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COMPARATIVE ECONOMIC AND ENTREPRENEURIAL ANALYSIS OF PESTICIDES TREATED AND NON-TREATED COWPEA (*Vigna unguiculata, L Walp*) FARMS IN ABUJA, NIGERIA.

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ABSTRACT

Cowpea (Vigna unguiculata L Walp) is a crop with high potentials for sustainable agriculture and food security in sub-Saharan Africa. Cowpea is very sensitive to pests and chemical protection of the crop is financially profitable and sustainable. Farmers will adopt new cowpea technologies with substantial and sustainable economic benefits. This study compared economic and entrepreneurial benefits of pesticides treated farms to non-treated cowpea farms in Abuja, Nigeria. The research used primary data obtained through questionnaire by interview method. Multi-stage sampling technique was adopted. The study employed descriptive statistics to draw conclusion on the socio-economic profile of the farmers. Gross margin analysis established the economic effect of pesticides application on cowpea production. Also, ordinary least squares regression analysis was adopted to isolate the variables influencing cowpea output in the area. The study revealed that cowpea farmers with treated and non-treated farms are in their active age and had formal education. Family size (X_5) and hired labour X_6 dictates the output of cowpea treated farms at $P < 0.01$ respectively. Relative large families provide readily available labour for timely execution of farming activities. Economic profitability in the production of cowpea is a function of the adoption of spray pesticides application. The gross margin of pesticides treated cowpea farm is 154,583.33 Naira per farmer per production season per hectare higher than that of non-treated farms with gross margin of 72,709.30 Naira. Cymbush application is the most used pesticides sprays for cowpea farms. Costs of pesticides and management of pesticides (integrated pest management) are among factors militating against pesticides usage in the area. The study concluded that cowpea production without pesticides is not economically profitable compares to that with pesticides application. Agricultural sustainability arises from shifts in the factors of agricultural production, from use of fertilizers to nitrogen-fixing legumes, from pesticides to emphasis on natural enemies, from ploughing to zero tillage. A necessary condition for

sustainable agriculture is that large numbers of farming households must be motivated to use coordinated resource management. The success of sustainable agriculture therefore depends not just on skills and knowledge of individual farmers, but on action taken by groups or communities as whole. The study recommends that training and capacity building of cowpea farmers on use of pesticides (integrated pest management) is necessary. Costs of pesticides should be affordable.

Keywords: Pesticides Treated and Non-Treated, Cowpea Farms, Economic and Entrepreneur, Nigeria.

INTRODUCTION

Cowpea (*Vigna unguiculata L Walp*) has the potentials to contribute to food security and poverty reduction in Africa (Coulibaly and Lowenberg-Deber, 2000). Cowpea is a good source of income for many smallholder farners in sub-Saharan Africa and contributes to the sustainability of cropping systems and soil fertility improvement in marginal lands in Africa through provision of ground cover and plant residue, nitrogen fixation and suppressing weeds (Fatokun, 2002). The grain is a good source of protein for human nutrition, while the haulms are valuable source of livestock protein (Sofoluwe and Kareem, 2011). The importance of cowpea in bridging the food gap in Africa cannot be over emphasized (Falusi, 1997). In sub-Saharan Africa, the prospects for reducing hunger, malnutrition and food insecurity through increase in cowpea productivity is significant (Coulibaly and Lowenberg-Debber, 2000).World cowpea production was estimated at 3, 319, 375 MT and 75% of that Production is from Africa (FAOSTAT, 2000). Nigeria, the largest cowpea producer in West Africa and the World also has the highest level of consumption with per capital consumption of 23 Kg per year. Cowpea growers range from those who market all they produce (commercial) to those who consume all that they grow (subsistence). Many assert that it is not feasible to grow the crop commercially without the use of insecticides sprays (Jackai *et al*, 1985; Karungi *et al*, 2000). The profitability of the cowpea cropping system depends mainly on different combinations of improved technologies, the cropping practices and management (use of chemicals including fertilizers and pesticides), the varieties used (local or improved) and the access to input and output market (Okike *et al*, 2007).The difference in gross margins of cowpea production systems is explained by the difference in the type of varieties (more resistance to pests and diseases, drought and heat tolerance, and higher yield). Also, the type of pesticides used for treatment and storage technology used can make a significant difference (Mohammed, 1989). There is a significant increase in cowpea production with adoption of spray pesticides by farmers in West Africa (Okike *et al*, 2007). To realize the goal of reducing hunger and malnutrition in Africa, the total output of cowpea must be increased. One way smallholder farmers can achieve sustainable agricultural development is to raise the productivity of their farms within the limits of the existing resource base and available technology. Sustainable agriculture and food security stand for maximizing the productivity of the land and improving the well-being of people under the constraint of minimal damage to natural resources (land, water, air and biodiversity) (Pretty, 1999). Economic sustainability ensures that farmers do not make any financial losses. This means that is physical and financial capital expressed in monetary units do not decrease. The food security and nutrition situation in Sub-Saharan Africa are clearly not sustainable (Kleemann, 2012). The problem of food security in Africa is as much a problem as the question of access. There are two types of access to food: self-sufficiency and markets. As a result of poverty, subsistence farmers are unable to feed themselves because they have insufficient factors of production at their disposal. In agriculture sustainability, if the soil is degraded, farming will not be economically productive. That is, it produces too little food. As a result, people suffer from hunger or malnutrition, which in turn leads to a destruction of natural resources. A recent study by Von Braun et al (2011) shows that about 17% of the agricultural production in Sub-Saharan Africa is lost due to land degradation. Fertile soils with good physical property to support root growth are essential for sustainable agriculture. Crop rotations, reduced tillage, cover crops, fallow periods, manuring and balanced fertilizer application can help maintain and restore soil fertility. The specific objectives of the study are to:-

(i) identify and compare the socio-economic characteristics of cowpea farmers with pesticides treated and non-treated farms in the study area;

(ii) compare the net farm income (NFI) of pesticides treated and non-treated cowpea farms in the study area;

(iii) evaluate factors influencing net farm income (NFI) of pesticides treated and non-treated cowpea farms in the study area.

METHODOLOGY

The Study Area

This study was conducted in two of the six area councils in Abuja, Nigeria. Gwagwalada Area Council lies between Longitudes 077^0 and Latitudes $07\ 57^0$ with a population of 157,770 people and total land area of 1043 Km Square (NPC, 2006). Kwali Area Council lies between Latitudes 89^0 South and Longitudes 78^0 East with population of 85,837 people and total land area of 1206 Km Square (NPC, 2006). Farming is the main occupation of the people. Major crops grown include; cowpea, sorghum, millet, yams, soybeans, cassava, and rice. Figure 1 shows map of Africa showing Nigeria. Figure 2 shows map of Nigeria showing Abuja, Federal Capital Territory.

Figure 1: Map of Africa showing Nigeria

Sampling Technique and Sample Size

Multi-stage sampling technique was used. The 1st stage was purposive selection of two from six extension blocks in the area. The 2nd stage was the simple random selection of 100 farmers within the two extension blocks.

Method of Data Collection

Primary data were used. The data were collected with the aid of a well-designed questionnaire. The structured questionnaire was administered to 100 farmers. Data were collected based on specific objectives stated.

Method of Data Analysis

Data were analyzed using the following tools:

(i) Descriptive Statistics

(ii) Net Farm Income (Budgetary Analysis)

(iii) Multiple Regression Analysis

Figure 2: Map of Nigeria showing Abuja, Federal Capital Territory.

Descriptive Statistics

This involves the use of mean, percentages, frequency-distributions. This was used to achieve specific objective one (i).

Net Farm Income (Budgetary Analysis)

The profitability of cowpea farming was estimated using economic analysis to estimate farmers net returns from production. The net return from operation per farmer per production season was computed as follows:

$$NR = Q_i P_{qi} - \sum_{i=1}^{n} X_i P_i$$

Where, NR= Net Return (Naira)

Q_i = Total Output (Kg)

P_{qi} = Price of Output (₦/Kg)

X_i= Quantity of input used for production per season (Units)

P_i= Price of the input used

This was used to achieve specific objective two (ii)

Multiple Regression Analysis

The implicit model is stated thus:

$$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, U_i)$$

Where,

Y = Net Farm Income (Naira)

X_1 = Farm Size (Hectares)

X_3 = Age (Years)

X_4 = Pesticide Used (Litres)

X_5 = Family Size (Units)

X_6 = Hired Labour Cost (Naira)

U_i = Error Term

The explicit functions are stated thus:-

$$Y = \beta_0 + \sum_{i=1}^{6} \beta_i X_i + U_i \quad \text{(Linear)}$$

$$\text{Ln } Y = \beta_0 + \sum_{i=1}^{6} \beta_i \text{Ln } X_i + U_i \quad \text{(Double-Log)}$$

$$Y = \beta_0 + \sum_{i=1}^{6} \beta_i \text{Ln } X_i + U_i \quad \text{(Semi-Log)}$$

This was used to achieve specific objective three (iii).

RESULTS

Socio-Economic Characteristics of Pesticide Treated and Non-Treated Cowpea Farmers in the Study Area.

Table 1 shows that 64.9% of farmers with pesticides treated cowpea farms were less than 50 years of age. This compares to 86.1% of farmers with non-treated cowpea farms. Cowpea farmers seem to be male dominated activity in the area as about 86% and 93% were male for treated and non-treated cowpea farms respectively. Usually, high literacy level allows the farmers to appreciate innovations in agricultural developments. As shown in Table 1, 57% of cowpea farmers with treated cowpea farms had formal education compares to 91% of cowpea farmers with non-treated farms. Years of farming experience of the sampled cowpea farmers in the study area revealed that 42.1% of farmers with treated farms and 25.6% of farmers with non-treated cowpea farms had less than 10 years experiences in cowpea farming.

Costs and Returns Analysis of Pesticides Treated and Non-Treated Cowpea Farms in the Study Area (Budgetary Analysis)

Costs and returns analysis of pesticides treated and non-treated cowpea farms are presented in Table 2. Costs incurred on various resources used and the profits obtained from the sales of the produce were estimated based on the market price at the period under consideration. The gross Income was calculated by multiplying the total quantity of produce harvested by the price of output sold. The net income was estimated to be 134,629.07 and 66, 290.58 Naira for pesticides treated and non-treated cowpea farms respectively. This agrees with findings of Omolehin *et al* (2011).

Factors Influencing Net Farm Income of Pesticides Treated and Non-Treated Cowpea Farms

The factors influencing net farm income of cowpea farmers are expressed in the econometric multiple regression analysis as presented in Table 3. Linear regression equations are selected as the lead equations for both treated and non-treated cowpea farms. Family size(X_5) and hired labour (X_6) were significant $P < 0.01$ respectively for cowpea treated farms. Hired labour was significant $P < 0.01$ for cowpea non-treated farm. Table 4 identified various pesticides used by farmers to treat their cowpea farms.

Table 1: Socio-Economic Characteristics of Farmers with Pesticides Treated and Non-Treated Cowpea Farms in the Study Area.

Variables	Frequency	Percentages
Age (Years)		
21 - 30	06(03)	10.5(7.0)
31 – 40	15(14)	26.3(32.6)
41 - 50	16(20)	28.1(46.5)
>50	20(06)	35.1(14.0)
Sex		
Male	08(40)	14.0(93.0)
Female	49(03)	86.0(07.0)
Household Size (Units)		
1-10	24(11)	42.1(25.6)
11 – 20	15(20)	26.3(46.2)
21 – 30	10(10)	15.8(23.3)
31 and Above	02(02)	14.0(04.7)
Level of Education		
Primary	10(08)	17.5(18.6)
Secondary	22(32)	38.6(74.4)
Non-Formal	25(03)	43.8(09.0)
Farm Experience (Years)		
1 -10	19(16)	33.3(33.3)
11- 20	24(22)	42.1(42.1)
21 – 30	12(04)	21.1(21.1)
31 and Above	02(01)	03.6(01.8)
Total	**57 (43)**	**100.00**

Source: Field Survey, 2015

Figures in Brackets are Pesticides Non-Treated Cowpea Farms

Table 2: Costs and Returns Analysis of Pesticides Treated and Non-Treated Cowpea Farms

Items	Mean Value (Naira) Treated	Non-Treated
Cost of Pesticides	2734.69	-
Cost of Fertilizers	4035.08	1677.78
Cost of Weeding	5906.25	4350.00
Cost of Transportation	3,266.67	2232.56
Cost of Labour	8114.04	4976.74
Cost of Harvesting	4033.33	3661.54
Total Variable Cost	28,090.07	16,898.62
Total Gross Income	151,583.33	72,709.30
Net Income	**134,629.07**	**66,290.58**

Source: Field Survey, 2015

Table 3: Econometrics Multiple Regression Analysis of Pesticides Treated and Non-Treated Cowpea Farms

Variable	Regression Coefficients		Standard Errors		t-Values	
	Treated	Non-Treated	Treated	Non-Treated	Treated	Non-Treated
Constant	17622.53	-213.339	18928.44	20336.46	0.931	-0.10
Farm Size (X_1)	0.808	0.311	1.895	0.890	0.426	0.3500
Family Labour (X_2)	896.54	0.916	625.459	0.866	1.433	1.058
Age (X_3)	139.41	212.754	381.608	367.587	0.365	0.579
Pesticide Used (X_4)	6500.88	-	4766.131	-	1.364	-
Family Size (X_5)	2.506	-0.517	0.433	1.720	5.795***	-0.301
Hired Labour (X_6)	1.567	1.791	0.420	0.303	3.730***	5.912***
R^2	0.693	0.507				
Adjusted R^2	0.656	0.441				
F-Value	18.769***	7.620				

Source: Field Survey, 2015

Table 4: Identification of Pesticides Used in Cowpea Treated Farms

Pesticides	*Frequency
Cymbush	75
Cypermethrine	27
Uppercolt	36
Shapper Plus	55

Source: Field Survey, 2015 *Multiple Responses

DISCUSSIONS

Socio-Economic Characteristics of Pesticides Treated and Non-Treated Cowpea Farmers in the Study Area

As shown in Table 1 farmers working in cowpea pesticides treated and non-treated farms are in their active age. Age is an important determination of socio-economic status of population since farmers wear energy as they advanced in age (Ibrahim and Tilson, 2007). However, it is important to note that the older farmers becomes better in his understanding of the climatic, social and economic factors that affect farming and thus become more experienced (Ibrahim and Tilson, 2007). Considerable number of cowpea farmers in both treated (57%) and non-treated (91%) acquired formal education. Illiteracy is one of the major factors militating against agricultural development in Nigeria. Costs and management of pesticides could be reason attributed to low adoption of the technology by farmers. Education is regarded as an investment in human capital which is able to raise the skills and quality of man, narrow his information gap and increase his efficiency thereby leading to more productive performance. On household size, most of the families are relatively large and nuclear in nature which provides ready labour for timely execution of farming activities.

Costs and Returns Analysis of Pesticides Treated and Non-Treated Cowpea Farms (Budgetary Analysis)

Table 2 shows the gross margin of 151, 583.33 Naira and 72,709.30 Naira were obtained per farmer per production season per hectare for treated and non-treated cowpea farms respectively. Hence, cowpea production under pesticides application is very much more profitable. The results revealed the high profitability of using pesticides over the non-using of pesticides in cowpea production. The findings confirm Aighali (2006); Ibrahim and Tilson (2007); Omolehin *et al* (2011); Tijani and Oshiotimehin (2007).

Factors Influencing Net Farm Income of Pesticides Treated and Non-Treated Cowpea Farms

From the multiple regression analysis as contained in Table 3, the linear functional forms was selected as the best fit based on the magnitude of the coefficient of multiple determinations (R^2); the relative signs of the coefficient to apriori expectations; significance of t-statistics and F-value. The R^2 was 0.693 and 0.503 for pesticides treated and non-treated cowpea farms. For pesticides treated cowpea farms the R^2 indicated that 69.3% variation in net farm income was explained by the specified independent variables. This is confirmed by ANOVA, the F-ratio was significant $P < 0.01$. The coefficient of the pesticides used (independent variable) was positive. This result agrees with findings of Ibrahim and Tilson (2007).

Pesticides Treated and Non-Treated Cowpea Farms: Implications for Sustainable Agricultural Development

As shown in Table 4, the use of agrochemicals in sustainable agriculture for the management of insect pests, disease and weeds can have a significant impact on the environment. Besides reducing pesticide use overall through integrated pest management including biological control, when chemical are necessary they can be used with greater precision since it is estimated that about 5% of all pesticide applied do not reach the intended target. Many technological innovations exist to improve this situation for example, low drift nozzles and spray shields (FAO, 2016). Effects of sustainable agriculture on pesticide use and yields shows that recent integrated pest management (IPM) programmes, particularly in developing

countries are beginning to show how pesticide use can be reduced and pest management practices can be modified without yield penalties (Brethour and Weerskink, 2001; Wilson and Tisdell, 2001; Gallagher *et al*, 2005; Herren *et al*, 2005; Pretty and Waibel, 2005; Hassanali *et al*, 2008)

CONCLUSION

Farmers would adopt new cowpea technologies with sustainable economic benefits. While, pesticides reduction is to be expected, as farmers substitute pesticide by information, yield increase induced by integrated pest management (IPM) is a more complex issue (Pretty, 2008).From the findings, costs of pesticides, management of pesticides (integrated pest management(IPM) are constraints militating the use of pesticides amongst cowpea farmers. Family size and hired labour strengthened the production base of the smallscale farmers, relatively large family provides readily labour for timely execution of farming activities on cowpea farms. It is probable, for example that farmers who receive good quality field training will not only improve their pest management skills but also become more efficient in other agronomic practices such as water, soil and nutrient management. They can also invest some of the cash saved from pesticides in other inputs such as higher quality seeds and inorganic fertilizers for sustainable agricultural development. This study concluded that cowpea production without pesticides is not economically profitable compares to that with pesticides application. Cymbush is the most used pesticides in cowpea production. Costs of pesticides, management of pesticides (integrated pest management) are constraints militating against the use of pesticides amongst cowpea farmers. Family size and hired labour strengthened the production base of the smallscale farmers, relatively large family provides readily labour for timely execution of farming activities on cowpea farms.

RECOMMENDATIONS

Based on findings of this study:

(i) Training and capacity building of cowpea farmers on use of pesticides (integrated pest management) is necessary to improve adoption of pesticides usage by cowpea farmers.

(ii) Costs of pesticides should be affordable to cowpea farmers

(iii) Environmentally and health friendly pesticides be made available to increase adoption of pesticides usage by cowpea farmers.

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