

# ECONOMIC ANALYSIS AND PATTERN OF AGROCHEMICALS USE AMONG SMALLHOLDER CROP FARMERS IN EDU LOCAL GOVERNMENT AREA OF KWARA STATE

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**Abstract.** This study addresses the economic analysis and pattern of agrochemicals use among smallholder crop farmers in Edu Local Government Area of Kwara State, Nigeria. A multistage random sampling technique was used to select 144 small-scale crop farmers interviewed for the study. Descriptive statistics and farm budgeting techniques were used for data analysis. The result shows that a typical small-scale crop farmer in the study area is, on average, a 31-year-old male with 11 to 20 years of farming experience. These groups of farmers also cultivate 0.78 hectares and have a household size of 8. Herbicides are the predominant agrochemical used during the survey; it was mostly applied both before and after crop emergence. Usually, pesticides were applied without following safety instructions. Users of agrochemicals obtained a total gross margin of USD 1,469.95 per hectare with a profitability ratio of 1.22 which indicates that farming is a profitable business in the study area. The study recommends to increase awareness on farmer safety measures when handling agrochemicals; and to establish educational programs that will educate farmers on how to safely use agrochemicals.

**Keywords:** Edu, agrochemicals, profitability ratio, gross margin, Nigeria, pesticides

## INTRODUCTION

Hand-weeding is the predominant weed control practice on smallholder farms in Africa (Vissoh et al., 2004).

This method of controlling weeds is less expensive but tedious in operation. The time-consuming and stress aspect of hand-weeding necessitate the introduction of agrochemical as a labor saver and a less-time consuming means of weed control.

Agrochemical (agricultural chemical) is the term used when referring to the numerous chemical products used in agriculture. Agrochemicals often refer to a broad range of pesticides, such as fungicides, herbicides and insecticides. According to Larry (2012), the term can also be used when referring to hormones, fertilizers and other chemical growth agents and concentrated stores of raw animal manure. Agrochemicals like neem, wood ash etc. can be prepared locally by farmers while others are manufactured industrially in accordance with a series of procedures. Agrochemicals are mostly used in agriculture, especially in crop production based on the old system which uses organic manures to provide nutrients to crops for high yielding over a long period (Albert, 1989).

However, in this paper, the term pesticides is used synonymously with agrochemicals. There are many different types of pesticides, including herbicides used to kill or inhibit the growth of weeds; fungicides used to control fungal; insecticides to control insects; molluscicides to control molluscs; ovicide to control eggs of insects and mites; rodenticides to control rodents;

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mothball to control fabric pests; and disinfectants to control germs.

Agrochemicals are expensive and harmful to the health of both humans and soil. This hinders their adoption by small farmers. WHO (2008) also reported that most agrochemicals are toxic and can endanger human health. Hence, their use is highly regulated worldwide with provisions and conventions. Any abuse of these chemicals through improper storage or usage can result in losses.

In addition to the aforementioned effects of agrochemicals, Fleisher (2006) reported that the excessive use of chemical fertilizers in developing countries often receives less attention than the uses of pesticides. The economic and ecological impacts can be dramatic. The farmers significantly loss topsoil fertility due to excessive use of chemical fertilizers and pesticides. Meanwhile, pesticides are used in plant production, animal husbandry and public health programs. The methods and parameters for measuring their efficiency or cost differ greatly. Andrew (2008) reports that the use of some agrochemicals is associated with certain ecological damages. For example, an excessive use of fertilizers may lead to contamination of groundwater with nitrates which renders it unfit for consumption by livestock and humans. More so, the run-off of agricultural fertilizers into lakes, streams and other surface water can cause eutrophication (an increase in productivity of those aquatic ecosystems). Many users of agrochemicals have little knowledge about the dangers involved, and hence end up in tasting to determine their potency and ignoring the safety measures when formatting or applying them. Due to frequent application of these chemicals, many pests had their natural enemies destroyed and others have developed resistance strains. As a consequence, the fertility status of farmland is falling year in year out.

Agrochemicals become rampart and common as it is being used by all categories of farmers in almost all localities. Agrochemicals make pests management easy and timely, it can as well proffer solution to poor soil fertility. For most small-scale farmers, this is a major problem which results from a continuous use of the same piece of land and human economic and non-economic activities (Larry, 2012). Meanwhile, according to WHO (2008), the use of these chemicals could do more harm than good if they are not handled with care; agrochemicals are toxic and dangerous to health of both human and soils. The outputs produced through

these chemicals can pose dangers on humans and livestock that feeds them. Water around the environment where agrochemicals are used can be poisoned which is a threat to aquatic lives. According to Seattle (2008), the farmers are confronted over the years with a problem of low yield as a result of poor performance of soil and random use of agrochemicals. It is important to examine the pattern of agrochemicals used, the economic benefit to the users and the effect it has on the crop output level of small-scale users. Therefore, this research is set out to assess how well agrochemicals are being used by small farmers. It is against these backdrops that this paper examines the pattern and economic analysis of pesticide use among smallholder crop farmers in the study area. To achieve the above objective, this study describes the socioeconomic characteristics of smallholder crop farmers; examines the pattern of pesticide inputs used by small-scale crop farmers; analyzes the economic benefits derived from crops grown as a result of using agrochemicals; and examines the output level achieved by agrochemical users.

## MATERIAL AND METHODS

This study was carried out in Edu Local Government Area of Kwara State, Nigeria which has three districts, namely: Tsaragi, Tsonga and Lafagi. The headquarters of the Local Government are located at Lafagi, about 105 km east of Ilorin, the Kwara State capital. It is bordered by Moro, Patigi and Ifelodun Local Government Areas of Kwara State and Mokwa Local Government Area of Niger State. The entire area is located in the North Central region of Nigeria, with a population of about 25,349 (2006 NPC). The area observes distinct wet and dry seasons with a mean annual rainfall of 1,000 to 1,500 mm. The climate, soil type and hydrology allow the growing of most of staple crops and still leave large areas for fresh water fisheries and grazing, especially in Lafagi and Tsonga districts. Farming is the main occupation of the inhabitants of Edu Local Government Area

### Sampling techniques

The population covered by this study are small-scale arable crop farmers in Edu Local Government Area, Kwara State who cultivate four types of farm crops, namely: millet, maize, rice and cowpea. Some of these crop farmers do grow the crops either in a mixed cropping

system or a mono-cropping system. A multistage sampling technique was employed to select respondents for the study. The first stage involves the random selection of two out of the three districts in the local governments; at this stage, Tsaragi and Tsonga districts were selected for the study in the Local Government Area. At the second stage of sampling, two wards were randomly selected from each of the selected districts while four villages were randomly selected from each of the selected wards at the third stage of sampling for the study. A total of sixteen villages were selected. In each village, the author (accompanied by enumerators) randomly selected nine small-scale crop farmers from the list of farmers prepared during the field visits. The total number of respondents used for the study was 144 small-scale crop farmers who cultivate four major crop types under consideration. The main instrument for data collection was structured questionnaire.

### Analytical techniques

Combinations of analytical techniques were used for the study, comprising of descriptive statistics and budgetary analysis. Descriptive statistics such as percentages, frequency distribution, mean and tabulation were used to describe the socioeconomic characteristics of respondents, the pattern of agrochemical inputs used and the output level of agrochemical users. In turn, budgetary techniques such as gross margin analysis were used to examine the income benefit of pesticide users. The profitability ratio was used to examine the profitability of the crop farming enterprise of agrochemical users.

### MODEL SPECIFICATION

#### Gross margin analysis

Following Olukosi and Erhabor (1988), farm budget was estimated on a per-hectare basis and specified as:

Gross Margin = Total Revenue (TR) – Total Variable Cost (TVC)

$$\begin{aligned} TR &= P_y \cdot Y \\ TVC &= P_x \cdot X \end{aligned}$$

where:

- $P_y$  – unit price of output
- $Y$  – quantity of output
- $P_x$  – unit price of variable input
- $X$  – quantity of variable inputs.

The profitability ratio was estimated as:

$$\text{Profitability ratio} = \frac{\text{Gross Margin per hectare}}{\text{Variable cost}}$$

In order for an enterprise to be profitable, the ratio should be greater than zero (Amaza, 1991).

### RESULTS AND DISCUSSION

Table 1 shows that most small-scale farmers in the study area are male (82.64%), married (71.53%) with a mean age of 31 years. This implies that males are the dominant gender involved in small-scale farming in the study area, and may have access to family labor which participates actively in farming activities.

This result is in line with the findings of Lawal et al. (2014) who posited that small-scale farmers in similar cultural settings are mostly male. Also, Alabi et al. (2014) reported that the mean age of small-scale farmers is between 35 and 45 years, although in this study it is quite smaller. Table 1 also reveals that the majority of small-scale farmers in the study area are educated (62.5%), have an average farming experience of 18 years and an average farm size of 0.78 hectare. The implication of this finding is that high levels of literacy may enhance the adoption of innovations.

**Table 1.** Socioeconomic characteristics of small-scale crop farmers in this study

Characteristic	Frequency	Percentage
1	2	3
<b>Gender</b>		
Male	119	82.64
Female	25	17.36
Total	144	100
<b>Age</b>		
11–20	17	11.81
21–30	57	39.58
31–40	42	29.17
Above 40	28	19.44
Total	144	100
Mean	31	

**Table 1 cont.**

	1	2	3
<b>Marital status</b>			
Single		34	23.61
Married		103	71.53
Widow/widower		7	4.86
Total		144	100
<b>Education level</b>			
None		54	37.50
Primary		31	21.53
Secondary		25	17.36
Tertiary		31	21.53
Quranic		3	2.08
Total		144	100
<b>Farming experience</b>			
1–10		36	25.00
11–20		54	37.50
21–30		38	26.39
Above 30		16	11.11
Total		144	100
Mean		18 yrs	
<b>Farm size</b>			
< 0.5		42	29.17
0.5–1		48	33.33
Above 1		54	37.50
Total		144	100
Mean		0.78 ha	
<b>Family size</b>			
1–5		28	19.44
6–10		20	13.89
11–15		39	27.08
Above 15		57	39.59
Total		144	100
Mean		12	

Source: field survey, 2018.

### Pattern of agrochemical use by small-scale crop farmers

The pattern of agrochemical use by small-scale farmers was examined based on the type of agrochemicals used, time of application, adherence to safety instructions, reason for non-adherence to safety instructions, disposal of agrochemical containers, agrochemicals storage method, addition of other material before application, and reasons for adding the material.

Table 2 shows that herbicides are most used of all agrochemicals (80%) in the study area. The result reveals that majority of the sampled farmers (51.30%) apply herbicides both before and after crops emerge. This indicates that farmers have knowledge of both selective and non-selective pesticides. A large proportion of farmers (54%) do not wear protective clothing while majority (78%) either eat, drink or smoke when handling agrochemicals, which is contrary to instructions on the handling and use of pesticides. Many of these chemicals are toxic, and exposure to and inhaling them can endanger human health. This result is in line with that of Kamel and Hoppin (2004) who found that most farmers in the developing world are not aware of health hazards posed by agrochemicals. The reason why most (47.20%) farmers deviate from safety instructions is that

**Table 2.** Distribution of crop farmers by pattern of agrochemicals use

Pattern	Frequency Percentage	
	1	2 3
<b>Type of agrochemical used</b>		
Herbicides	120	80.00
Insecticides	21	14.00
Fungicides	19	6.00
<b>Time of herbicide application</b>		
Before crop emergence	16	10.70
After crop emergence	57	38.00
Both before and after crop emergence	77	51.30
<b>Safety instructions</b>		
Do wear protective clothing	69	46.00
Do not wear protective clothing	81	54.00
Eating when handling agrochemicals	117	78.00

**Table 2 cont.**

	1	2	3
<b>Reasons for deviation from safety instruction*</b>			
Cannot read and understand		83	26.60
Protective materials are too costly		62	19.87
Materials are not readily available		20	6.41
Instructions are not important		147	47.12
Total		312	
<b>Disposal of agrochemical containers*</b>			
Used for beverage		138	39.43
Burnt		37	10.57
Buried		42	12.00
Left on farm		47	13.43
Dumped in open space		86	24.57
Total		350	
<b>Agrochemicals storage habit*</b>			
Store		43	20.57
House		119	56.94
Farm		31	14.83
Anywhere		16	7.66
Total		209	
<b>Addition of other materials before calibration*</b>			
Salt		13	4.04
Detergents		43	13.35
Diesel		34	10.56
Others		24	7.45
Do not add any material		208	64.60
Total		322	
<b>Reasons for adding the materials*</b>			
To make it more effective		61	20.00
To increase quantity		24	7.87
For both effectiveness and quantity		22	7.21
No reasons		198	64.92
Total		305	

Source: field survey, 2018.

\*Multiple responses existed.

they feel the instructions are not important, meaning that the farmers are ignorant of the safety instruction. Reasonable numbers of the sampled farmers (39.43%) used pesticide containers for beverage after use. This habit of disposal is very dangerous to health, especially if the containers are not properly cleaned and sterilized. The study also reveals that majority (56.94%) of the respondents store pesticides in their living quarters.

The implication is that a long exposure to these chemicals may result in diseases as reported by WHO (2000). This result is in contrast with the findings of (Tijani, 2006) who reported that majority of the farmers place agrochemicals in a store. Reasonable numbers of farmers (35.40%) do add material to agrochemicals before application with no reason for the act.

### Impact of agrochemicals on outputs and incomes of small-scale farmers

Arable crop farmers in the study area cultivated maize and millet in mixed cropping on a piece of land while rice and cowpea were cultivated in mono-cropping. Table 3 reveals the average outputs obtained by users of agrochemical inputs. The table shows that cowpea gives the highest output per hectare.

**Table 3.** Distribution of outputs among users and non-users of agrochemicals

Crops	Average outputs of users (kg/ha)
Maize	960
Millet	800
Rice	942
Cowpea	1 022

Source: field survey, 2018.

### Gross margin analysis for users of agrochemical inputs

Table 4 shows that labor costs had a large contribution to total variable costs, with a value of USD 448.02, i.e. ca. 37.21% (hired and family labor). Rice crops give the highest revenue to small-scale farmers in the study area, representing 40.39% of revenue earned. The Table also reveals that average total variable costs were USD 1,203.71 while the total revenue recorded was USD 2,673.66 per hectare. Thus, gross margin (GM)

**Table 4.** Gross margin analysis for users of agrochemical inputs (per hectare)

Variable inputs	Quantity	Unit cost (USD)	Total cost (USD)	Percentage
<b>A variable costs</b>				
Pesticides	32.68 liters	3.59	117.43	9.76
Transportation	–	–	338.79	28.15
Storage	–	–	96.22	7.99
Packaging	–	–	29.27	2.43
Hired labor	4058 man-days		129.32	10.74
Family labor	10021 man-days		318.70	26.47
Seeds			173.98	14.46
Total variable cost			1,203.71	100
<b>B Revenue</b>				
	kg			
Maize	960	0.33	316.80	11.85
Millet	800	0.34	272.00	10.17
Rice	942	1.15	1,083.30	40.52
Cowpea	1022	0.98	1,001.56	37.46
Total revenue			2,673.66	100
Gross margin (B – A)			1,469.95	
Profitability ratio			1.22	

Source: field survey, 2018.

A total gross margin of USD 1,469.95 was received by small-scale farmers using agrochemical inputs.

was USD 1,469.95. The profitability ratio was found to be 1.22. This implies that small-scale farmers using agrochemicals earned a profit of USD 1.22 which is ca. 122% of invested funds. This result is supported by the finding of Bhandari (2014) who reported that agrochemicals are considered as a powerful weapon or magic bullets in the developing countries in order to enhance the profitability and productivity of agriculture.

## CONCLUSION AND RECOMMENDATIONS

This study found that most small scale-farmers in the study area used agrochemical inputs, and that safety instructions were not adhered to by majority of farmers in the study area. The farmers' inability to comply with safety instructions was as a result of inadequate knowledge of health implications of agrochemicals. The study also

revealed that the use of agrochemical inputs improves crop yields, thereby increasing farming incomes in the study area. Therefore, this study concludes that the use of agrochemical inputs increases the profitability of arable crops enterprise in the study area. Furthermore, safety instructions regarding agrochemical use are not adhered to. The study therefore recommends that programs on agrochemical usage be initiated to educate farmers.

## SOURCE OF FINANCING

Self-financed.

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