Research Article

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Socioeconomic Determinants of Insect Pest Control Methods' Utilization for Storage in North Central Nigeria

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ABSTRACT

The impetus for this study is the need to understand factors influencing the use of insect pest control methods in North Central Nigeria. Specifically, the study described the socioeconomic characteristics of respondents, assessed awareness and use of insect pest control methods, examined farmers' considerations and investigated factors influencing insect pest control decisions. Using a structured interview schedule to elicit information, data was collected by means of multi-stage sampling technique to select a total of 384 cowpea farmers for this study. A purposive selection of Kwara and Niger States paved way for the purposive choice of two agricultural zones in Kwara state and one agricultural zone in Niger state. Percentages, frequency counts, ranks, mean, and ordinary least square regression was used to analyze the data. The study revealed that the intended time of sale, time required to apply method, and time of application were the factors most considered for store insect pest control. Ordinary Least Square regression estimates demonstrate positive significant relationship between farm size (t=4.681), group membership (t=4.688), and quantity stored in tons (t=2.312) and intensity of use. Conversely, years of education (t=-2.196), years of cowpea farming experience (t=-3.419), and frequency of extension contact (t=-.534) had significant negative relationship with intensity of use. In conclusion, it is recommended that policy makers and extension staff put into consideration farm size, group membership, quantity stored, years of education, years of cowpea farming experience and frequency of extension contact in optimizing extension strategy for promotion of indigenous and alternative insect pest control methods.

Keywords: alternative, conventional, grains, indigenous, storage.

INTRODUCTION

The importance of insect pest control as a logical attempt to protect crops both in field and in store is well recognized. It is driven by the need to guarantee the availability of food, a key pillar of food security, and the desire to preserve investments. Insect pest control is all the more expedient since about 70% of the farming communities are smallholders (Akpan *et al.*, 2014), who have to contend with other inherent distinctiveness of the agricultural sector in Nigeria such as its rain-fed nature, vulnerability to climate change effects, and its subsistence and traditional characteristics (Kelemu, 2015). Crop production is the dominant subsector of the agricultural sector in Nigeria (Oyaniran, 2020) and the country holds a global competitive advantage in cowpea production. By some distance, Nigeria is the largest producer and consumer of cowpea accounting for 48% of production in Africa and 46% worldwide (IITA, 2017). It supplies food as a cheap source of protein, animal feed and cash for the rural populace (Bashir *et al.,*

2018) in addition to providing ground cover due to the spreading habit of the plant (Claudius-Cole *et al.,* 2014). In spite of the many advantages of the crop, the benefits that would have accrued to farmers and the nation have been severely limited by the activities of insect pests. As a result of the significantly detrimental effects of insect pests, cowpea production activities in Nigeria is trademarked by the use of different insect pest control methods starting from production through storage. Losses of between 20 and 50% have been attributed to insect pests in cowpea (Adebayo and Anjorin, 2018). Insect pest control is therefore imperative for increase in yield, protection of crops, preservation of quality and quantity of crops, safeguarding food availability, and maximization of efficiency. The methods are diverse with farmers embracing perceived proven and effective methods that span indigenous, conventional and alternative.

The conventional method, that is the application of synthetic pesticides, has been more extensively used, however, in recent times and indeed over the past decade, there has been an increased effort to promote indigenous and alternative pest control methods because of the associated human hazards. Underpinning this drive is the quest for responsible production and consumption which is the crux of the 12th Sustainable Development Goal of the United Nations. Accounts of food poisoning leading to death have continued to be reported (Gwary *et al.*, 2012). In the same vein, excessive pesticide use has brought censure on Nigerian agricultural exports. Given the foregoing, this study sought to ascertain the awareness and use of indigenous, and alternative insect pest control methods along with factors influencing their use by cowpea farmers in North Central Nigeria and was guided by an hypothesis stated in the null form as: no significant relationship exists between socio-economic characteristics of respondents and the frequency of use of insect pest control methods in Kwara and Niger States.

MATERIALS AND METHODS
The study was conducted in Kwara (Latitude 8^0 05' and 10^0 05' North and Longitude 2^0 50' and 6^0 05' East of Greenwich Meridian) and Niger (Latitudes $8^0$20' N and $11^0$30' N and Longitudes $3^0$30' E and $7^0$20' E) States. Both states are renowned for high production of cowpea (Bolarinwa *et al.*, 2021). The population comprised all cowpea farmers in both States. A multi-stage sampling procedure was employed to select respondents for the study. The first stage involved the purposive selection of two Agricultural Development Project (ADP) zones (Zone B and C) from the four zones in Kwara State and one zone (Zone I) from the three ADP zones in Niger State. Abdullahi and Tsowa (2014) reported a high concentration of cowpea farmers in Niger State ADP Zone I while Abdullahi (2016) asserted that Kwara State ADP Zone B and C respectively are more involved in cowpea production than other zones in Kwara State. The second stage involved the purposive selection of two local government areas (LGAs) namely Patigi and Edu (Zone B; Kwara State) Asa and Ilorin East (Zone C; Kwara State) and Edati and Mokwa (Zone I; Niger State) to ensure adequate representation of population in drawn sample. The third stage was the proportionate sampling of 112, 117 and 155 cowpea farmers to make for a total of 384 respondents. Data was obtained using a structured interview schedule and was analyzed using both descriptive (percentages, frequencies, means & ranks) and inferential (Ordinary Least Square Regression) statistics.

RESULTS AND DISCUSSION
Socioeconomic characteristics
As shown in Table 1, cowpea cultivation in Kwara and Niger States is male dominated (80.2%) and reflects the male-dominated nature of many societies in North Central Nigeria. The average land area cultivated is 3.6

hectares while the average quantity of cowpea stored was 4.1tons in the last farming season; cowpea farmers in Kwara and Niger States could be considered small scale farmers. The average age of the respondents was 48.9 years and 22.4% had received some form of tertiary education.

Awareness and Use of Insect Pest Control Methods in Store
Awareness is generally a precursor to utilization and adoption. There is a relatively high awareness of indigenous methods among respondents. For alternative pest control methods, PICS Bag (74.7%), Heat/steam treatments (61.5%), Hermetic Steel Drum (59.1%), and Silos (58.1%) were the most known. About half of respondents were aware of Cold Treatment (49.0%), and ZeroFly® hermetic bag (50.3%) in the study area. PICS Bag has been popularized through the Agricultural Development Projects (ADPs) in Nigeria for more than a decade. Alalade *et al.*, (2017) that majority of farmers in Kwara State were aware of the indigenous pest control methods. There is greater awareness (93.8%) and use (87.8%) of conventional methods to control cowpea insect pest than other methods. Sabo *et al.* (2014) affirmed that up to 99% of farmers use synthetic pesticides to control cowpea pest attack. The use of plant extracts in Kwara and Niger States is low despite a high percentage of farmers being aware.

Table 1. Socioeconomic Characteristics

Variables	Frequency (n=384)	Percentage	Mean (Std Dev.)
Sex			
Male	308	80.2	
Female	76	19.8	
Age (years)			48.9 (10.71)
21 – 40	89	23.2	
41 – 60	247	64.3	
61 and above	48	12.5	
Cowpea Farm size (Hectares)			3.6 (2.59)
Less than 1.0	10	2.6	
1.0 – 5.0	314	81.8	
6.0 – 10.0	45	11.7	
10.1 and above	15	3.9	
Level of Education			
0 year (No formal education)	121	31.5	
1-6years (Primary education)	104	27.1	
7-12years (Secondary education)	73	19.0	
Above 12years (Tertiary education)	86	22.4	
Quantity Stored (Tons)			4.1 (11.66)
Less than 1	141	36.7	
1 – 10	209	54.4	
11 – 20	25	6.5	
Above 20	9	2.3	

Source: Field Survey, 2021

Table 2. Awareness and Use of Insect Pest Control Methods in Store

Pest Control Methods	Aware	Not Aware	Used	Not Used
Indigenous				
Admixture with wood ash	310(80.7)	74(19.3)	218(56.8)	166(43.2)
Application of Neem extracts	311(81.0)	73(19.0)	195(50.8)	189(49.2)
Use of Jerry Cans	342(89.1)	42(10.9)	308(80.2)	76(19.8)
Storing unthreshed	337(87.8)	47(12.2)	269(70.1)	115(29.9)
Sunning at regular intervals	352(91.7)	32(8.3)	297(77.3)	87(22.7)
Admixture with fine sand	219(57.0)	165(43.0)	112(29.2)	272(70.8)
Admixture with clay dust	159(41.4)	225(58.6)	101(26.3)	283(73.7)
Oils (sunflower, cotton seed, groundnut)	225(58.6)	159(41.4)	166(43.2)	218(56.8)
Conventional				
Synthetic pesticides	360(93.8)	24(6.3)	337(87.8)	47(12.2)
Alternative				
ZeroFly® bag	193(50.3)	191(49.7)	109(28.4)	275(71.6)
Cold Treatment	188(49.0)	196(51.0)	145(37.8)	239(62.2)
PICS Bag	287(74.7)	97(25.3)	251(65.4)	133(34.6)
Heat/steam treatments	236(61.5)	148(38.5)	177(46.1)	207(53.9)
Hermetic Steel Drums	227(59.1)	157(40.9)	169(44.0)	215(56.0)
Silos	223(58.1)	161(41.9)	160(41.7)	224(58.3)

Source: Field Survey, 2021

Table 3. Frequency of Use of Insect Pest Control Methods in Store

Pest Control Methods	Always used	Sometimes used	Never Used	Mean (SD)
Indigenous				
Admixture with wood ash	90(23.4)	128(33.3)	166(43.2)	0.80(0.79)
Application of Neem extracts	109(28.4)	86(22.4)	189(49.2)	0.79(0.86)
Use of Jerry Cans	169(44.0)	139(36.2)	76(19.8)	1.24(0.76)
Storing unthreshed	135(35.2)	134(34.9)	115(29.9)	1.05(0.81)
Sunning at regular intervals	160(41.7)	137(35.7)	87(22.7)	1.19(0.78)
Admixture with fine sand	35(9.1)	77(20.1)	272(70.8)	0.38(0.65)
Admixture with clay dust	51(13.3)	50(13.0)	283(73.7)	0.40(0.71)
Oils (sunflower, cotton seed, groundnut)	87(22.7)	79(20.6)	218(56.8)	0.66(0.83)
Conventional				
Use of synthetic pesticides	223(58.1)	81(21.1)	80(20.8)	1.37(0.81)
Alternative				
ZeroFly® bag	34(8.9)	75(19.5)	275(71.6)	0.37(0.64)
Cold Treatment	64(16.7)	81(21.1)	239(62.2)	0.54(0.73)
PICS Bag	102(26.6)	149(38.8)	133(34.6)	0.92(0.78)
Heat/steam treatments	67(17.4)	140(36.5)	177(46.1)	0.71(0.74)
Hermetic Steel Drum	61(15.9)	108(28.1)	215(56.0)	0.60(0.75)
Silos	83(21.6)	77(20.1)	224(58.3)	0.63(0.82)

Source: Field Survey, 2021

Table 3. Frequency of Use of Insect Pest Control Methods in Store

Pest Control Methods	Always used	Sometimes used	Never Used	Mean (SD)
Indigenous				
Admixture with wood ash	90(23.4)	128(33.3)	166(43.2)	0.80(0.79)
Application of Neem extracts	109(28.4)	86(22.4)	189(49.2)	0.79(0.86)
Use of Jerry Cans	169(44.0)	139(36.2)	76(19.8)	1.24(0.76)
Storing unthreshed	135(35.2)	134(34.9)	115(29.9)	1.05(0.81)
Sunning at regular intervals	160(41.7)	137(35.7)	87(22.7)	1.19(0.78)
Admixture with fine sand	35(9.1)	77(20.1)	272(70.8)	0.38(0.65)
Admixture with clay dust	51(13.3)	50(13.0)	283(73.7)	0.40(0.71)
Oils (sunflower, cotton seed, groundnut)	87(22.7)	79(20.6)	218(56.8)	0.66(0.83)
Conventional				

Use of synthetic pesticides	223(58.1)	81(21.1)	80(20.8)	1.37(0.81)
Alternative				
ZeroFly® bag	34(8.9)	75(19.5)	275(71.6)	0.37(0.64)
Cold Treatment	64(16.7)	81(21.1)	239(62.2)	0.54(0.73)
PICS Bag	102(26.6)	149(38.8)	133(34.6)	0.92(0.78)
Heat/steam treatments	67(17.4)	140(36.5)	177(46.1)	0.71(0.74)
Hermetic Steel Drum	61(15.9)	108(28.1)	215(56.0)	0.60(0.75)
Silos	83(21.6)	77(20.1)	224(58.3)	0.63(0.82)

Source: Field Survey, 2021

Table 4. Factors Considered for Insect Pest Control in Store

Factors	No Not Important	Yes Important	Very important	Mean (SD)	Rank
Intended time of sale	29(7.6)	121(31.5)	234(60.9)	1.55(0.633)	1st
Time required to apply control method	40(10.4)	123(32.0)	221(57.6)	1.47(0.677)	2nd
Time of application	37(9.6)	143(37.2)	204(53.1)	1.43(0.663)	3rd
Quantity of required	43(11.2)	137(35.7)	204(53.1)	1.42(0.685)	4th
Cost of control method	44(11.5)	145(37.8)	195(50.8)	1.39(0.685)	5th
Climatic and environmental condition	21(5.5)	191(49.7)	172(44.8)	1.39(0.591)	6th
Type of pest	42(10.9)	153(39.8)	189(49.2)	1.38(0.675)	7th
Availability of pest control method	22(5.7)	196(51.0)	166(43.2)	1.38(0.591)	8th
Quantity of grains to be stored	19(4.9)	206(53.6)	159(41.4)	1.36(0.576)	9th
Familiarity with control method	25(6.5)	200(52.1)	159(41.4)	1.35(0.599)	10th
Labour requirement	41(10.7)	174(45.3)	169(44.0)	1.33(0.661)	11th
Effectiveness of control method	11(2.9)	241(62.8)	132(34.4)	1.32(0.523)	12th
Period of storage desired	51(13.3)	163(42.4)	170(44.3)	1.31(0.693)	13th
Price/cost benefit analysis	28(7.3)	210(54.7)	146(38.0)	1.31(0.600)	14th
Method of application of pest control	33(8.6)	207(53.9)	144(37.5)	1.29(0.615)	15th
Recommendation by extension agents	48(12.5)	200(52.1)	136(35.4)	1.23(0.654)	16th
Advice from agrochemical dealers	65(16.9)	169(44.0)	150(39.1)	1.22(0.716)	17th
Ease of application of method	49(12.8)	214(55.7)	121(31.5)	1.19(0.639)	18th
Period of efficiency of method	79(20.6)	156(40.6)	149(38.8)	1.18(0.750)	19th
Level of infestation	49(12.8)	245(63.8)	90(23.4)	1.11(0.593)	20th
Counsel by researchers	94(24.5)	169(44.0)	121(31.5)	1.07(0.746)	21st
Use by peers	83(21.6)	198(51.6)	103(26.8)	1.05(0.695)	22nd
Tradition	127(33.1)	130(33.9)	127(33.1)	1.00(0.814)	23rd

Source: Field Survey, 2021

Factors Considered for Insect Pest Control Methods in Store

The results of the important factors considered for pest control methods of cowpea in the store is presented in Table 4. The table show that intended time of sale (mean=1.55), time required to apply control method (mean=1.47), and time of application (mean=1.43) were ranked first, second and third factors indicated by respondent and implies that intended time of sale, time required to apply control method, and time of application were the leading factors considered for cowpea store pest control methods in Kwara and Niger States. The prominent concerns of cowpea farmers in this study are met by synthetic pesticides and explains its high use.

Determinants of Use of Insect Pest Control Methods

As shown in Table 5, the socioeconomic determinants are made up of six variables which significantly determine the frequency (intensity) of use of pest control methods in the study area hence the research hypothesis was rejected. The coefficient of farm size in hectares (t=4.681), group membership (t=4.688) and quantity stored in tons (t=2.312) are positive and indicate that a unit increase in the hectare of land cultivated, year of membership in group, and tons of cowpea stored by the farmers will increase their frequency of use of insect pest control methods. Large farm sizes connote increased investment, and may lead to a greater reliance on a control method to protect grains and investments. In like manner, large cowpea quantities in store would heighten the need for protection. On the other hand, the negative coefficient of years of education (t=-2.196), years of cowpea farming experience (t=-3.419), and frequency of contact with extension (t=-.534) imply probability for reduced frequency of use of pest control methods at every unit increase in years of education, frequency of extension contact and years of cowpea farming experience. Education improves knowledge as does the frequency of contact with extension since both exposes the farmer to a gamut of options and widens the farmer's know-how.

Table 5. Ordinary Least Square Estimates of the Determinants of Frequency of Use

	Coef. (β)	Std. Error	t-value	$P > \lvert t \rvert$
(Constant)	30.593	4.190	7.301	0.000
1. Sex	-.186	1.141	-.163	0.871
2. Age	-.037	.056	-.656	0.512
3. Marital Status	-.738	.672	-1.098	0.273
4. Education	-.914	.416	-2.196	0.029*
5. Farm Size	1.073	.229	4.681	0.000*
6. Household Size	-.195	.222	-.877	0.381
7. Primary Occupation	-.812	.456	-1.782	0.076
8. Group Membership	4.880	1.041	4.688	0.000*
9. Group Type	.386	.264	1.463	0.144
10. Income	4.249	.000	.430	0.667
11. Quantity Stored	.104	.045	2.312	0.021*
12. Farming Experience	-.187	.055	-3.419	0.001*
13. Land ownership	-.092	.245	-.375	0.708
14. Extension contact	3.797	2.528	1.502	0.134
15. Frequency of extension contact	-.534	.574	-.931	0.000*
16. Types of Cowpea grown	-.254	.143	-1.785	0.075
17. Cropping system	.149	.928	.160	0.873
18. Source of Pesticide	-1.573	.390	-4.037	0.976

Source: Field Survey, 2021

CONCLUSION

The factors that significantly affect the utilization of insect pest control methods among respondents are restricted to farm size, group membership, quantity stored in tons years of education, years of cowpea farming experience and frequency of extension contact. These form the array of important predicators and it is recommended that these factors are considered in the deployment of extension strategy for achieving greater utilization of safe and eco-friendly indigenous and alternative insect pest control methods among cowpea farmers in Kwara and Niger States.

CONFLICT OF INTEREST

The author here declares that there is no conflict of interest in the publication of this article.

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