**Equity Journal of Science and Technology, 2019 6(1): 42-50**

**ISSN; 2354 – 1814**

EQUIJOST *An Official Publication of Kebbi State University of Science and Technology, Aliero, Nigeria*

# ECONOMIC ANALYSIS OF PESTICIDE USE IN FRUIT VEGETABLE PRODUCTION AMONG FARMING HOUSEHOLD IN KWARA STATE

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**Abstract**

For a good result in fruit vegetable production, pest control is a major task. Even though efforts are being intensified to reduce the amount of chemical used in the control of pests through the introduction of integrated pest management, pesticides use in fruit vegetable production has been reported to be shoot up dramatically. Therefore, the study is based on the economic analysis of pesticide use in fruit vegetable production among farming households in Kwara State. A two-stage sampling procedure was used for the study and the analytical tools used include; descriptive statistics, gross margin, T-test, average treatment effect and three point likert scale. The result revealed that fruit vegetable production has a gross margin of ₦953,244.4/ha for pesticide users and ₦ 154,554.5/ha for non-pesticide users. It was revealed that pesticide users produce more fruit than non-pesticides users. The major factors affecting pesticide usage are farm size, pesticide training and farmer income. Based on the findings of the study, it can be concluded that pesticide usage is profitable in fruit vegetable production in Kwara State. The study therefore recommends that agricultural associations should organize trainings for fruit vegetable farmers on the usage of pesticide and methods to protect them from its harmful effect.

**Keywords:** Pesticide, Fruit vegetable, Production, Gross margin, Kwara State.

## 1.0 Introduction

Pesticides are agro-chemicals that are used for crop protection. They are substances intended to prevent, destroy, repel or control any pest or diseases caused by microorganisms as well as weeds [1]. Tijani and Oshotimehin [2] posited that pesticides are protective resources, which are unique and differ from other productive resources. This is because they do not affect productivity directly but are applied to eliminate those factors that directly reduce productivity. For a good result in fruit vegetable production, pest control is a major task. Even though efforts are being intensified to reduce the amount of chemical used in the control of pests through the introduction of integrated pest management, pesticides use in fruit vegetable production has been reported to be skyrocketing dramatically [3]. It is therefore obvious that the use of pesticides in fruit vegetable production is inevitable if success must be recorded among small scale farmers who control the bulk of domestic output. A report given by NFRA [4], revealed that the total land area cultivated by small holder farmers and their output of fruit vegetable in

Kwara state, Nigeria has dropped drastically in recent times. The low yield obtained in most fruit vegetable producing areas of West Africa is largely due to field insect pests, which feed on reproductive plant parts causing most economic damage thereby necessitating appropriate control measure [5]. Effective control of pest infestation on fruit vegetable can only be achieved through the use of convectional pesticides. The efficacy of pesticides (which include insecticides) depends mainly on their level of use which in turn depends on their market prices and also help farmers lose less of their crops as a key factor in promoting food security which is the first step towards greater economic independence [6].

Excessive use of chemical pesticides has many consequences on agriculture and environment, such as increased production costs, pest resistance to pesticides, and dangerous diseases to human. In order to reducing disease and pests and increase income from crop activities, farmers resorted to using more pesticides [7, 8].

Pests and diseases pose big problems in crop production, which require intensive pest management. Each year these pests destroy a substantial quantity of the world's food crop. Thus, the prudent use of crop coupled with appropriate pesticides may likely actually improve human diet by decreasing the cost of vegetables and increasing their availability, affordability, quality and variety as well.

The specific objectives of the study are to determine the major fruit vegetables produced by rural households, identify the levels of pesticide usage in fruit vegetable production, assess the cost and returns of farmers using pesticides, examine the effects of pesticide usage on fruit vegetable production.

## 2.0 Methodology

### 2.1 Study area Sampling Technique

The study was conducted in Kwara state of Nigeria. Kwara state lies within the North central geopolitical zone of Nigeria. Primary data was used for the study. The population for this study comprises of fruit vegetable farmers in the study area. Asa, Oyun, Irepodun, Ifelodun local government areas were selected purposively since they are prominent fruit vegetable producing areas in the state. A three stage sampling procedure was adopted. The first stage involved the purposive selection of four (4) villages known for producing fruit vegetable in a relatively large quantity from each of the local governments. Second stage was identifying the fruit vegetable farmers using pesticide in the four villages while the third stage involved a random sampling of seven farmers from each of the four villages thus having a total of 112 farmers.

### 2.2 Analytical Technique

Likert Scale: It was used to identify the level of pesticide usage on fruit vegetable production. Farmers were asked the level at which they use pesticide on a 3-points numerical rating scale

High > 5litres; Moderate = 4-5 liters; Low < 4litres

For a given level, the mean score was calculated as

$$\text{Mean Score} = \frac{\text{Total score of each of the level}}{\text{Total number of respondent}}$$

Gross Margin: was used to determine the cost and returns of the farmers in the study area**.**

Gross margin is expressed as:

GM = TR - TVC

Where: GM = Gross Margin (Naira/ha); TR = Total Revenue (Naira/ha); TVC = Total Variable cost (Naira/ha)

Average Treatment Effect: was used to examine the effects of pesticide usage on fruit vegetable production.

The treatment effect for individual *i* is given by

$y_1(i) - y_0(i) = \beta_i$

The average treatment effect is given by

$$\frac{1}{N}\sum_i y_1(i) - y_0(i)$$

$\beta_i$ = is the treatment effect for individual $i$
$y_1(i)$ = is the status of pesticide users
$y_0(i)$ = is the status of non-pesticide users
$N$=individuals in the population

## 3.0 Results and Discussion

### 3.1 Major Fruit Vegetables Produced by Rural Household

Table 3.1 below shows the mean quantity of the crop produced in the three categories of farms owned by all farmers. The result shows that pesticide users produce more crops than non-pesticide users, this can be attributed to the boost in production from the use of pesticide, the protection of crops from injuries and damages caused by pests which will in turn increase the quantity of harvest by the farmers. In all of the farms, tomato is more produced by all the farmers (45.45%), which is followed by pepper (33.77%) and okra (19.48%). The least produced crop is onion (1.30%). This is due to the transportation of onions from the north and cheap price (>100 Naira/Kg) at which it is sold; this will discourage more farmers from its cultivation. Although the crops that are highly cultivated (tomato and pepper) are also transported from the northern region of the country, but the quantity is not sufficient, and demand rises at all times, which is why most of these farmers make a lot of revenue from these crops.

### 3.2 Levels of Pesticide Usage on the Fruit Vegetable Production

The levels of pesticide used have a strong correlation on the crop produced. The result in Table 3.2 revealed that mean, minimum, maximum and total quantity of each pesticide used by the farmers. Insecticide is the highest pesticide used by the farmers. Farmers apply more insecticide on tomato than any other crop, followed by pepper, okra and the least being onion.

Pesticide usage on crops has a recommended level in Table 3.3, which is the maximum litre farmers, can apply per hectare which will not have a detrimental effect on the crop or leave residues on the crops produced. Pesticide usage was further categorized into low, medium and high. A lot of farmers use high levels of insecticide on crops compared with other pesticides. The table above shows that insecticide is the most used pesticide on crops which shows that crops in the study area get more attacks from insects than from nematodes and fungi (Farmers use low level of fungicide and Nematicide on the crops). Although some symptoms on the crops may not be due to insects, but farmers in the study area believe more in insecticide than any other pesticide to solve their crop problems, which is why some farmers use it in excess.

### 3.3 Pesticide Cost for Farmers who use Pesticides

Pesticide cost for farmers was categorized in Table 3.4 based on the point of purchase of the pesticide. The sources of pesticide available to the farmers are open market, agricultural stores and farmers association. More farmers purchase pesticides from agricultural stores than any other source. This is because there is a level of assurance of the quality from agricultural stores than any other source. Insecticides are more expensive in the open market than the other sources, while herbicides and nematicides are more expensive in the agricultural stores than the other sources.

**Table 3.1: The Major Fruit Vegetables Produced by Rural Household**

| Farm 1 | Pesticide usage | | Non-pesticide usage | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| **Crops grown** | | | | |
| Tomato | 35 | 45.45% | 14 | 40.00% |
| Pepper | 26 | 33.77% | 12 | 34.29% |
| Okra | 15 | 19.48% | 8 | 22.86% |
| Onions | 1 | 1.30% | 1 | 2.86% |
| **Quantity Harvested** | | | | |
| < 1000kg | 0 | 0.00% | 4 | 11.43% |
| 1001-5000kg | 39 | 50.65% | 31 | 88.57% |
| > 5000kg | 38 | 49.35% | 0 | 0.00% |
| **Farm 2** | **Pesticide usage** | | **Non-pesticide usage** | |
| | Frequency | Percentage | Frequency | Percentage |
| **Crops grown** | | | | |
| Tomato | 14 | 33.33% | 0 | 0.00% |
| Pepper | 14 | 33.33% | 2 | 40.00% |
| Okra | 14 | 33.33% | 2 | 40.00% |
| Onions | 0 | 0.00% | 1 | 20.00% |
| **Quantity Harvested** | | | | |
| < 1000kg | 42 | 100.00% | 5 | 100.00% |
| 1001-5000kg | 0 | 0.00% | 0 | 0.00% |
| >5000kg | 0 | 0.00% | 0 | 0.00% |
| **Farm 3** | **Pesticide usage** | | **Non-pesticide usage** | |
| | Frequency | Percentage | Frequency | Percentage |
| **Crops grown** | | | | |
| Tomato | 3 | 17.65% | 0 | 0% |
| Pepper | 6 | 35.29% | 0 | 0% |
| Okra | 5 | 29.41% | 0 | 0% |
| Onions | 3 | 17.65% | 0 | 0% |
| **Quantity Harvested** | | | | |
| < 1000kg | 0 | 0.00% | 0 | 0.00% |
| 1001-5000kg | 13 | 76.47% | 0 | 0.00% |
| > 5000kg | 4 | 23.53% | 0 | 0.00% |

**Source: Field Survey, 2018**

**Table 3.2: The Levels of Pesticide Usage on the Fruit Vegetable Production**

| Crop produced | | No of Farmers | Mean | Minimum quantity of pesticide | Maximum quantity of pesticide | Total quantity of pesticide in litre |
|---|---|---|---|---|---|---|
| Tomato | Total Herbicide | 49 | 4.16 | 0.00 | 22.00 | 204.00 |
| | Total Insecticide | 49 | 11.92 | 0.00 | 42.00 | 584.00 |
| | Total Nematicide | 49 | 5.71 | 0.00 | 25.00 | 28.00 |
| | Total Fungicide | 49 | 0.80 | 0.00 | 27.00 | 39.00 |
| Pepper | Total Herbicide | 38 | 3.05 | 0.00 | 24.00 | 116.00 |
| | Total Insecticide | 38 | 6.84 | 0.00 | 13.60 | 366.00 |
| | Total Nematicide | 38 | 0.66 | 0.00 | 12.00 | 25.00 |
| | Total Fungicide | 38 | 0.29 | 0.00 | 5.00 | 11.00 |
| Okra | Total Herbicide | 23 | 3.30 | 0.00 | 24.00 | 76.00 |
| | Total Insecticide | 23 | 8.74 | 0.00 | 45.00 | 201.00 |
| | Total Nematicide | 23 | 0.65 | 0.00 | 9.00 | 15.00 |
| | Total Fungicide | 23 | 0.45 | 0.00 | 8.00 | 10.00 |
| Onions | Total Herbicide | 2 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Total Insecticide | 2 | 12.00 | 0.00 | 24.00 | 24.00 |
| | Total Nematicide | 2 | 1.50 | 0.00 | 3.00 | 3.00 |
| | Total Fungicide | 2 | 0.00 | 0.00 | 0.00 | 0.00 |

Source: Field Survey, 2018

**Table 3.3: Level of Pesticide Measured in Three Scale**

| Crop produced | Insecticide | | | Herbicide | | | Nematicide | | | Fungicide | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low | Medium | High | Low | Medium | High | Low | Medium | High | Low | Medium | High |
| Tomato | 18 | 21 | 10 | 41 | 7 | 0 | 47 | 1 | 1 | 47 | 0 | 0 |
| Pepper | 18 | 11 | 7 | 30 | 6 | 2 | 37 | 0 | 0 | 38 | 0 | 0 |
| Okra | 7 | 9 | 5 | 17 | 3 | 2 | 21 | 1 | 0 | 21 | 0 | 0 |
| Onions | 1 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 |

**Source: Field Survey, 2018**

Low usage -0-3Litres/ha; Medium usage -4-5Litres/ha; High usage - >5Litres/ha

**Table 3.4: Pesticide Cost for Farmers who use Pesticides**

| **Source** | **Pesticide** | **Frequency** | **Amount ₦/Litre** |
|---|---|---|---|
| **Open Markets** | Herbicide Cost | 24 | 6087.50 |
| | Insecticide Cost | 24 | 25750.00 |
| | Nematicide Cost | 24 | 708.33 |
| | Fungicide Cost | 24 | 1720.83 |
| **Agricultural Stores** | Herbicide Cost | 31 | 9070.97 |
| | Insecticide Cost | 31 | 23964.52 |
| | Nematicide Cost | 31 | 3074.19 |
| | Fungicide Cost | 31 | 677.42 |
| **Farmers Association** | Herbicide Cost | 17 | 4152.94 |
| | Insecticide Cost | 17 | 22641.18 |
| | Nematicide Cost | 17 | 5258.82 |
| | Fungicide Cost | 17 | 2970.59 |

Sources: Field Survey, 2018

### 3.4 Other Costs Incurred by Farmers

Other variable costs incurred by the farmers (Table 3. 5) are further divided into pesticide users and non-pesticide users. These costs include land clearing cost, planting cost, application costs of the pesticide, fertilizer cost, and harvesting cost etc. Table 3.5 shows the significant level of the costs, which tells if there is significant difference between the costs of the pesticide and non-pesticide users. A significant value less than 0.05 shows that there is a significant difference between the costs and vice-versa. Except fertilizer cost where non-pesticide users incur more, this shows that non-pesticide users substitute the use of pesticide by using more fertilizer to increase their production. All costs have a significance value less than 0.000 except fertilizer application costs which shows that although non-pesticide using farmers apply more fertilizer than pesticide users farmers, there is no significant difference in the cost they use in applying the fertilizer.

### 3.5 Return on Fruit Vegetable Production

Table 3.6 reveals the mean revenue and the mean crop produced from all the farms, including farmers who operate multiple farmlands. The table above shows that pesticide using farmers got more revenue from tomato cultivation than any other crop while non-pesticide using farmers got more revenue from pepper than any other crop. Pesticide using farmers got more revenue in all crops than non-pesticide using farmers. This can be seen in the mean quantity of crop produced for both of the groups, e.g. pesticide using farmers produced a total of 354,044kg tomato, with a mean of 23,183kg from all the farms they own, while non-pesticide using farmers produce a total of 24,804kg with a mean of 1772kg. Most non-pesticide using farmers only own one farm; this is why the mean crop produced is much smaller than the pesticide using farmers. Each pesticide using farmer got about ₦2.3million from tomato, ₦1.7million from pepper, ₦1.4milliion from okra and about ₦340,000 while non-pesticide using farmers make about ₦182,000 from tomato, ₦400,000 from pepper, ₦232,000 from okra and ₦148,000 from onions.

### 3.6 Gross Margin

An assessment of the profit level of the farmers across all crops produced shows that farmers that use pesticides enjoyed more revenue across all crops than non-pesticide users. This was based on analysis of costs and quantity of crop produced in the previous table. The gross margin was computed by the difference between the farmer's revenue and the costs incurred during production.

The gross margin analysis results in Table 3.7 revealed that pesticide users have the highest profitability. Mean total output of Pesticide users is 9622.5Kg for which they realized ₦953244 profit while non-pesticide users produce a mean 1754.4Kg of crops for which they realized ₦154554.5. Pesticide users realized about ₦100/kg of crops produced and non-pesticide users realized about ₦90/kg.

### 3.7 Effect of Pesticide Usage on Fruit Vegetable Production

Table 3.8 shows that pesticide users realized ₦798,689 in revenue more than the non-pesticide users. This is the effect of pesticide on the revenue of farmers. Pesticide has a positive effect on the revenue of farmers who use it, although farmers who do not use pesticide realized revenue from the crops, but pesticide has a negative effect of ₦798,689 on their revenue when compared to the revenue of the pesticide using farmers.

**Table 3.5: Other Cost Incurred by Farmers**

| **Labour cost(₦)** | **Pesticide users** | **Non pesticide users** | **Sig.** |
|---|---|---|---|
| Total Pesticide | 35997.40 | 0.00 | 0.000* |
| Land clearing | 33298.81 | 5942.86 | |
| Planting | 10577.92 | 2142.86 | 0.000* |
| Weeding | 6720.78 | 1971.43 | 0.000* |
| Herbicide application | 4285.71 | 0.00 | 0.000* |
| Insecticide application | 8564.94 | 0.00 | 0.000* |
| Fertilizer | 2012.99 | 15014.29 | 0.016 |
| Fertilizer application | 285.71 | 1571.43 | 0.117 |
| Harvesting | 13766.23 | 3342.86 | 0.000* |
| **Total** | 115510.49 | 29985.73 | 0.000* |

*Represents 1%
Source: Field Survey, 2018

**Table 3.6: Returns of Pesticide Users and Non-Pesticide Users per Season**

| | **Pesticide usage** | | **Non-pesticide usage** | |
|---|---|---|---|---|
| **Crop produced** | **Mean crop produced (unit)** | **Revenue (Naira)** | **Mean crop produced (unit)** | **Revenue (Naira)** |
| Tomato | 23183 | 2310494.00 | 1772 | 182707.72 |
| Pepper | 15306 | 1704259.59 | 3808 | 397750.00 |
| Okra | 10264 | 1403833.33 | 2090 | 232500 |
| Onions | 2333 | 338333.33 | 1480 | 148000 |

Source: Field Survey, 2018

**Table 3.7: Gross Margin**

| | Pesticide users | Pesticide Non Users | T-test | Sig. |
|---|---|---|---|---|
| Total Output | 9622.5195 | 1754.4000 | 12.405 | .000 |
| Non-Farm Revenue | 35558.4416 | 32600.0000 | 10.989 | .027 |
| Total Farm Revenue | 1068754.89 | 184540.23 | 19.608 | .000 |
| Total Variable Cost | 115510.49 | 29985.73 | 14.231 | .000 |
| Gross Margin | 953244.4 | 154554.5 | 18.411 | .000 |

Source: Field Survey, 2018

**Table 3.8: Treatment effect of revenue**

| | Gross Margin of pesticide users | Gross Margin of non - pesticide users | Treatment effect |
|---|---|---|---|
| Revenue | ₦953244.4 | ₦154554.5 | ₦798689.9 |

Source: Field Survey, 2018

## 4.0 CONCLUSION AND RECOMMENDATIONS

From the study, it was observed that there is need for fruit vegetable farmers to protect their crops from pests to prevent loss in their income level. The use of pesticides is an effective means to control these pests. Therefore, it can be concluded that the use of pesticides is profitable in fruit vegetable production in Kwara state. The usage is limited by factors like effect on health, high cost of purchase and distance from source.

The following recommendations are made:

- Agricultural associations should organize trainings for fruit and vegetable farmers on the usage of pesticides and its harmful effects.
- Government should provide incentives to fruit vegetable farmers such as fertilizer, improved seeds and pesticides through instituting favorable prices for the input.
- Farmers should allow researchers to identify their problems by providing adequate and accurate information. This will help researchers to know the actual constraints of farmers and the strategy to employ to solve their problems.

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