganic fertilizer, pre-emergence herbicides as well as pesticides were the most common agro-chemicals used by the farmers in the study area. These findings are in line with Okoloko (2006) who reported that for Nigeria to feed her growing population, it must increase food production by 4% per year for the next 10 years and for this objective to be accomplished, the use of inorganic fertilizers must be increased from an average of 10kg/ha to 50kg/ha because the organic sources of soil nutrients for the farmlands in the country will not be sufficient. Okwoche *et al.* (2011) also posit that herbicides reduce the drudgery that is associated with persistent weeds and chronic labour shortages. In the last 100 years, the use of herbicides has led to a geometrical increase in world agricultural production as more land is put into cultivation (Eifediyi *et al.,* 2014).

Table 3: Distribution of farmers according to the types of agro-chemicals used (n=196)

Variables	Frequency	Percentage
Pre-emergence herbicides	82	27.33
Post-emergence herbicides	50	16.67
Pesticides	66	22.00
Inorganic fertilizer	92	30.67
Biological measures	10	3.33
	*300	

Source: Field Survey, 2015; *****Multiple response

Trainings Received on Agro-chemicals Usage

Results in Table 4 shows that majority (75.51%) of the farmers received training on application of agro-chemicals, 24.49% were of the opinion that no training on agro-chemicals usage was provided to them. This findings therefore, revealed that majority of the farmers in the study area were provided with trainings on how to apply different types of agro-chemicals. These trainings may be of importance to the farmers in terms of when and how to apply agro-chemicals, rate of the agro-chemicals required to be applied to a given area of farmland and precautionary measures needed to be taken by the farmer in order to safeguard his health and that of the environment.

Table 4 further indicates that 35.0% of the farmers received training from the Extension workers, 29.0% received training from professional agro-chemicals servicemen, 12.0% of the farmers received training from agro-chemicals companies. These findings imply that farmers were provided with training on the use of agro-chemicals by experts. The implication of this finding is that farmers that were provided with adequate training will be able to utilize the agro-chemicals appropriately based on recommendations and it shows that they had a contact with the extension workers on how to calibrate and use the

chemicals appropriately. This finding is in contrast with Bottrell, (1984) who reported that inadequate extension services and limited resources also contributed to the regular and wide spread incidence of poisoning and misuse of pesticides.

Findings in Table 4 also show that 49.52 % of the farmers received training on application of agro-chemicals and 22.8% of the farmers did not receive any form of training on the usage of agro-chemicals. The results indicated that most of the farmers in the study area received one form of training or the other on the use of agro-chemicals; as such they are expected to apply the agro-chemicals appropriately on their farms without causing serious harm to their crops and the environment. This finding is in agreement with Avav and Oluwatayo (2006) that the conventional methods of raising farm productivity since the World War II has centered on employing the use of externally acquired inputs like fertilizers and protection chemicals (Agro-chemicals) among others and which are indiscriminately applied by the farmers.

Table 4: Distribution of farmers according to trainings received on agro-chemicals usage

Variables	Frequency	Percentage
Training on use of Agro-chemicals		
Yes	148	75.51
No	48	24.49
Provision of Trainings		
Extension workers	70	35.0
Professional agro-chemicals Servicemen	58	29.0
Agro-chemical companies	24	12.0
No training received	48	24.0
	*200	
Types of Trainings Received		
Agro-chemicals calibration	40	19.05
Application of agro-chemicals	104	49.52
Precautionary measures	18	8.57
No training provided	48	22.86
	*210	

Source: Field Survey, 2015; * Multiple response

Test of Research Hypothesis

Table 5 shows the results of regression analysis on the relationship between some selected farmers' socio-economic characteristics and the utilization of agro-chemicals. The results obtained reveal that Age (β= 0.018*** P< 0.01); Household size (β = 0.007**; P 0.01); Educational attainment (β =0.080**, P<0.01) and Farm size (β = 0.003**, P <0.01) as well as farming experience (β = 0.000***, P < 0.001) were significantly related to agro-chemicals utilization by the farmers, as such the formulated hypothesis was rejected. The ΔR^2 value which measures the variation in the dependent variable (utilization of agro-chemicals) that is explained by the independent variables (socio-economic characteristics) was 0.478. This means that 47.8% of the variation in the dependent variable is explained by the independent variables. The F-value which measures the level of significance of all the explanatory variables in the regression model was 1.379 and it was significant at (P<0.01).

The significance and positive F-value was an indication that the model was fit and suitable for the data.

Table 5: Relationships between Farmers Socio-economic Characteristics and Utilization of agro-chemicals

Variables	B	SE	*b*	t-value	P-value	R^2	ΔR^2	F-value
Constant	0.591	0.543		1.089	0.279			
Age	0.018**	0.011	0.315	1.554	0.124			
Sex	-0.440	0.465	-0.13	-0.95	0.346			
Marital Status	0.333**	0.174	0.267	1.916	0.059**	0.478	0.478*	1.379*
Household size	0.007**	0.019	0.047	0.364	0.717			
Educational level	0.080**	0.071	0.121	1.122	0.265			
Farm size	0.003**	0.030	0.011	0.110	0.912			
Farming experience	0.000***	0.013	0.005	0.026	0.979			

*P < 0.05; **P < 0.01; ***P < 0.001; B – unstandardized coefficients; b – standardized coefficients; SE – standard error.

CONCLUSION

Based on the findings of this study it is concluded that the common agro-chemicals used by the farmers in the study area are inorganic fertilizers, pre-emergence herbicides and pesticides. It is also concluded that majority of the farmers were conversant with agro-chemicals but lack training on its calibration and application.

More awareness creation strategies should be employed to sensitize farmers on agro-chemicals utilization especially the health hazards it poses to the farmers and the environment. Sensitization on the use of protective equipment for agro-chemical application is recommended. More training is recommended for the farmers on calibration, agro-chemicals rate/farmland and health hazards of inappropriate use of the chemicals.

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