International Journal of Agriculture Innovations and Research
Volume 3, Issue 6, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 15/03/2015 | Accepted on : 31/03/2015 | Published : 03/06/2015

Studies on Cowpea Insect Pests Management Practices Among Cowpea (*Vigna unguiculata* L. Walp) Farmers in Mubi Zone, Nigeria

Sabo Elizabeth
School of Agriculture, National Open University, Nigeria
Email: elikwabe@yahoo.com

Abstract – **The roles of institutional and socioeconomic variables as they affect awareness and effectiveness of insect pests management technologies in cowpea was investigated among cowpea farmers in Mubi zone, Adamawa state, Nigeria. Respondents are cowpea farmers selected from cowpea growing areas in the study area. A multistage sampling method was used to identify the locations and farmers were randomly selected. The focus group discussion and questionnaires were used to source for information from the respondents. Findings indicated that awareness and adoption rate of insect pest control technologies were especially for use of insecticides. On the other hand awareness was low for use of bio-pesticides and resistant varieties. Similarly effectiveness the use of resistant varieties and bio-pesticides were least adopted and effective compared to the use of insecticides, certified seeds and spraying method and regime. This investigation showed that expensive inorganic insecticides, health hazards, farm size, high cost of control methods and illiteracy limit effective use of IPM technologies communicated to the farmers.**

Keywords – Cowpea, Technology Information, IPM, Bio-Pesticides, Over Use.

INTRODUCTION

Innovation is an idea or practice that is perceived as new by an individual. Technology innovations consist of both the idea component and the object component [1] and [2]. The transfer of technology (scientific and technical knowledge, ideas, services, inventions and products) from the origin of their development to where they can be put into operation is important for purposes of high farm returns. The importance of technology to insect pests' management is widely recognized. This is predicated on the observed impact of these technologies and its potential and actual contribution to seed yield and income as well as health and environmental hazards. [3] noted that the rate of adoption of technologies by farmers using chemical fertilizers in Northern Zone of Tanzania was 64% and 44% on moderate rainfall zone and low rainfall zone respectively. Several studies had indicated that the characteristics of household head such as age influence the rate of adoption [4]. Specifically, young farmers tended to be more educated and innovative than older farmers and have a lower level risk averse towards technology adoption [5]. Gender is another factor that influences adoption of technologies either positively or negatively. For instance, [6] and [7] found that gender showed significant negative influence on the rate of adoption of technologies in several development projects. Also [8] found that gender had significant influence on technology adoption. Institutional factors affect adoption of technology through supporting services offered to farmers. For instance, [9] reported that well established credit system, research and marketing stimulate small businesses which enable adoption of new technologies. Also, several studies had indicated that farmers contact with extension staff increases probability of adopting introduced technologies [10]. The reason is that extension services create awareness on the availability and importance of new innovation on economic development of small holders farmers. However, studies have shown that, the negative relationship between extension services and adoption of technologies could be attributed to inappropriateness of technology brought to the target group [11]. In most farming communities farmers adopt technologies when such technology will impact positively on their production, livelihood and profitability, however such technologies must be easy to interpret, adapt to their conditions and cheap. In general extension services must create awareness on the availability and importance of new innovation for economic empowerment of small holder's farmers. However, a negative trend in this regard could result into inappropriateness of technology brought to the target group. This is the decision of the farmer to reject an innovation after having previously adopted. In farming communities' farmers either rejecting an innovation in order to adopt a better one that supersedes it or reject an idea as a result of dissatisfaction with its performance. However there is the possibility that this trend could have guided the adoption of some cowpea insect pests' management in Mubi zone of Adamawa state. Cowpea production is limited by an array of agronomic (poor soil fertility, high cost of land preparation etc), socio economic (sex, age, education etc) and institutional (farm size, membership of social organization etc) constraints, this is also applicable to the study area. These have negatively impacted on crop growth, yield and livelihood. The preponderance of cowpea insects on farmers' fields causes huge yield losses in most cases grain yield less than 10kg are obtained on farmers' fields [12]. In addition, high cost of insecticides, adulteration, misuse and over use have been the bottle of cowpea production [13]. This has greatly contributed negatively yield obtained on farmers' field, on the other hand farmers require high capital for purchase of seeds, agrochemicals and payment of labour, these makes cowpea production very complex and not interesting. The extension services have not been able to disseminate and impact to cowpea farmers in this zone, the recommended integrated pests' management practices, which emphasize the use of resistant varieties alongside complementary practices [14]. At present farmers are not adopting this all important agronomic and integrated approaches designed for insect pest management. This may be due to the complexity of the technology or inadequate on-farm demonstration and dissemination [15]. It is important to understand awareness level of insect pests' management techniques by cowpea farmers, how socio-economic, institutional, demographic variables and agronomic practices influence awareness and adoption of insect pests' management techniques. Further how effective are these insect pests' management techniques among farmers in Mubi zone. However, it is important to understand if insecticides are being spread by farmers at a recommended dose or over dosed. Either of these conditions poses a serious health hazard to the farmers and the communities, degradation of the soil and environment. There is inadequate information on awareness, adoption and determinants of adoption of information technology in the study area hence the need for this research [15]. Several parameters have influenced adoption behavior of farmers from qualitative and quantitative models. Social scientists investigating farmers' adoption behavior have accumulated considerable evidence to show that demographic variables, technology characteristics, information sources, knowledge, awareness, attitude, and group influence affect adoption behavior. This could either be positive or negative. In most cowpea farming communities' adoption of insect pests technologies and factors that influence adoption need to be constantly updated to keep pace with constantly changing farmers attitudes, needs, preferences and perception about new and existing technologies, and changes in environment. The objectives of this study are to evaluate the institutional and socioeconomics characteristics of cowpea farmers, evaluate awareness and effectiveness of the insect pests' management technologies communicated to cowpea farmers.

Methodology

A multistage sampling procedure was adopted for this study, five local government areas, which constitute Mubi zone were purposively selected for this study. Two districts each from each LGA namely Michika and Bazza (Michika Local Government Area), Muchala and Mubi (Mubi North Local Government) Maiha and Pakka (Maiha Local Government), Gulak and Shuwa, (Madagali Local Government Areas) and Mugulvu and Gella (Mubi South Local Government) were purposively selected due to preponderance of cowpea cultivation activities and population density. Thereafter two villages were selected at random from each district Muchala (Mayo bani and Muva), Mubi (Batonde and Mukta), Michika (Watu and Lughe), Bazza (Kudzum and Likuni), Maiha (Bwade and Cede), Pakka (Dafra and Duhu), Gulak (Sukur and Duhu), Shuwa (Mayowanda and Gubla). Proportionate sampling of farmers was undertaken to select 700 farmers from the 10 districts, and 20 villages based on their population. For the purpose of this study both primary and secondary data were used, the questionnaire was the source of the primary data. Of the 700 questionnaires administered over two years, 611 were returned and thus constituted the sampling size and were processed for data analysis. For each village 20 cowpea farmers were randomly selected to provide information on the cowpea production activities, awareness, and adoption of insect pests' management technologies. The survey took place through August 2008 and December 2009 cowpea cropping season, Questionnaires were administered by the researcher alongside some assistants from the ADP staff. The data covered demographic, socio-economic characteristics, awareness of insect pests' management techniques and influence of socio economic, demographic and institutional variables on adoption of integrated insect management technologies. The following variables were measured; Age, level of education, gender, marital status, type of cropping system, farm size, experience (in years) of cowpea farming, access to credit, access to extension services, source of labour. Chi-square was used to test the 'goodness-of–fit' for a frequency distribution and if the categories observed for socio-economic, institutional and production variables differ or are similar. The extent to which socioeconomic variables, institutional and production characteristics limit adoption of IPM techniques and cowpea production was rated. Awareness of cowpea production of technologies were categorized in accordance to a four-point Likert-type scale of Great extent = (4), some extent = (3), little extent = (2) and No extent = (1). And effectiveness of cowpea IPM packages for cowpea was evaluated using percentages. IPM packages were expressed on a scale of very effective= (4), effective= (3), ineffective= (2) and very ineffective = (1). Data collected between August 2008 to December 2009 were also categorized in accordance to four-point Likert scale of very important = (4), important= (3), slightly important = (2), not important = (1) and great extent= (4), some extent= (3), little extent= (2) and no extent = (1). The mean score for each technology information/factors was determined. Technology information/factors with a mean score of equal and above the cut-off mean of 2.0 was declared as information source perceived as important, and any mean score lower than 2.0 was classified as information that is not important.

Result and Discussion

Respondents within the age group of 31 - 40 years accounted for 43%, this implied that majority of the farmers are young and of the middle age group, expectedly they are supposed to be physically able and mentally alert in learning new technologies than older farmers (Table 1). In a separate study [15] had reported that young adult farmers have high aspirations to accept new technologies than older farmers. Cowpea production is male dominated; consistent with this result are previous reports of [16] among cotton farmers in Zone 1 and 2 of Adamawa State. In contrast to high participation and willingness of women farmers as compared to men in cultivation of *Kalima* variety of cowpea in Malawi [17]. 21% of the respondents had no formal education, cowpea farmers with primary/quoranic education were predominant, most of the respondents were married (76%), and the implication of this is that labour could be readily available for farm activities. Respondents with household 1- 5 accounted for (36%), 41% of the respondents had 6-10 household size. Large household size implied availability of farm labour and could reduce labour cost. This result mirrored those reported by [18] among citrus famers. 90% of the respondents are actively involved in cowpea farming, this is an indication interest will be high for new technology that could assist to improve livelihood of the farmers. 37% of the respondents had below 10 years experience in cowpea production, 32% had between 11 and 20 years of experience, and farmers who had between 21 and 30 years experience accounted for 23%, because of their experience, they are able to acquire needed skills to use technologies compared with the younger ones. Farmers who owned between 1 and 5 hectares accounted for 75%, farm size is important in farm decisions. The use of insecticides, fumigants, biopesticides and cultural practices are a few of the insect pests' management technologies developed by research and communicated to farmers' as Insect Pests Management Technology (IPM) in the study area, primarily to reduce damage on cowpea by insect pests during field planting and storage. To understand the challenges in the use of insecticides and how effective are these insecticides in the control of insect pests in cowpea, farmers were asked to provide information on types of insecticides used, application methods and how effective are these insecticides in the control of insect pests in cowpea.

Table 1: Socio-economic variables of cowpea farmers in Mubi zone

Variable	Category	Frequency	Percentage	Df	Chi square	Probability
Age	20-30	102	17	3	128.65	**
	31-40	261	43			
	41-50	167	27			
	51>	81	13			
	Mean= 38					
Gender	Male	449	74	1	134	***
	Female	162	26			
Educational attainment	No formal education	127	21	4	271.6	**
	Primary/Quoranic	267	44			
	Secondary school	77	12			
	Diploma	121	20			
	Degrees	19	3			
Marital status	Single	147	24	1	164.47	**
	Married	464	76			
Household size	1-5	219	36	3	410.11	**
	6-10	250	41			
	11-15	84	14			
	>15	58	9			

Source: Field survey, 2008-2009. ** P<0.01, *** P<0.001 level of probability.

As shown in Table 2, 98% of the cowpea farmers indicated that they used inorganic chemicals to control insect pests during field planting and storage, while 2% indicated otherwise. The preponderance in use of inorganic insecticides as compared to organic insecticides observed in this study is similar to reports of [19] on the preponderance of inorganic insecticides and organic insecticides among Nigerian cowpea farmers and elsewhere. In addition, this present investigation showed that several insecticides are used by the cowpea farmers in the study area. It is important to note that insecticides have varying mode of activity, while some have narrow spectrum activity, other have broad spectrum activity. Cowpea farmers in the study area who applied insecticides twice during the crop cycle accounted for 50% of the respondents. Those who applied insecticides three times during cowpea crop cycle accounted for 21% of the respondents. While those who sprayed once constituted 9% of the cowpea farmers. Farmers who applied insecticides for a period of four times and over summarized 21% of the cowpea farmers interviewed. In addition, the quantity of insecticides (liter) used by the cowpea farmers is dependent on the insect pest predominance, farm size, spraying regime (spraying intensity) and dilution ratio (water to insecticides). This study indicated that insecticides (liter) used by farmers per acre ranged between 1 and 3 liters. Cowpea farmers who used 1 liter/hectare accounted for 57%, and cowpea farmers who applied between 2 and 3 liter/acre accounted for 29% and 14% respectively. The foregoing is a pointer to an excessive use of insecticides by cowpea farmers in this zone, and the possibility that the farmers do not adhere to recommended dilution of insecticides, which is recommended as 20 mls into 10 liters of water. Also, this study sought to understand how long it takes for insects to appear on cowpea plant after each spraying in Mubi zone. Responses diverge between 1 week and 5 weeks. Farmers' who indicated that it took 1 week, 2 weeks, and 3 weeks to see insects on cowpea after spraying accounted for 16%, 22% and 18% respectively (Table 3). However, farmers who indicated 4 weeks and 5 weeks accounted for 33% and 12% respectively. The Chi-square goodness of fit for

IJAIR
International Journal of Agriculture Innovations and Research
Volume 3, Issue 6, ISSN (Online) 2319-1473

this category was significant (P<0.05). This implies that distributions into these categories differed. The resurgence of insects on cowpea plants is dependent on the mode of action of the insecticide (contact or systemic), whether it is narrow or broad spectrum approach and the active ingredient. However, a rainfall between 5 - 45 minutes after a spray of insecticides will affect the efficacy of the insecticide. Therefore, farmers are advised to spray after rainfall or whenever the sky is not cloudy. In Table 3, majority (71%) of cowpea farmers interviewed indicated that consideration for the cost of insecticides is extremely not important during purchase. Similarly, consideration for the dealer 76% was important criterion during purchase of insecticides in the open market.

Insect Pests' Management Technologies by Farmers

Awareness and adoption rate of insect pest control technologies were evaluated using fifteen integrated pests' management practices obtained from the Agricultural Development Project and Ministry of Agriculture, Yola, Adamawa State (Table 4). Items included in the package are listed in the Table. However in view of variation in soil factors and farmers preference, variation in technology recommendations was noticed, specifically for planting distances, application of SSP before planting and application of SSP at $200kg/ha^{-1}$. In Table 4, awareness of insect pests' management technologies ranged between 7% and 100%. Awareness was low for use of biopesticides (7%), insect resistant varieties (16%) and early maturing varieties of cowpea (3%) and high (100%) in intercropping, seed treatment, insecticides, weed management, spraying technology and regime, harvest technology and management of storage pests, but moderate (51%) for use of improved varieties. A lower awareness score may be associated with inadequate information made available to the farmers through communication channels in the study area. However, technologies which recorded high awareness rate may be due to the availability of such technologies to farmers in the study area. In addition, using the six stages of adoption for each insect pests technology, the number of cowpea farmers who adopted each technology and the adoption rate in Table 4 indicated a low (2%) to high (100%) adoption rate for use of insect resistant varieties, resistant varieties, biopesticides and high rate (90-100%) for use of insecticides, spraying method and regime, management of storage pests, spacing and crop rotation. While intercropping and harvest technology recorded values intermediate between the two extremes. A high adoption rate as found in this study for use of insecticides, spray time and regime and management of storage pests is traceable to the fact that farmers are aware that treatment of seeds, spraying of insecticides, making use of spraying time and regime are requirements for high yield in cowpea. In a similar study [15] and [20] reported a high rate of awareness and adoption of use of inorganic insecticides in cowpea production. A low adoption rate for use of improved seeds, resistant varieties, biopesticides and early maturing varieties may be associated with a low rate of awareness, complex nature of these technologies, inadequate result demonstration to convince the farmers to adopt these technologies. In another study [21] reported that among cowpea farmers in northern Nigeria, that low use of some technologies such as fungicides, herbicides, and fertilizers may be related to low awareness and high cost. Effectiveness was evaluated for sixteen insect pests' management technology information communicated to the farmers using four point Likert scale. The mean score of 2.0 was assumed moderate, mean score greater than 2.0 was assumed to be very effective and whenever the score was less than 2.0, such a technology was assumed to be less effective or in effective.

Table 2: Distribution of respondents by use of insecticides and effectiveness of these chemical

Character	Category	Frequency	Percentage	Df	Chi square	Probability
Type pesticides used in control of insect pests	Inorganic insecticides	600	98	1	564.21	**
	Organic chemical	11	2			
Types of insecticides used in cowpea storage	Karate	382	63	8	1566.11	**
	Decis	59	10			
	Sherpa plus	14	5			
	Nuvacron	94	2			
	DD Force	20	12			
	DDT	17	3			
	Perfekthion	5	3			
	Upper cott	5	1.3			
	Super cott	4	0.7			
Period (time) of application of insecticides in one cycle of cowpea planting	Once	58	9	5	555.96	**
	Twice	120	50			
	Thrice	308	21			
	Four times	66	11			
	Five times	22	4			
	Six times	37	6			

Severity of insect damage at flowering before spraying	Yes	511	83	1	74.39	**
	No	100	17			
Quantity of insecticides (lit) used/ha	1 liter	256	57	2	126.72	**
	2 liter	133	29			
	3 liter	63	14			

**P<0.01=Significant at 1% level of probability.

Table 3: Distribution of respondents by use of insecticide and effectiveness of these chemical

Presence of insect after spraying at flowering	No	147	24	1	55.23	**
	Yes	464	75			
Insect damage serious after spraying	Yes	404	66	1	4.28	**
	No	207	34			
Time interval for appearance of insects after spraying	1 week	98	16	4	8.97	**
	2 weeks	132	22			
	3 weeks	105	18			
	4 weeks	204	33			
	5 weeks	72	12			
Consideration of the dealer during purchase of insecticides	Extremely important	175	29	1	111.49	**
	Not important	436	71			
Consideration of price during purchase of insecticides	Extremely important	542	76	1	401.75	**
	Very important	69	11			

**P<0.01 level of probability.

Table 5 reveals that the effectiveness rating was high for use of insecticides (3.36) and spraying method (3.3). This was closely followed by spraying methods and techniques, spraying time and regime and weed management. Other technology information evaluated recorded moderate effectiveness mean scores 2.00 - 2.33. These technologies included intercropping, crop rotation, harvesting and processing methods. Eight insect pests management technology information packages namely: spacing, seed treatment, cultural practices, use of traps, planting resistant varieties and spray bio-pesticides recorded mean scores less than 2.0. The effectiveness scores in Table 5 shows that spacing, seed treatment, cultural practices, use of traps, planting resistant varieties and spraying bio-pesticides are less effective in control of insect pests in cowpea farms in Mubi zone. This may be associated with absence of information about these technologies and complex nature of these technologies.

Table 4: Distribution of respondents based on awareness and adoption of insect pests' management technologies information packages.

Technologies	Awareness number (Frequency)	Awareness percentage (%)	Adopted (Frequency)	Adoption rate (%)
Use of improved seed (seed yield)	311	51	106	17
Spacing	600	98	548	90
Intercropping	611	100	341	56
Seed treatment	611	100	606	99
Use of insecticide	611	100	611	100
Weed management	611	100	458	75
Crop rotation	603	99	580	96
Spraying technology and regime	611	100	607	99
Harvest technology	611	100	320	52
Processing and storage	450	74	211	35
Integrated pest management	457	75	300	49
Use of resistant varieties	100	16	12	2
Use of biopesticides	42	7	12	2
Early maturing variety	17	3	27	4
Management of storage pests	611	100	587	96

Table 5: Rating of insect pests' management technologies information packages among cowpea farmers in Mubi zone (n=611)

Variables	Very effective	Effective	Ineffective	Very ineffective	Total	Mean Score	Rank
Use of improved seeds	45 (0.29)	100 (0.49)	200 (0.65)	266 (0.44)	611	1.87	11
Spacing	0 (0.00)	200 (0.98)	270 (0.88)	141 (0.23)	611	2.09	8
Intercropping	99 (0.65)	81 (0.40)	290 (0.95)	141 (0.23)	611	2.23	6
Seed treatment	251 (1.64)	284 (1.39)	70 (0.23)	6 (0.01)	611	3.27	4
Weed management	90 (0.59)	270 (1.34)	231 (0.76)	20 (0.03)	611	2.71	5
Crop rotation	67 (0.44)	82 (0.40)	244 (0.80)	285 (0.47)	611	2.11	7
Spraying methods and teach	274 (1.79)	280 (1.37)	40 (0.13)	17 (0.03)	611	3.32	2
Harvest methods	100 (0.65)	33 (0.16)	278 (0.95)	200 (0.33)	611	2.05	10
Processing and storage	72 (0.47)	100 (0.49)	241 (0.79)	198 (0.32)	611	2.07	9
Cultural practices	0 (0.00)	82 (0.40)	278 (0.91)	251 (0.41)	611	1.72	13
Spray time and regime	270 (1.77)	258 (1.27)	80 (0.26)	3 (0.005)	611	3.31	3
Use of trap crops	0 (0.00)	0 (0.00)	321 (1.05)	290 (0.47)	611	1.52	14
Use of inorganic insecticides	250 (1.64)	341 (1.67)	11 (0.04)	9 (0.01)	611	3.36	1
Use of resistant varieties	0 (0.00)	8 (0.04)	234 (0.77)	369 (0.60)	611	1.41	15
Early maturing varieties	21 (0.14)	44 (0.22)	359 (1.18)	187 (0.31)	611	1.85	12

Numbers in parenthesis are calculated scores for each category
Mean score > 2.00 was effective; Mean score < 2.00 was ineffective.

Conclusion

Awareness was found to be high for most insect pests' management technologies surveyed among cowpea farmers. Also awareness rate was high for use of inorganic insecticides, spraying time and regime, crop rotation, but low for use of resistant varieties and bio-pesticides, which are technologies that have little adverse effects on the environment. However, spraying methods and regime, use of inorganic insecticides, spraying time and regime, weed management and seed treatment were found to be very effective among the farmers. This present investigation evaluated the extent to which socioeconomic and institutional variables limit adoption of some insect pests' management technologies. The outcome indicated that expensive inorganic insecticides, health hazards, farm size, high cost of control methods and illiteracy.

References

[1] E. M. Rogers, and F. F. Shoemaker, (1971). *Communication of Innovation: A cross-cultural Approach, Second* Edition, New York, The Free press, collier MacMillan publishing Co. Inc. 12-23.

[2] Rogers, E. M (1983). Diffusion of Innovation: (3rd Edition), Collier Macmillan, New York.

[3] Nkonya, E. (2001). Cross pollinated crop variety adoption studies and seed recycling: the case of maize in Tanzania. International Food Policy Research Institute, Kampala, Uganda. 20.

[4] Steele, W. M. (1972). Cowpea in Africa. PhD thesis, University of Reading, Reading, UK.

[5] Ntare, B. R.(1990). Intercropping morphologically different cowpeas with pearl millet in a short season environment in the Sahel. *Experimental Agriculture,* 26: 41-47.

[6] Adugna,T. (1997). Factors influencing the Adoption and intensity of use of fertilizer: The case of Lume District, Central Ethiopia. *Quarterly Journal of International Agriculture,* 36:173-187.

[7] Saginga, C.P (1998). Adoption and social impact assessment of agricultural technologies. The case of Soybean in Benue State, Nigeria. Unpublished Thesis for Award of PhD Degree at University of Ibadan, Nigeria. 13.

[8] Adesina, A., Mbila, D, Nkamleu, G. B. and Endamana, D (2000). Econometric analysis of the determinants of adoption of alley farming by farmers in the forest zone of southwest Cameroon. *Agricultural, Ecosystems and Environment,* 80:255-265

[9] Minde, I and Mbiha, E. R. (1993). Production,Technology and Constraints in the sorghum and millet based farming systems, In: Minde, I. J and Rorhrbach, D.D. (eds). Sorghum and millet marketing and Utilization in Tanzania. Proceedings of the *Food security and Development*, 3-5 May 1993 Arusha International Conference Centre. SUA, MoAC and SADC-ICRISAT, 28-44.

[10] Rutatora, D.F and Mattee, A.Z (2001). Major agricultural extension providers in Tanzania. Center for Sustainable Rural Development, Sokoine University of Agriculture. *African study Monographs,* 22 (4): 155-173.

[11] Dimara, E. and Skuras, D.(1998). Adoption of New Tobacco varieties in Greece; Impact of Empirical findings on policy design. *Agricultural economics,* 19: 297-307.

[12] Jackai, L. E. N. and Adalla, C. B. (1997). Pest management practices in cowpea: A Review.Pages 240-258 in Advances in cowpea research, edited by B. B. Singh, D.R. Mohan Raj, K.E. Dashiell, and L. E. N. Jackai, Sayce Publishing, Devon, UK.

[13] Adebayo, K (1997). *Communication in Agriculture*. Abeokuta Greenlinks International:53-54.

[14] Adamawa State Development Programme (1990). Yearly Bulletin Pp 2.

[15] Agwu, A. E. (2000). Diffusion of Improved Cowpea Production Technologies among Farmers in the northeast Savanna zone of Nigeria. Phd Thesis, Department of Agricultural Extension, University of Nigeria, Nsukka.

[16] Sabo, E and Dia, Y. Z (2009). Awareness and effectiveness of vegetable technology information packages by vegetable farmers in Adamawa State, Nigeria. *African Journal of Agricultural Research,* 4(2): 065-070.

[17] Masangano, C. M and Miles, C. A. (2004).Factors influencing farmers' adoption of kalima Bean (*Phaseolus vulgaris* L.) variety in Malawi. *Journal of sustainable Agriculture*, 24 (2) 117-129.

[18] Eniola, P. O. and Fawole, O. P. (2007). Access to production information among citrus farmers in Atisbo Local Government Area of Oyo State. *Journal of Agricultural Extension*, 10:12-19.

[19] Tamo, M., Bottenberg, H., Arodokoun, D., and Adeoti,R. (1997). The feasibility of classical biological control of two major cowpea insect pests. *In* Advances in cowpea research, edited B. B. Singh, D. R. Mohan Raj, K. E. Dashiell and L. E. N. Jackai (eds), *Advances in Cowpea Research*, Syace Publishing, Devon, UK. 249-265.

[20] Agwu, A. E (2004). Factors affecting adoption of improved cowpea production technologies in Nigeria *Journal of International Agriculture and Extension Education*, 11(1) 81-88.

[21] Alghali, A, M.(1993). Intercropping as a component in insect pest management for grain cowpea (*Vigna unguiculata* [L] Walp) production in Nigeria. *Insect Science and Application,* 14:49-54