Journal of Agriculture and Environment Vol. 13 No. 1, 2017: 57-63
ISSN 1595-465X

DETERMINANTS OF ADOPTION OF CHEMICAL PEST CONTROL TECHNOLOGIES AMONG COTTON FARMERS IN KATSINA STATE, NIGERIA

C.C. Ezeh and I. Haliru

College of Agriculture, Ahmadu Bello University, Zaria, Kaduna State, Nigeria

ABSTRACT

This survey based study was carried out to ascertain the determinants of the adoption of chemical pest control technologies in cotton production and evaluate existing gaps. A combination of purposive and random sampling was used to select four cotton growing Local Government Areas in the state, 20 villages and 192 respondents. Data were collected through interviews using a structured questionnaire. Data were analysed using descriptive statistics (means, frequencies and percentages) and multiple regression analysis. Results showed that the mean age of the farmers was 39.6 years, the mean farm size 1.8 ha and majority of the respondents (76%) had over 15 years experience in cotton production. Educational status, farm size and membership of cooperative were shown to significantly influence the adoption of chemical pest control ($P<0.05$); contact with extension workers was also significant ($P<0.01$). In contrast, age, farming experience, mixed cropping and increasing net returns had no significant influence on adoption. Constraints limiting the adoption of chemical pest control were identified and recommendations including subsidizing the cost of farm inputs, intensifying extension delivery and enhanced access to credit were proffered.

Keywords: Adoption; Chemical pest control; Technology; Cotton farmers

INTRODUCTION

The cotton plant (*Gossypium* sp.) is a warm-season annual plant generally grown as a fibre crop. Over the years, several varieties of cotton have been developed to suit the demands of different ecological zones and physiological attributes. According to Fortucci (2009) cotton is one of the most important and widely produced agricultural crops in the world. Cotton is produced for various purposes, it may be exported to earn foreign exchange, or it may provide raw materials for textile production. At the domestic level, cotton is an important cash crop for million of farmers worldwide and the income generated contributes to rural household food security, especially in the developing countries (Fortucci, 2009). In Nigeria, about 0.5% of the country's total cultivable land is allocated to cotton (Sement, 1998). Over the past decade however, cotton production has faced increasingly critical challenges. It is probably a trickier crop to grow than most traditional crops and required greater attention. It is labour intensive and the grower must have the necessary equipments and supplies (Ajibade, 1996).

Weeds, plants diseases and disorder, insects and other pest frequently limit the development of our crop plants, causing reduction in yield and quality as well as variations in the productivity of land from one season to the next. Of the over one million species of insecticides existence, Hill and Walter (1990) estimate that 10,000 of these species are agricultural pests of some consequence damaging some major crops such as cocoa, coffee and cotton. Still on cotton pests, Okumade (2009) posited that about 15% of the world's total crop is lost during cultivation as a result of pest attack. Losses in crop production resulting from the menace of insects and pest in both advanced and developing agricultural systems are often substantial. Sometimes, the losses are so devastating that crop protection has become one of the key aspects of food production. According to Hill and Walter (2009), the combined effect of pest attack and plant disease may result in a loss of 35% to 50% of the potential yield of crops in tropical areas; often greater in countries that can least afford them. A reduction of such losses with a resultant increase in agricultural productivity is therefore of paramount importance especially in the developing countries of the tropics. As a result, legislation, biological and cultural methods, and more importantly chemical control methods are used in the constant struggle to prevent colossal waste.

One major area of concern in cotton production is the devastating effect of pests on the cotton plant. Cotton pests are the principal cause of yield losses (Okunmah and Eruotor, 2012). In tropical Africa, some 480 species of insects, mites, myriapods and nematodes are known to feed on cotton plant and a large number of them are harmful to the crop. They attack the different organs of the plant, either by eating them, sucking the sap, or introducing into them toxic secretions or germs of disease or rot (Sement, 1998; Okaamah and Eruotor, 2012). The spraying of cotton plants with insecticides (Chemical control) is the principal method of pest control. However, according to Nduka (2012) each spraying operation ought to pay for itself by increasing yield. Incidentally, evaluative studies on this have not been concluded. Also worthy of evaluation are the various factors which influence or impede the adoption of recommended chemical control technologies by farmers in the cotton growing belt of Nigeria. These nutty issues have guided this study aimed at covering selected Local Government Areas of a major cotton producing Katsina State.

The study therefore, aimed at assessing the determinants of chemical control technologies in Katsina State, describe the socio-economic characteristics of the farmers, determine the variables that influenced adoption, and identify the major constraints limiting adoption of chemical control technologies.

MATERIALS AND METHODS

The Study Area

Katsina State is one of the states of the Federal Republic of Nigeria. The state is predominantly agricultural and stretches from the Guinea Savannah in the Southern parts to the Sahel Savannah in the Northern fringes. A major cotton growing state in the country, Katsina State is bordered to the West by Zamfara State, to the South by Kaduna State, East Kano State and North by Niger. The topography of the State is generally flat with the northern fringes covered with undulating sand dunes. The climate is tropical, usually with high temperatures recorded between the months of April and October. Rainy season is short from May to September with average rainfall of between 600 mm and 1000 mm; the southern part of the state having higher rainfall than the northern parts.

Over 80% of the population in the state live in the rural areas and agriculture is the dominant occupation of the people. Major crops grown include millet, sorghum, maize and cotton; the people also engage in livestock husbandry mainly cattle, sheep and goats.

Sampling and Data Collection

A combination of purposive and random sampling techniques was used, firstly to select four major cotton growing Local Government Areas (Dutsima, Faskari, Kankia and Safana). Five villages were randomly selected from each LGA and 10 cotton farmers from each selected village were randomly selected using the list of cotton farmers provided by the Agricultural Department of the LGAs. The selected 200 respondents were interviewed using a structured questionnaire administered by one Field Assistant per LGA. At the end of the exercise, 192 questionnaires were duly completed and retrieved.

Data Analysis

Data were analyzed using simple descriptive statistics including means, frequencies and percentages. Multiple regression analysis was used to determine the socio-economic variables that influenced adoption of chemical pest control techniques. The implicit function of the multiple regression model used is as shown:

$A = F (X_1, X_2, X_3, X_4, X_5....X_8+e)$

Where:

A	=	Adoption rate
X_1	=	Respondent age
X_2	=	Farmer's level of education
X_3	=	Farming experience
X_4	=	Contact with extension agents
X_5	=	Membership of voluntary/cooperative association
X_6	=	Size of farm
X_7	=	Mixed cropping pattern
X_8	=	Use of practice to increase farm returns

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Cotton Farmers

Results in Table 1 showed that the mean age of the cotton farmers in the study area was 39.6 years. Majority (71.4%) of the farmers fell in between 31 and 50 years and only 16.1% were above 50 years, implying that most of the respondents are in their active productive years which is in line with the findings of Azadeh *et al*. (2009) in their study of socio-economic characteristics of farmers regarding sustainable soil management (SSM).

Educational status of the respondents was found to be generally low; only about 33% had gone through formal education. This agrees with the findings of Ibrahim and Umar (2008) and Azadeh *et al*. (2009) about farmers in their respective studies. It is evident that in terms of farming experience, majority (76%) have been farming for over 15 years.

In line with the findings of Ajani (2000), the more experienced a farmer, the more likely that he will be able to make sound decisions regarding resource allocation and management.

The result also showed that farm size varied extensively from less than 0.5 ha to over 10 ha, with a mean farm size of 2.8 ha. This is consistent with the findings of Ibrahim *et al*. (2009) in their study in North Central Nigeria where the mean farm size was 2.16 ha and the predominant range observed was 1-2.99ha. Regarding membership of cooperatives and farmers groups, 48.4% belonged while 51.6% did not belong to any group. The level of extension contact was also assessed and only 5.2% claimed to make contact on monthly basis; 22.9% quarterly, 41.1% once in six months and 30.8% once a year. Low extension contact among the cotton farmers was similar to the findings of Olaleye *et al*. (2009) on access to agricultural inputs in Niger State.

Table 1: Distribution of cotton farmers based on socio-economic characteristics (n-192)

Characteristics	Frequency	Percentage (%)	Mean
Age			
< 30 years	24	12.5	
31-40 years	60	31.3	39.6
41-50 years	77	40.1	
>50 years	31	16.1	
Educational Attainment			
No formal education	87	46.3	
Primary education	42	21.9	
Secondary education	15	7.8	
Tertiary education	7	3.6	
Adult education	41	21.4	
Farming experience			
<15 years	46	24.0	
16-30 years	89	46.4	23.2
>30 years	57	29.6	
Farm size			
< 2 hectares	14	49.0	
3-4 hectares	69	58.9	2.8
>5 hectares	29	15.1	
Membership of cooperative			
Yes	93	48.4	
No	99	51.6	

Source: Field Survey (2014)

Level of Awareness and use of chemical control techniques

The study sought to elicit the level of awareness as well as the use of chemical control of cotton pests. The results showed that 93.2% of the respondents were aware of the practice and only 6.85% are unaware of the practice. Evidently, this is a popular practice among cotton farmers in the area considering the high level of awareness. Among those who are aware of the practice, 54.8% apply chemical control on a regular basis, 24.7% sometimes, while 17.8% seldom used the technique for pest control. These results are

similar to the findings of Ajibaje (1996) and Adeniji (2007) on the production and constraints to cotton production. In their separate studies, the level of awareness was generally higher than the level of application of practice.

Table 2: Distribution of respondents based on level of awareness and use of chemical control (n-192)

Awareness and use	Frequency	Percentage (%)
Aware and use regularly	98	51.0
Aware and use occasionally	49	25.5
Aware but seldom use practice	32	16.7
Not aware of practice	13	6.8
Total	192	100

Source: Field Survey (2014)

Socio-Economic Variables Influencing Adoption

The regression result showed that educational status, farm size and membership of organizations significantly influenced adoption of chemical control at P<0.05 level. Contact with extension workers was also found to be significant at P<0.01 level. In contrast, age, farming experience, mixed cropping patterns and increasing net returns did not seem to have any significant influence on the adoption of chemical pest control on cotton either at P<0.01 or P<0.05 levels.

These results are similar to those of Ndagbu *et al*. (2015) in their study on adoption and impact of early maturing maize in Safana Local Government Area of Katsina State where they found the factors influencing adoption to include age, size of farm, extension contact and previous income.

Table 3: Regression estimate of variables influencing adoption of chemical pest control

Variable	Regression coefficient	T-value
Age	-0.005	-1.324
Educational status	0.012	2.537**
Farming experience	0.004	0.117
Extension contact	0.039	1.987*
Membership of organization	0.024	4.107**
Size of farm	0.031	2.163**
Mixed cropping pattern	-0.001	0.012
Increasing net returns	0.010	1.334

Source: Field Survey (2014); R^2=0.381 * significant at P<0.01; **Significant at P<0.05

Constraints to the Adoption of Chemical Control Techniques

The constraints as well as their severities as perceived by the framers are shown in table 4. The results showed that high cost of pesticide ranked first in terms of severity,

followed by the technical nature of the chemical application and the non-availability of the pesticides sometimes. The high and rising cost of agro-chemicals in the country was the reason given by those who claimed to have discontinued using chemical control or use technique sometimes. Technical nature of the practice was the second ranked constraints, aspects of which have to do with choice of equipment, calibration and even mixing and diluting chemicals. The farmers also complained about the chemicals not being available sometimes, in addition to having to check for genuine products in view of the prevalence of adulterated forms in local markets. Inadequacy of extension input and crop mixtures are other constraints identified by the farmers. The importance of effective extension reach cannot be over-emphasized considering the technical nature of this technique and the generally low level of education of the farmers. These constraints are similar to those identified by Adeogun and Uwagbue (2008) in their study of integrated pest management (IPM) practices adopted by cocoa farmers in Osun State, Nigeria.

Table 4: Constraints to adoption

Constraints	Frequency	Percentage	Ranking
Technical nature of technique	132	22.1	2
Non-availability of chemicals	85	14.2	3
High cost of chemicals	171	28.6	1
Prevalence of fake/adulterated chemicals	76	12.7	4
Crop mixtures	63	10.5	6
Inadequacy of extension advice	71	11.9	5
Total	598*	100	-

Source: Field survey (2014) *multiple responses recorded

CONCLUSION

There was high level of awareness of the chemical pest control techniques among the cotton farmers with few farmers claimed ignorant of the techniques. However, majority of the respondents are aware and regularly apply the technique. The high cost of chemicals was the most limiting constraints to the use of chemical control. This was followed by the technical nature of chemical control technique, non-availability of chemicals and the prevalence of adulterated forms especially in remote rural markets.

The results of the multiple regression analysis showed that educational status, farm size and membership of cooperative significantly influenced adoption of chemical control techniques ($P<0.05$). Also of significant influence was contact with extension workers ($P<0.010$). In contrast, age, farming experience, crop mixtures and increasing net returns did not show any significant influence on the adoption of chemical control either at $P<0/01$ or $P<0.05$ levels.

Based on the constraints identified as mitigating the adoption of chemical pest control techniques, recommendations are proffered in the area of subsidizing the cost of farm inputs, especially agro-chemicals, intensifying extension contact delivery and enhancing access to farm credit.

REFERENCES

Adeniji, O.B. (2007). Constraints to improved Cotton production in Katsina State, Nigeria. *Journal of Applied Sciences*, 7:1647-1651.

Adeogun, S.A. and Uwagbue, E.O. (2008). Integrated pest management (IPM) by Cocoa farmers in controlling pests and diseases of Cocoa in Osun State. *Nigerian Journal of Rural Society*, 8 (1): 126-136.

Ajani, O.I. (2000). Resource Productivity in Food Crop Farming in the Northern Area of Oyo State, Nigeria. PhD Thesis, Department of Agricultural Economics, University of Ibadan.

Ajibade, R.O. (1996). Production and \Marketing of Cotton in Zaria: Problems and Prospects. HND project report. SCA/ABU, Zaria, pp.4.

Azadeh, N., Abdokizim, A., Mohammed, C. and Masoud, B. (2009). The socio-economic characteristics of wheat farmers regarding adoption of sustainable soil management (SSM). *Journal of Human Ecology*, 27(3): 201-205.

Fortucci, P. (2009). The contribution of cotton to economic and food security in developing countries. FAO Commodities and Trade Divisions, Technical Report, Rome. 10 pp.

Hill, D.S. and Walter, J.M. (1990). *Pests and Diseases of Tropical Crops*. Intermediate Tropical Agriculture Series, London, 175 pp.

Ibrahim, H. And Umar, H.S. (2008). Determinants of poverty among farming households in Nasarawa State, Nigeria. *Journal of Production Agriculture and Technology*, 4(1):11-21.

Ibrahim, H. Bello, M. And Ibrahim H. (2009). Food Security and Resource Allocation Among Farming Household in North Central Nigeria. *Pakistan Journal of Nutrition*, 8(8): 1235-1239.

Ndagbu, N.N., Abdulsalam, Z,. Abdulraham, S and Abdoulaye, T. (2015). Adoption and impact of early maturing maize varieties on farm income in Safana Local Government Area of Katsina State, Nigeria. *African Journal of Agricultural Research* 10(34): 3374-3381.

Nduka, I.U. (2012). *Economic Empowerment Through Agricultural Production*. Umah Publications, Benin, Pp. 284.

Okonmah, L.U. and Eruotor, P.G. (2012). *Arable Crop Production*. Ethiope Publishing Corp. Benin. 226 pp.

Olaleye, R.S., Ibrabim, M. And Ojo, M.A. (2009). Probit Analysis of Women Access to Agricultural Inputs in Bosso Local Government Area, Niger State, Nigeria. *Journal of Agricultural Extension*, 13(2): 1-9.

Sement, G. (1998). *Cotton.* Macmillan Publishers, New York. 314 pp.