



## Economic Assessment of Pesticides Usage in Leafy Vegetable Production among small-scale Farmers in Kwara State

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### Abstract

The study assessed the returns to leafy vegetable production due to pesticide usage and examined the factors that influence pesticide usage in leafy vegetable production. Three-stage sampling technique was used to select 120 respondents that were administered with well-structured questionnaire. Descriptive Statistics, Gross Margin Analysis, and the Ordinary Least Square (OLS) regression were the analytical tools employed for the study. The findings revealed that *Corchorus olitorius* (Ewedu) was the mostly produced vegetable by 84.17% of small-scale farmers and the least produced vegetable was *Vernonia amygdalina* (Bitter leaf). The total revenue of vegetable farmers is ₦3,268.00 and gross margin is ₦1,936.51 due to pesticide usage with a rate of returns of 59%. This indicated that leafy vegetable production is an essential income earner for farmers in the study area. The results of the multiple linear regression revealed that all the variables (age, fertilizer use, farm income, family size, farm size, and years of experience, pesticide training, apathy and access to credit) were positively significant at 1%, 5% and 10% respectively. The findings of the study therefore will inform the government and agricultural related agencies on the relevance of pesticide usage for profitability in the production of leafy vegetables among small-scale farmers.

**Keywords:** Vegetable production, small-scale, vegetable farmers, pesticide, pesticide usage

### INTRODUCTION

The production and consumption of vegetables is essential mainly because of its contribution to good health in human diet and also as cheap sources of minerals and vitamins needed to supplement people's diet which is mainly carbohydrate. Ayodele (2005) emphasised that, apart from vegetable's nutritional and economic importance, it is also medicinal in terms of improving healthcare delivery and treatment of minor ailments such as stomach ache. However, vegetable production is inadequate in Nigeria. This is because the nation's population keeps growing and the number of vegetable farmers is declining day by day, with little or no farmers to produce in order to meet the demands of the escalating population (Oladoja, *et.al.* 2006). Even though, the importation of fresh vegetables into the country is uncommon (Ibrahim and Omotesho, 2009), the domestic demand is still met essentially from local production. Vegetable production in Nigeria is mainly subsistence and is characterized by cyclic deficits and poverty prompted by unreliable rainfall patterns, declining soil fertility and pest and disease infestation (DFID, 2002). However, pest and disease infestation remain detrimental to bumper harvest of vegetable. For instance, insect pest infestation accounts for 20 to 60% pre-harvest vegetable losses (Sithanatham, Matok, Nyarko, Reddy & Olubayo, 2003). Pests and diseases affect the quality of leafy vegetables produced and they lead to increased cost of production. Madisa, Assefa & Obopile (2010) showed in their study that the major constraints encountered by farmers in

vegetable production are pests, lack of labour, and lack of capital, market accessibility, water shortage and inaccessibility of production inputs. These major hiccups were perceived to be the limiting factors faced by farmers in vegetable production. Madisa *et al.*, (2010) further emphasised in their study that pests constituted more than 47% of the constraints faced by farmers in vegetable production. The only way to overcome the infestation problem on leafy vegetable production is by adequate access to quality inputs such as seeds, fertilizers, pesticides and water supply. Okunlola (2007) iterated that, pests and diseases in vegetable production have a negative economic impact on individual farmers and the industry as a whole. It is important to protect vegetable crops from pests and diseases and also to recognize early signs of pests and diseases. Use of pesticides is increasing at the rate of 25% a year (USAID, I-LED, 2006-2009).

The use of pesticides helped to considerably reduce crop losses and to get better yield of the crops such as corn, maize, vegetables, potatoes and cotton. The use of pesticides among small scale farmers is not uncommon but rarely used due to the high cost of purchase. Oyeniran (2013) showed that the problems militating against vegetable production were identified as high cost of fertilizers, pests and diseases problem and lack of capital. Oyeniran (2013) in the study further suggested the use of organic manure to improve soil fertility. This is to totally eliminate the problem of increasing cost of purchase of fertilizers. Keeping in view high demand of quality products, the Asian, African Center and South American farmers generously used the pesticides, as it ensures yield and paves the way for self-sufficiency in food related products (Mansour, 2004). Traditional vegetable farming systems (i.e. without any chemical inputs) are incapable of meeting this challenging demand of the constantly growing population, the use of pesticides by small scale farmers will help minimize the spread of pests and diseases thereby preventing excessive loss of income. Pests and diseases create big problems in vegetable production which require intensive pest management to control them. Thus, the practical use of appropriate pesticides may actually improve our diet by decreasing the cost of vegetables and increasing their availability, abundance, quality, and variety as well (Jamaliet *al.*, 2014).

Although, the use of pesticides have been promoted in the Nigerian agriculture for the past two decades, vegetable farmers are yet to align the practice into their pest management system, owing to the subsistence nature of production and high poverty levels. Based on this, several studies in the current literatures have been investigated on vegetable production but their focus towards pesticide usage to promote vegetable productivity remains inadequate. This study intends to proffer solutions to the research gap through the following research questions: what are the factors influencing usage of pesticide in leafy vegetable production and what is the returns to leafy vegetable production due to pesticide usage? The main objective of this study is to assess the returns to leafy vegetable production due to pesticide usage in Kwara State. The specific objectives are to determine the returns to leafy vegetable production due to pesticide usage; and identify the factors influencing usage of pesticide in leafy vegetable production.

## **MATERIALS AND METHODS**

### **Study area**

The study was conducted in Kwara State, Nigeria. The state is located in the central part of Nigeria within latitude 7°45' – 9°30'N and longitude 2°30'–6°25'. The state has a total population of about 2,371,089million. Agriculture is the mainstay of the economy in Kwara State as it accounts for about 70 percent of the labour force. Its climate is conducive for growing vegetables and fruits such as mangoes, peppers, pineapple, okra, pepper and leafy vegetables as well. The state is divided into four main agro-ecological zones of Zone A, B, C and D. The zones are as

follows: Zone A: Baruteen and Kaima LGA, Zone B: Edu and Patigi LGA, Zone C: Asa, Ilorin East, Ilorin South, Ilorin West & Moro LGA and Zone D: Ekiti, Ifelodun, Isin, Offa, Oke-Ero & Oyun LGA.

### **Sampling Technique**

A three-stage sampling technique was used to select the respondents for the study. The first stage was the purposive selection of Zone C due to the presence of a large population of leafy vegetable farmers. The second stage was a random selection of one village from each of the five local government areas that make up the zone. The third stage comprised a random selection of 24 leafy vegetable farmers in each village making a total of 120 respondents selected for the study.

### **Sources of Data**

Primary data was used for this study. The primary data used for the study was collected from a sample of target population through the use of structured questionnaire. Other materials used in this study were obtained from journals and online related researched papers.

### **Methods of Data Analysis**

The statistical data analytical methods employed for this study were Descriptive analysis and inferential statistics like the ordinary least square and gross margin analysis. Descriptive statistics comprising the use of frequency distribution and percentages were used to analyse the data for this study. Ordinary Least Square method was used to identify the factors influencing usage of pesticide in leafy vegetable production. This is expressed as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, D_1, D_2, D_3, e)$$

Where

Y = cost of pesticide (₦)/raised bed

X<sub>1</sub> = age of farmers (yrs.)

X<sub>2</sub> = farm income (₦)

X<sub>3</sub> = family size

X<sub>4</sub> = quantity of fertilizer (kg)

X<sub>5</sub> = experience of the farmers (yrs.)

X<sub>6</sub> = farm land size (ha)

d<sub>1</sub> = training on use of pesticide

d<sub>2</sub> = lack of interest

d<sub>3</sub> = access to credit

e = error term

The cost and return analysis was used to estimate the gross margin, return to pesticide use, cost share of pesticide used and profit share of leafy-vegetable enterprise. There are variations in the growing surface patterns over which to grow leafy-vegetable plants. The surface patterns for leafy-vegetable production are flat-top mounds, ridges and untilled-top soil. The most widely used growing-surface pattern is raised ground bed or flat-top mounds. The length of the raised bed varies according to space but is typically 8-10 ft. long. The depth or height of the raised bed varies but for most vegetable crops it is 8-12" or more (Nair, 2016). This can be expressed as follows:

$$GM = TR - TC$$

Where GM = Gross Margin (naira/raised bed)

TR = Total Revenue (naira/raised bed)

TVC=Total Variable Cost(naira/raised bed)

The TVC is computed from the costs of seed, labour, pesticide and fertilizer. The cost share of the pesticide used is gotten from the ratio of pesticide cost to the TVC. Likewise the profit share of the leafy-vegetable business is derived from the ratio of gross margin to the total revenue.

**RESULTS AND DISCUSSIONS**

Table 1 showed the types of leafy vegetables planted by the farmers. It shows that 84.17% plant *Ewedu*, 10% plant *Eeku*, 65.83% plant *Soko*, 10.83% plant spinach, 71.67% plant *Tete*, 27.50% plant pumpkin, 9.16% plant *Amuntutu*, 3.33% plant *Efirin*, 18.33% plant bitter leaf and 25.83% plant water leaf. The results suggest that the farmers plant a wide variety of leafy vegetables. It further shows that *Corchorus olitorius* (*Ewedu*) is the vegetable which is mostly planted by farmers with a highest percentage of 84.17% and *Ocimum basilicum* (*Efirin*) is the vegetable least planted by farmers with the lowest percentage of 3.33%.

**Table 1 Types of crops planted by respondents**

Leafy Vegetables	Frequency (n= 120)	Percentage (%)
<i>Corchorus olitorius</i> ( <i>Ewedu</i> )	101	84.17
<i>Celosia argentea</i> ( <i>Soko</i> )	79	65.83
<i>Sesamum indicum</i> ( <i>Eeku</i> )	12	10.00
<i>Spinacia oleracea</i> (Spinach)	13	10.83
<i>Amaranthus hybridus</i> ( <i>Tete</i> )	86	71.67
<i>Telferia occidentalis</i> (Pumpkin)	33	27.50
<i>Basella alba</i> ( <i>Amuntutu</i> )	11	9.16
<i>Ocimum basilicum</i> ( <i>Efirin</i> )	4	3.33
<i>Talinium triangulareae</i> (Water leaf)	31	25.83
<i>Vernonia amygdalina</i> (Bitter leaf)	22	18.33

*Source: Data Analysis, 2014*

Table 2 revealed that a sum total of ₦1,331.49 (one thousand, three hundred and thirty-one naira, forty-nine kobo) is invested on leafy vegetable production which make the respondents earn the average amount of ₦3,268.00 (three thousand, two hundred and sixty-eight naira) , with the gross margin of ₦1,936.51 (one thousand, nine hundred and thirty-six naira, and fifty-one kobo), and a profit share of 59%, this study infers that leafy vegetable production is a profitable business venture. It was also revealed that the cost share of pesticides is 22.5% which is a proportion of the total variable cost, with the return of ₦735.3.

**Table 2 Costs and Returns to the use of pesticide in Leafy Vegetable Production**

Parameters	Average Values (₦)/raised bed
Total Revenue	3,268.00
Seed	582.86
Pesticide cost	300
Labour cost	237.33
Fertilizer cost	211.6
Total variable cost	1,331.49
Gross Margin	1,936.51
Return to pesticides use	735.3
Cost Share of Pesticides	22.50%
Profit share for vegetable enterprise	59.00%

Source : Data Analysis, 2014.

It can be inferred that an investment of ₦300 for pesticide brought about a return of ₦735.3. This implies that the cost invested on seed and pesticide is higher compared to the cost incurred on labour and fertilizer. Although, the planting of vegetable seeds, application of pesticide and fertilizer require certain level of labour input, the low cost incurred on hired labour is attributed to the fact that the study could not account for the family labour mostly used by small-scale farmers. The respondents of the study expended more on pesticide than other inputs (labour and fertilizer). This might also be a reflection on the level of pest and disease infestation which could have necessitated the need to incur more cost on pesticide.

**Table 3 Factors Affecting Pesticide Usage in Leafy Vegetable Production**

Variables	Semi-log <sup>+</sup>	Linear	Double-log	Exponential
Age	207.9400*** (1.70)	7.5130* (2.47)	0.4063 (1.61)	0.0159* (2.62)
Fertilizer use	156.8547* (3.42)	0.4307* (4.25)	0.3756* (3.96)	0.0009* (4.38)
Farm income	14.1900(0.38)	-0.0001 (-0.13)	-0.0423043 (-0.54)	-1.24e-06 (-0.75)
Family Size	37.7563(0.53)	-6.5753 (-0.57)	0.03498 (0.24)	-0.0125 (-0.54)
Farm Size	212.5903* (4.32)	555.5426* (2.56)	0.3617* (3.55)	1.0442** (2.41)
Years of Experience	-38.7578 (-0.64)	-2.5863 (-0.59)	-0.0830 (-0.66)	-0.0084 (-0.95)
Pesticide Training	9.9813 (0.15)	-39.5419 (-0.57)	0.07877 (0.58)	-0.0211 (-0.15)
Apathy	-68.7924 (-1.45)	1.9636 (0.04)	-0.1186(-1.19)	-0.0064 (-0.06)
Access to Credit	-68.7522 (-0.90)	-20.6896 (-0.26)	-0.1458 (-0.92)	-0.0537 (-0.33)
Constant	-345.1927 (-0.60)	275.6163 (1.33)	3.8731* (3.27)	4.8845* (11.79)
F-value	13.12	9.87	10.43	8.92
R <sup>2</sup>	0.5365	0.4468	0.4794	0.422
Adjusted R <sup>2</sup>	0.4956	0.4015	0.4334	0.3747

Source: Data Analysis, 2014

Figures in parentheses are t-value. Dependent Variable: Cost of Pesticide Used, + = indicates lead equation. \*\*\*, \*\*&\* = indicates significant at 10%, 5% and 1% level respectively.

Table 3 reveals the results of the ordinary least square method. The method was used to examine the factors affecting pesticide usage in leafy vegetable production. It shows the coefficients of the pesticide usage function. The model was demonstrated and reported in four-functional forms. Based on the criteria that the equations with high R<sup>2</sup>, high F-value, high significant variables and

*a priori* expectation. The semi-log function was chosen as lead equation. The  $R^2$  and Adjusted  $R^2$  values were 0.5365 and 0.4956 respectively. This implies that 54% variations in cost of pesticides use to leafy vegetable production are jointly explained by the independent variables. It explains the best fit by 54% which shows how the pesticide cost is explained the variation in the independent variable. It can be deduced from Table 3 that coefficients of fertilizer input and farm size are positively significant at 1%. This implies that the rate of change of pesticide used to the fertilizer input and farm size utilized for leafy vegetable production is greater than unity. The estimates indicate that one unit increase in fertilizer input and farm size would lead to 156.85 and 212.59 increase in the cost incurred on pesticide. The implication of this result is that the more respondents applied fertilizer for the growth of leafy vegetable, the more the growth of weed on the leafy vegetable plot and the higher the cost they incurred on pesticides to control the weed. Busari *et al.* (2012) in their study showed that the cost of chemicals was significant that had a positive relationship with gross margin and is statistically significant at 5% level. This is because the variable is a strong determinant of gross margin. It was also revealed that the age of respondents was positively significant at 10%. This indicates that the rate of change of pesticide used to the age of respondent is greater than unity. The estimate of the age's coefficient explains that one unit increase in age of the respondents would translate to 207.94 increases in pesticide usage. The result showed that the age of leafy vegetable farmers is positively significant, in that the higher the age, the more the level of pesticide usage.

## CONCLUSION

Vegetable farmers are faced with a number of problems including pest and disease infestation. This has led to increase in the use of pesticides in vegetable production. Pesticide usage is very important in leafy vegetable production because it helps to reduce losses due to infestation by pests and diseases. The most common vegetable crop planted by farmers is *Corchorus olitorius* (Ewedu) at 84.7 % and the least is *Vernonia amygdalina* (Bitter leaf) at 18.33%. The study showed that the leafy vegetable farmers earned a total revenue of ₦3,268.00 (three thousand, two hundred and sixty-eight naira), with the gross margin of ₦1,936.51 (one thousand, nine hundred and thirty-six naira, and fifty-one kobo), and a profit share of 59% indicating that leafy vegetable production is a profitable business venture. The total revenue for vegetable farmers is ₦3268. The factors that influenced pesticide usage include age, farm size, farm income, family size, fertilizer use, years of experience, pesticide training, apathy and access to credit. This study therefore concludes that pesticide usage is common and profitable in leafy vegetable production in Kwara State.

## RECOMMENDATION

The findings of the study therefore will inform the government and agricultural related agencies on the relevance of pesticide usage for increased returns in the production of leafy vegetables among small-scale farmers. Agricultural associations should also organize trainings for leafy vegetable farmers on the usage of pesticides.

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