UTILISATION OF INDIGENOUS PRACTICES FOR THE CONTROL OF ARMYWORM AMONG MAIZE FARMERS IN OYO STATE, NIGERIA

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ABSTRACT
Armyworm pest infestations are not without economic, environmental and social burdens for maize farmers. Control measures have also posed a serious challenge because of its resistance to major chemicals available in Nigerian market. Indigenous practices as a measure to control the pest among maize farmers in Oyo state was therefore investigated. The study used four-stage sampling procedure to select 121 respondents using Agricultural Development Programme (ADP) structure. Questionnaire and In-depth Interview (IDI) were used to elicit information on respondents' socioeconomic characteristics, sources of information, maize farmers' utilisation of indigenous methods, effectiveness of the indigenous practices and constraints to the use of indigenous knowledge for armyworm control. Data were analysed using descriptive and inferential statistics at α 0.05. Respondents' mean age was 57.1 ± 12.4. They were predominantly male (73.6%), married (66.9%), had a household size of 6.9±2.8 persons and earned an annual income of above ₦500,000 from maize production. Majority (87.6%) attained one form of formal education or the other and more than half (57.8%) had at least 20 years farming experience. Aged experienced farmers were ranked as highest sources of information ($\bar{x}$=1.91) and Indigenous practices mostly utilized in the study area were neem leaves ($\bar{x}$=1.33) and Siam weed ($\bar{x}$=1.32) soaked in water to spray infected plants. Constraints to utilisation included high labour intensity involved in the preparation ($\bar{x}$=2.07), scarcity of resources ($\bar{x}$=2.00) and secrecy of indigenous practices used ($\bar{x}$=1.82). Respondents perceived the use of Neem leaves ($\bar{x}$=1.33), Siam weed ($\bar{x}$=1.32) and Palm sheaves ($\bar{x}$=0.93) to be more effective in the control of armyworm. Utilisation of indigenous practices had significant relationship with year of farming experience (r=0.083). Effort should be made by researchers and extension agents to repackage and document indigenous practices for adoption among maize farmers in the study area.
Keywords: Indigenous practices, Armyworm, Pest control, Maize cultivation, Cultural practices

INTRODUCTION
Maize is the second most important cereal crop worldwide after wheat (Awata *et al*, 2019). Maize is a staple food of great economic importance in sub-Saharan Africa and Nigeria, and has now risen to its commercial crop status on which many agro-based industries depend on as a source of raw material (Tajamul *et al* 2016). It is an important food and annual crop that is cultivated in all agro-ecological zones of Nigeria and extensively grown across the world. Africa produces 6.5% of maize worldwide, while Nigeria, which produces nearly 8 million tons annually, is the largest producer in Africa (Oni and Odekunle, 2015). It is one of the important grains in the country, not only on the basis of the number of farmers engaged in maize cultivation, but also in its economic value (Coster and Adeoti, 2015). It is considered to be the miracle seed for Nigeria's agricultural and economic development (Onuk *et al.*, 2010). The demand for maize will double in the developing world by 2050, and maize is predicted to become the crop with the highest production globally and in the developing world by 2025 (Cairns *et al*., 2012). However, maize production has been declining in recent times, partly as a result of armyworm (*Spodoptera frugiperda*) infestation in the country (IAPPS, 2016). Armyworm attacks many crops, but shows a strong preference for maize (FAO, 2017).

It was first detected in Central and Western Africa in early 2016 (Benin, Nigeria, Sao Tome and Principe, and Togo) and in whole of mainland Southern Africa (except Lesotho and the Island States), in Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Gambia, Ghana, Guinea Bissau, Niger, Senegal, and Ethiopia, Burundi, Kenya, Rwanda, South Sudan, Uganda, and it is expected to spread further, probably beyond the African continent. Its modality of introduction, along with its ecological adaptation across Africa is still speculative (FAO, 2017). The effects of armyworm infestation go far beyond reducing crop yields in a season. The vast majority of farmers in Sub-Saharan Africa are smallholder family farmers, who often depend on production to maintain household food and nutrition security, as well as household livelihoods. There are tens of millions of smallholder family maize farmers across Sub-Saharan Africa, farming the majority of the 35 million hectares of maize produced annually in the region. For the most part, the farmers face very significant risks with little risk transfer mechanisms and marginal economic viability of their production systems, putting them at great risk to the added shock of armyworm infestation.

The introduction of significant use of pesticides, especially in maize-based cropping systems risks both the economic viability of these systems and poses a significant threat of putting smallholder farm families on an unsustainable "pesticide treadmill" (FAO,2017). This control measure posed a serious challenge because of

armyworm resistance to major chemicals available in Nigerian market coupled with residual effects on the environment in the long run (Huang, *et al.* 2014). Furthermore, improper handling and application of the chemicals can predispose humans to health hazards such as cancer (Weichenthal *et al.*, 2010).

In view of the foregoing, an alternative pest control measures that is sustainable and environmentally friendly will be a better option for consideration. Farmers can use indigenous practices such as bio-pesticides or simple plant extracts, which can be prepared at home and sprayed on the maize to keep away the pest. This consideration otherwise called indigenous practice involves combination of knowledge and practices established through past experiences and observations that are held and used by people (Masango, 2010). It is informal knowledge, skills and practices that are not obtained through formal education but rather through the local heritable ways in rural areas (Lodhi and Mikulecky, 2010). It is knowledge which has been accumulated by people over generations by observation, experimentation and experience (Ofor *et al.*, 2010). Among farmers, there is awareness of wide range of plant species with pesticide effects and various materials, devices which could be used to trap, chase or destroy pests or keep pests away from crops (Okwute, 2012). Indigenous knowledge on insect pests is considered vital because it was found to be essential at providing food security and survival of users of such knowledge, long before the intervention of synthetic pesticides (Lodhi and Mikulecky, 2010). It can serve as the basis through which appropriate technology can be generated by research institutes that will be socially acceptable, economically viable and environmentally friendly. This knowledge can be used to produce simple, cheap, traditional technology that can produce immediate results and could be integrated into existing cropping systems. However, the utilisation of indigenous knowledge is being challenged, as majority of farmers have turned to modern agriculture that involves use of synthetic pesticides. This study was therefore carried out to empirically assess maize farmers' indigenous practices for the control of armyworm.

The general objective of this study was to assess maize farmers' indigenous practices for the control of armyworm in Oyo State, Nigeria. The specific objectives were to describe the socio-characteristics of maize farmers, identify maize farmers' sources of information on indigenous practices for control of armyworm, determine the indigenous practices utilized by maize farmers for control of armyworm, ascertain perceived effectiveness of the indigenous practices utilized and identify maize farmers' constraints to use of indigenous practices for control of armyworm. The hypotheses were: there is no significant relationship between maize farmers' socio-economic characteristics, constraints to use of indigenous practices and indigenous practices for control of armyworm.

METHODOLOGY

The study was carried out in Oyo State which is one of the 36 states of Nigeria. Oyo is located between latitude $7^0$2' and $9^0$1' North of the equator and between longitude $2^0$5' and $4^0$3' east of the Greenwich Meridian. The mean annual rainfall ranges from 56 inches in the south and 46 inches in the north. Multistage sampling procedure was used to select respondents for the study. Two out of the four ADP zones were randomly selected in the first stage (Ibadan/Ibarapa and Oyo zones), after which thirty percent of the 9 and 5 blocks in Ibadan/Ibarapa and Oyo zones respectively were randomly selected to give a total of 5 blocks (3 and 2 blocks respectively). Thirty percent of the 8 cells in each selected block were randomly selected to give a total of 10 cells. Ten percent of the registered maize farmers in the selected cells were randomly selected to give a total of 121 respondents.

The measurement of the variables of the study was done as follows:

i. Sources of information on indigenous practices for control of armyworm were measured using a 3-point scale of always, sometimes and never. These were scored 2, 1, and 0, respectively. The maximum and minimum score was 16 and 0, respectively. Mean scores were generated and used to rank the sources of information in order of importance.

ii. Utilisation of indigenous practice methods for armyworm control was measured using a 3-point scale of always, occasionally and never. These were scored 2, 1, and 0, respectively. The maximum and minimum score was 40 and 0 respectively. Mean scores were generated and used to rank the methods in order of importance.

iii. Perceived effectiveness of the indigenous practices utilized – An In-depth Interview (IDI) was conducted with four leaders of maize farmers' group to ascertain the perceived effectiveness of the indigenous practices utilized. Responses were subjected to descriptive analysis to arrive at the perceived effectiveness of the indigenous practices utilized.

iv. Constraints to use of indigenous practice for armyworm control was measured using a 3-point scale of severe, mild and not a constraint. These were scored 2, 1, and 0, respectively. The maximum and minimum score was 21 and 7, respectively. Mean scores were generated and used to rank the constraints in order of severity.

RESULTS AND DISCUSSION

Socioeconomic characteristics

Results of the analysis of the socio-characteristics of the respondents as shown in Table 1 indicate that more than half (54.6%) of the respondents were between the ages of 50 – 69 years. The mean age of 57.1 years indicates an ageing group of farmers, but aged farmers are often considered the custodians of indigenous knowledge which is passed down from generation to generation. Owolabi and Okunlola (2015) observed that most farmers receive information on indigenous knowledge from aged farmers. It is worthy to note that age determines the level of farmers' involvement in farming activities (Taiwo and Kuponiyi, 2013). Majority (73.6%) of them were males. This gives a reflection that males were more involved in agriculture in the study area. Binuomote *et al* (2017) similarly noted that males are more involved in farming than female as they possess the energy required to meet the demands of agricultural activities. The educational attainment was high, with 87.6% of them having attained one form of formal education or the other and 44.6% having had tertiary education. This high literacy level is expected to make the respondents appreciate the risks armyworm poses to maize production and hence take measures to mitigate them. More than half (57.8%) had farming experience of at least 20 years, with the mean farming experience of 27.6 years. This indicates that most of the farmers are to an extent, experienced in maize farming, which according to Ogaji (2010), and has the probability of influencing their interest and knowledge about farming and indigenous practices. More than half (52.9%) of the respondents earned an annual income of above ₦500,000 from maize production, pointing out that their farm income were reasonably profitable. This might make them take measures to prevent any damage that can be caused by pests such as armyworm.

Table 1: Distribution of respondents by socio-characteristics

Variable	Category	Frequency	Percentage	Mean	Standard deviation
Age	30-39	9	7.4	57.1	12.39
	40-49	27	22.3		
	50-59	29	24.0		
	60-69	37	30.6		
	70 and above	19	15.7		
Sex	Male	89	73.6		
	Female	32	26.4		
Education	No formal education	15	12.4		
	Primary school	21	17.4		
	Secondary school	31	25.6		
	Tertiary	54	44.6		
Religion	Christianity	50	41.3		
	Islam	65	53.7		
	Traditional	6	5.0		
Marital status	Single	6	5.0		
	Married	81	66.9		
	Divorced	4	3.3		
	Widow(er)	30	24.8		
Years of farming experience	< 10	20	16.5	27.56	19.56
	10-19	31	25.6		
	>20	70	57.8		
Household size	≤6	60	47.1	6.9	2.82
	7-12	48	40.2		
	>12	13	10.2		
Income (annually)	<250000	22	18.2		
	250001-500000	35	28.9		
	500001-750000	17	14.1		
	>750000	47	38.8		

Source: Field survey, 2017

Sources of information on indigenous practices

Table 2 shows the different sources through which the respondents receive information on indigenous practices. Aged farmers ($\bar{x}$=1.91), fellow farmers ($\bar{x}$=1.50) and farmers' groups ($\bar{x}$=1.49) were vital sources of information on indigenous practices available to the respondents. Aged farmers are often considered the custodians of indigenous practices as they are passed down from generation to generation, usually by word of mouth. Owolabi and Okunlola (2015) noted that most farmers receive information on indigenous practices

from their grandparents some of whom are aged farmers. Farmers often belong to farmers' groups because of the benefits they can derive from such groups, as for instance they are important in relaying latest information on farming practices to farmers.

Table 2: Distribution of respondents based on sources of information on indigenous practices

Sources of information	Mean	Rank
Aged farmers	1.91	1st
Fellow farmers	1.50	2nd
Farmers group	1.49	3rd
Radio	1.07	4th
Television	0.93	6th
Extension workers	0.95	5th
Researchers	0.84	7th
Cooperative society	0.66	8th

Source: Field survey, 2017

Indigenous practices Utilised for control of armyworm

Table 3 shows that the indigenous practices mostly employed by the maize farmers in the study area were neem leaves soaked in water ($\bar{x}$=1.33), Siam weeds soaked in water ($\bar{x}$=1.32) and palm sheaves burned to ashes and mixed in water ($\bar{x}$=0.93). This is premised on the fact that farmers employ different indigenous practices depending on how convenient it is to them. It was found out during the course of the study that though indigenous practices are effective in controlling pests such as armyworm, they however do not have a fast action and any potential damage a farmer is trying to prevent may have been inflicted on crops before they become effective. Bio-pesticides, which are plants extract can be instrumental as part of an Integrated Pest Management (IPM) approach that is normally used for short-term pest control against the armyworm (Pretty and Bharucha, 2015).

Table 3: Distribution of respondents based on the extent indigenous practices utilisation

IK methods in study area	Preparation and application	Mean	Rank
Neem leaves soaked in water	Grinded neem leaves are soaked in water for at least one day, after which the mixture is filtered. The filtrate is then sprayed on maize plants.	1.33	1st
Siam weeds soaked in water	Grinded siam leaves are soaked in water for at least one day, after which the mixture is filtered. The filtrate is then sprayed on maize plants.	1.32	2nd
Palm sheaves (*Aran ope*) burned to ashes and mixed in water	Ash from palm sheaves is soaked in water for a while after which the mixture is filtered. The filtrate is then diluted and sprayed on maize plants.	0.93	3rd
Fruitless pawpaw leaves soaked in water	Pawpaw leaves are grinded and soaked in water for at least one day, after which the mixture is filtered. The filtrate is then sprayed on maize plants.	0.78	4th
Dry ashes mixed in water	Ash from any material is soaked in water for a while after which the mixture is filtered. The filtrate is then diluted and sprayed on maize plants.	0.73	5th
Sun flower (*Ewe sepeleba*) soaked in water	The whole sun flower plant is grinded before it is soaked in water. After a while the mixture is filtered and used to spray maize plants.	0.67	6th
Locust beans (*Irupete*) soaked in water	The paste of locust beans is soaked in water for some days. The mixture is filtered and used to spray maize plants.	0.60	7th
Red pepper (*Rodo*) soaked in water	Grinded pepper fruits are soaked in water for some time. The mixture is thereafter filtered and used to spray maize plants.	0.36	8th
Red pepper and tobacco leaves mixed with neem leaves soaked in water	Grinded pepper fruits are soaked in water for some time. The mixture is thereafter filtered and used to spray maize plants.	0.29	9th

Source: Field survey, 2017

Perceived effectiveness of indigenous Practices utilized

An In-depth Interview (IDI) account with male and female maize farmers' group leaders revealed that neem solution is widely used because of its effectiveness. One of the interviewees put it this way:

"I soaked the leaves in water for three days, after which the solution was sieved to remove the leaves. The extract/solution was then applied to the affected maize plants with the use of a knapsack sprayer. The action was very effective as I did not notice any subsequent damage to the leaves of the maize plants. Also, the population of the worm was totally wiped out" (IDI, Maize Farmers Leader Ibadan/Ibarapa zone 2017).

Other interviewees opined that:

"*The use of neem extract comes with no cost implications, which makes it convenient for farmers to use. The solution is quite effective when the worm is still at the early stage of development i.e. larva stage. However, when the worm has gone beyond the larva stage, the solution will not be able to completely destroy it. After spraying with the solution, the worm may be incapacitated for some days but will reappear subsequently" (IDI, Maize Farmers Leader Oyo zone 2017).*

This submission is in tandem with the assertion of Organic Farmer (2018) that asserted that most pesticides in the market cannot control the pest if it is at the first and third stage (eggs, pupae or third instar). Therefore, it is not advisable for farmers to go for expensive chemical pesticides because the chemical pesticides cannot control the pest at egg or pupae stage.

Constraints to the use of indigenous practices

Results in Table 4 show that the most serious constraint to the use of indigenous practices by the respondents was that it is labour intensive ($\bar{x}$=2.07). This finding aligns with Onoh *et al* (2012) who identified the labour intensive nature of indigenous practices as a limiting factor to its use. Lack of resources ($\bar{x}$=2.00), secrecy of indigenous practices ($\bar{x}$=1.82) were other major constraints to the use of indigenous practices. Poor awareness ($\bar{x}$=1.79), according to Nnadi *et al* (2013), relates to, among other things, farmers' inability to estimate the efficacy of prepared indigenous practices formulations. Generally, when farmers consider that the limitations to the use of a particular technology are high, they will most likely look out for alternatives measures.

Table 4: Distribution of respondents by constraints to use of indigenous practices

Constraints	Mean	Rank
Labour intensive	2.07	1st
Lack of resources	2.00	2nd
Secrecy of Indigenous practices	1.82	3rd
Poor awareness	1.79	4th
Climatic factors	1.72	5th
Modernization	1.61	6th
Religion	1.37	7th

Source: Field survey, 2017

Relationship between respondents' socio-characteristics, constraints and indigenous practices for control of armyworm

Tables 5a and 5b show that maize farmers' farming experience (r=0.08), age (r=0.08), and religion (χ^2=5.98) were significantly related to indigenous practices utilized for control of armyworm. This implies that farmers who possess more years of farming experience are not only expected to be aware of the different indigenous practices that can be used for controlling armyworm, but also the procedure for their formulations and hence their utilisation. This takes into consideration of an earlier finding of this study which identified aged farmers, who possess ample years of farming experience, as the custodians of indigenous practices. Meludu and Adesina (2014) in a similar study documented favourable disposition of maize farmers to the use of indigenous practices, which was premised on age and years of farming experience. Also, the maize farmers' beliefs serve as a helpful tool for utilisation of indigenous practices.

Table 5a: Correlation analyses between respondents' selected socio-characteristics, constraints and utilisation of indigenous practices for armyworm control

Variable	r-value	p-value
Age	0.08	0.04*
Farming Experience	0.08	0.04*
Constraints	-0.06	0.54

Source: Field survey, 2017. *significant @≤ 0.05

Table 5b: Chi-square analyses between respondents' selected socio-characteristics and utilisation of indigenous practices for armyworm control

Variable	χ^2	Df	p-value
Sex	0.15	1	0.70
Marital status	8.11	4	0.09
Religion	5.98	2	0.05*

Source: Field survey, 2017. *significant @≤ 0.05

CONCLUSION AND RECOMMENDATIONS

Based on the results from the study, neem soaked in water was the mostly used indigenous practice for controlling armyworm pests due to its perceived effectiveness. The methods used were however associated with constraints such as by high intensity of labour involved in its preparation, scarcity of resources to meet the required application and secrecy of indigenous practices by custodian to divulge information, which in most cases are not documented.

Relevant stakeholders' assistance to mass produce and properly store perceived effective indigenous pesticides will go a long way to promote easy access and wide scale practice needed to mitigate incidence of armyworm infestation among maize farmers. Sensitization programmes through extension agents at the grass root to document and modify indigenous practices would be a potential avenue to achieving environmentally sound agriculture and maintain the ecosystem. Also, publication inform of bulletin would preserve the indigenous practices gradually going into extinction.

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