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Traded Synthetic Insecticides for Postharvest Crop Protection in Oyo State, Southwestern Nigeria

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Abstract

Insects are major storage menace of agricultural production because they destroy produce and reduce *substantial revenue of the farmers. The use of synthetic insecticides is a major pest control method of crop protection. This study was a survey which employed the use of a questionnaire to identify the predominantly traded synthetic insecticides and factors that influenced the predominance of the insecticides in four major towns (Ogbomoso, Oyo, Saki and Ibadan) of Oyo State, southwestern Nigeria. Data collected were subjected to statistical analysis using frequency, percentages, weighted mean score and ranking. Majority of the respondents (78.4%) identified DD Force, followed by Sniper (61.7%) and Nopest (32.3%) as the most commonly traded synthetic insecticides. The most rated factor for the predominance of the pesticides was product efficacy (WMS = 4.30), while the least rated factor was longevity of time of use/popularity (WMS= 4.00). The study recommends that pesticides users should be educated on the ecological compatibility of the traded synthetic insecticides, so that ecological safety should be a criterion for the choice of synthetic insecticides.*

Keywords: Synthetic insecticides, Postharvest crop protection, Storage pests, Southwestern Nigeria

Introduction

Insect pests have been a great menace to farmers globally. Besides, the quantitative damage caused by them, insect pests contaminate food items with faeces, broken body parts and dead remains. In times of severe infestation, seeds are rendered unfit for sowing, while the grains become unfit for consumption (Babarinde et al., 2015). Nigeria is among the nations facing serious postharvest insect pests infestation, which often begins from the field and skyrockets in the store. Unfortunately, reliable and efficient storage facilities are either unavailable or unaffordable. Therefore a good proportion of rural farmers and grain handlers use various insecticides for the control of insect pests in Nigeria, and some other developing countries.

Pesticides use has become an important part of modern agriculture (Narita et al., 2014; Jallow et al., 2017). Food production has doubled in the last decades with the help of pesticide use, which has effectively controlled insect pests of crops and as such increased crop yields (Narayanasamy, 2006; McDougall, 2010; Idris et al., 2013). Consequently, farmers have more profits from the sale of quality farm produce which are regularly available and affordable to consumers with a resultant improvement in the societal life as a whole (Damalas, 2009). In 2016, it was reported that the quantity of pesticide use in China was three times the quantity of pesticides used by the rest of the world in order to keep food production steady to save the Asian nation from famine (Fan et al., 2017). Globally, about 3 million tonnes of pesticides (costing approximately USD 40 billion) are used in order to produce and maintain good quality food crops and our immediate environment annually (Popp, 2011; Abrol and Shankar, 2014). This may include pesticides overused by farmers due to lack of education or lack of technical knowhow. Apparently, the choice of a certain pesticide to be used for controlling certain pest by a farmer is often determined by the drive of the previous performance of such pesticide (Hashemi and Damalas, 2010; Al-Zaidi et al., 2011; Chen et al., 2015).

Several insecticidal formulations are available in the agrochemical markets in the developing countries. The primary aim of the farmers is to destroy the target insect pests to guarantee high crop yield and

safeguard the produce at the postharvest level (Babarinde et al., 2008; Salameh, et al., 2014; Damalas and Eleftherohorinos, 2011; Hashemi, et al., 2012; Damalas and Hashemi, 2017). Longe (2012) reported that insecticides may be applied as powder or in the form of fumigant which has Organophosphates, pyrethroid or hydrogen cyanide as the active ingredients (El-Nagar et al., 2012; Steiskal et al., 2014). The recommended insecticides for storage of cowpea in Nigeria include Actellic 25 EC, Actellic 2% dust and phostoxin tablets (Ilesanmi and Gungula, 2010). Incidentally, farmers are often faced with the problems of choice making when the well-known proven products are not available, or their prices are unaffordable. Bawa et al. (2012) later reviewed major control methods of cowpea storage pests with some highlights on the application methodology and recommended doses of the available synthetic insecticides. However, the pertinence of such reviews for food crops at regular intervals cannot be over-emphasized, since it promises an update of knowledge with safety precautions as a matter of special attention. Therefore, this research was designed to identify the updates in terms of the most-traded synthetic insecticides available for protection of food crops in parts of Oyo State, southwestern Nigeria, and to evaluate the factors that influenced their preference by the farmers for the preservation of food crops.

Materials methods

A survey on the identification and factors affecting the trade of commercially available synthetic insecticides used for preservation of food crops was carried out. There were four Agricultural Zones in Oyo State, Nigeria viz: Ibadn/Ibarapa, Ogbomoso, Oyo and Saki. One town was purposefully selected in each of the four agricultural zones, based on the available number of agrochemical dealers in each town. The respondents were the agrochemical dealers in the selected towns (Ogbomoso, Oyo, Saki and Ibadan) of the state.

Method of data collection

The traders of synthetic insecticides in the study area were the respondents. A structured questionnaire was designed to collect data on the socio-economic characteristics of the respondents, which included name of respondents, age of respondents, sex of the respondents, years of experience in the business of synthetic insecticides and source of purchase. Other information collected were available synthetic insecticides, class of chemical, trade name, chemical name, factors affecting buyer□s preference and reasons why the traded pesticides were demanded for by the buyers. Fifty questionnaires were randomly distributed in each of the four towns in the study area to make a total of two hundred questionaires. Out of the 200 numbers of questionnaire randomly distributed, 169 were favourably attended to by the respondents, which were subsequently coded and subjected to data analysis.

Data analyses

Data collected from the research were subjected to descriptive statistical analysis of ranking,

frequency, percentage, mode, Likert Measurement Scale of very High (VH), High (H), Moderate

(M), Low (L), Very Low (VL) and Weighted Means Score (WMS) was computed and ranked

accordingly. All analyses were done with the aid of Statistical Package for Social Sciences (SPSS) Software.

Results

Socio-economic Characteristics of the respondents

The socio-economic characteristic of the respondents is represented in Table 1. Majority (67.5%) of the respondents were male, while 32.5% were female. This implies that both genders were involved in the agro-allied business. The result of educational qualification of the respondents revealed that 7.7% were holders of West African School (Senior Secondary School) Certificate, while 26.6% and 20.7% had Ordinary National Diploma (OND) and Higher National Diploma (HND), respectively. Also, 18.9%, 14.2% and 11.8% held Bachelor of Science Degree (B. Sc.), Masters of Science (M. Sc.) and Doctorate (Ph. D) Degrees, respectively.

The result of age distribution of the respondents revealed that 26.1%, 51.5%, 12.4%, 8.3% and 1.8% were within the age ranges of $\leq$ 30 years, 31-40 years, 41-50 years, 51-60 years and >60 years, respectively. On the number of years spent in agro-allied business, 65.7%, 27.3%, 4.2% and 3.0% of the respondents had between $\leq$ 10 years, 11-20 years, 21-30 years and >30 years of experience in the agro-allied business. Only 27.2% of respondents purchased pesticides directly from the manufacturer, majority (61.5%) purchased from wholesalers while 11.3% of the respondents purchased from retailers (Table 1).

Table 1: Distribution of Socio-economic characteristics of respondents in the study areas

Socio-economic characteristics	Frequency	Percentage (%)
Sex		
Male	114	67.5
Female	55	32.5
Educational Status		
O.L. Certificate holders	13	7.7
OND holders	45	26.6
HND holders	35	20.7
B.Sc holders	32	18.9
M.Sc holders	24	14.2
Ph.D holders	20	11.8
Age(years)		
?30	44	26.1
31-40	87	51.5
41.50	21	12.4
51-60	14	8.3
?60	3	1.8
Years of Experience		
?10	111	65.7
11-20	46	27.3
21-30	7	4.2
>30	5	3.0
Source of Purchase		
Manufacturer	46	27.2
Wholesaler	104	61.3
Retailers	19	11.3

Source: Field survey, 2017

Available synthetic insecticides on Shelves

The available insecticides on shelves are presented in Table 2. Majority of the respondents identified the synthetic insecticides on their shelves by their trade names. DD Force was among the most commonly sold pesticides (sold by 78.4% of the respondents), while 61.7% and 32.3%, respectively indicated Sniper and Nopest as traded insecticides. Comparatively low proportions (30.5%, 28.8%, 18.6%, 18.0%, 17.4%, 16.8%, 15.0%, 12.6% and 9.6%) of the respondents indicated Best Action, Perfect Killer, PrimeForce, Marshal, Laraforce, Attacke, Daksh, Multiphos and Cyperforce, respectively as the available synthetic pesticides on their shelves. Similarly, 6.6% of the respondents traded Basuka and Forcetoxin, 5.4% traded Crush and Sheild, 4.8% indicated Pestox, Cyperdiforce, Clofos and Rocket, 4.2% traded Redforce, 3.6% traded Magicforce, Demiforce, Spike and DD Power; while 3.0% traded Toptoxin, and Lambdash, other products like Karate, Lamdaca, Lamican, Kuru, Endosel, DD Com, Wonsile, Vibrant, Kombat, Sunphosite, Armyforce, Dethrin, Chemtrin, Avesthrin, Scorpion and Actin 40 and Dressforce were traded by a very small proportion of the respondents (≤2.4%) (Table 2).

Table 2: Available synthetic insecticides on agrochemical tr aders□ shelves

[illegible]	Chemical name	Frequency	Percentage	Class
Cyper-diforce	Cypermethrin+ Dimethoate	16	4.8	Pyrethroid+ Organothiophosphate
Attacke	Lambda-cyhalothrin	9	16.8	Pyrethroid
Cyper force	Cypermethrin	12	9.6	Pyrethroid
Best Action	Cypermethrin+ dimethoate	4	30.5	Pyrethroid+ Organothiophosphate
Magicforce	Dimethoate + lambda cyhalothrin + Dimethyl dat	6	3.6	Organothiophosphate + Pyrethroid + Pyrethroid
Demiforce	Dimethoate	6	3.6	Organothiophosphate

Laraforce	Lambda cyhalothrin	8	17.4	Pyrethroid
Sniper	DDVP Dichlorvos	2	61.7	Dialkenylphosphate
DD force	DDVP Dichlorvos	131	78.4	Dialkenylphosphate
Rocket	Chloropyrifos	8	4.8	Organothiophosphate
Perfect killer	Chloropyrifos	48	28.7	Organothiophosphate
Spike	DDVP Dichlorvos	6	3.6	Alkenylphosphate
Lambdash	Lambda cylothrin	4	2.4	Pyrethroid
Lamdaca	Lambda cylothrin	4	2.4	Pyrethroid
Clofos	Chloropyrifos	8	4.8	Organothiophosphate
Sharpshooters	Protonotes+ Cypermethrin	14	6.0	Pyrethroid
Sunphosite	Isopropylamine	2	1.2	Alkylamines
Redforce	Matalaxyl-m + Copper	7	4.2	Phenylamides
Shield	Chloropyrifos	15	5.4	Organothiophosphate
Multiphos	Aluminium phosphide	11	12.6	Inorganic compound
Nopest	DDVP Dichlorvos	3	32.3	Dialkenylphosphate
Armyforce	Diflubenzuron	2	1.2	Benzoylurea
Daksh	DDVP Dichlorvos+ Cypermethrin	10	15.0	Dialkenylphosphate+ Pyrethroid
Lamican	DDVP Dichlorvos	4	2.4	Dialkenylphosphate
Primeforce	DDVP Dichlorvos	6	18.6	Dialkenylphosphate
Marshal	Lambda cyhalothrin	7	18.0	Pyrethroid
DD power	DDVP Dichlorvos	6	3.6	Dialkenylphosphate
Endosel	Protonotes+ cypermethrin	4	2.4	Pyrethroid

*Multiple responses

Buyers' reasons for demand of the most traded synthetic insecticides

The buyers' reasons for demand of the most traded synthetic insecticides are presented in Table 3. The product efficacy has highest weighted mean score (WMS) of 4.30 and was ranked first among the reasons for the buyer's demand of synthetic insecticides. The reason ranked next was timely effectiveness of the insecticides (WMS= 4.27 **ranked** 2nd). Longevity of efficacy was ranked 3rd with WMS 4.14, ease of purchase ranked 4th (WMS = 4.11), availability ranked 5th (WMS = 4.05) and long term of popularity ranked 6th (WMS = 4.00).

Table 3: Reasons for the buyers□ demand for most traded synthetic insecticides

	Very High	High	Moderate	Low	Very Low	WMS	Rank
Availability	51 (30.2)	84(49.7)	29(17.2)	2 (1.2)	3(1.8)	4.05	5th
Fast effectiveness	64(37.9)	98(58.0)	1(0.6)	-	6(3.6)	4.27	2nd
Efficacy	61(36.1)	103(60.9)	2(1.2)	-	3(1.8)	4.30	1st
Ease of purchase	41(24.3)	116(68.6)	6(3.6)	1(0.6)	5(3.0)	4.11	4th
Long time of use/ popularity	53(31.4)	86(50.9)	18(10.7)	1(0.6)	11(6.5)	4.00	6th
Longevity of efficacy	44 (26.0)	110(65.1)	12(7.1)	-	3(1.8)	4.14	3rd

Source: Field Survey, 2017
(VH) Very High, (H) High, (M) Moderate, (L) Low, (VL) Very Low, (WMS) Weighted Means Score
Figures in parentheses are percentages

Table 4 Reasons for stocking synthetic insecticides available on the shelf

Reasons for stocking insecticides	Very High	High	Moderate	Low	Very Low	WMS	Rank
Connection to the source of purchase	28(16.6)	94(55.0)	36(21.3)	2(1.2)	9(5.3)	3.77	6th
Ease of application	29(17.2)	121(71.6)	9(5.3)	1(0.6)	9(5.3)	3.95	4th
Low cost	18(10.7)	83(49.1)	59(34.9)	4(2.4)	5(3.0)	3.62	7th
Profit margin	32(18.9)	92(54.4)	37(21.9)	1(0.6)	7(4.2)	3.83	5th
Long term popularity	44(26.0)	101(59.8)	15(8.9)	1(0.06	8(4.8)	4.02	3rd
Ease of transportation	41(24.3)	115(68.0)	5(3.0)	3(1.8)	5(3.0)	4.09	2nd
Choice of consumers	58(34.3)	101(59.8)	3(1.8)	-	7(4.2)	4.20	1st

Source: Field Survey, 2017
(VH) Very High, (H) High, (M) Moderate, (L) Low, (WMS) Weighted Mean Score
Figures in parentheses

Reasons for stocking synthetic insecticides available on the shelves

The reasons for stocking synthetic insecticides available on the shelves are presented in Table 4. Choice of consumers had the highest WMS of 4.20 among the identified reasons for stocking synthetic insecticides by the respondents and was ranked 1st, followed by ease of transportation with WMS of 4.09 which was ranked 2nd. The other reasons for stocking synthetic insecticides were long term popularity with WMS of 4.02, ease of application with WMS of 3.95, profit margin with WMS of 3.83, connection to the source of purchase with WMS of 3.77 and low purchasing cost of the insecticide with WMS of 3.62 which ranked 3rd, 4th, 5th, 6th and 7th, respectively (Table 4).

Discussion

The results of this research show that both male and female literates were involved in agro-chemical trade in the study area. Though with different educational backgrounds, age ranges and years of experience in the trade was expected to influence the different sources of purchase of the synthetic insecticides. The data indicated the various classes of synthetic insecticides traded to be pyrethroids, organophosphates, organochlorines, organothiophosphates, monoisopropylamine, necotinoids and phenyl amides. Some of the classes of synthetic insecticides have been earlier reported as effective chemical pesticides for protecting crops (Agriculture and Life Science, 2015; Ojo, 2016). The factors that influenced the demand for most traded synthetic insecticides were in the order product efficacy>fast effectiveness>longevity of efficacy>ease of purchase >availability>longtime of use and popularity. The result was in line with Adejumo et al. (2014) who earlier reported the factors influencing choice of pesticides used by grain farmers in southwestern Nigeria. In a study conducted in Iran, Hashemi and Damalas (2010) also reported that the previos bioactivity/performance of a pesticide influenced farmers' choice.

The reasons adduced by respondents for stocking synthetic insecticides available on the shelves were choice of consumers, ease of transportation, long term popularity, ease of application, profit margin, connection to the source of purchase, and low cost. Some of those reasons were also suggested in previous related studies (Schreinemachers et al; 2017; Mengistie

and Mol et al., 2017). The lowest ranking of low cost of pesticides could be regarded as operational factor for some traders while some respondents were less-concerned with low cost of insecticides. This is suggestive of the fact that the respondents are large and more experienced in the trade whereby low cost may not affect their income, which was corroborated by Damalas and Koutroubas (2017) in a survey of determinants of farmers decision on pesticide use in oriental tobacco in Greece.

The result of this research shows that ease of purchase, availability and long term popularity was among the reasons that influenced the demand for synthetic insecticides by the respondents. However, variation in the ranking may be due to differences in their perception, knowledge and individual experience in the synthetic insecticides business.

Conclusions and Recommendation

The most traded insecticides belonged to organophosphate. The stocking of these insecticides were mostly influenced by the choices of consumers, ease of transportation, and long term popularity. It is crucial to educate pesticides users on the ecological compatibility of the traded synthetic insecticides, so that their choices should be based on the product efficacy and ecological safety. That would increase the production and preservation of food and reduce the risks of nutritional insecurity and ecological safety.

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