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Assessment of pest problems and farmers' perception on the use of botanical pesticides in Ekiti State, Nigeria

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Abstract

The careless and indiscriminate use of synthetic pesticides with its attendant side effects on humans and the ecosystem have led to co-operative research efforts to curtail the menace. These efforts have produced alternative approaches among which are the use of botanical pesticides for management of pests. Botanically derived pesticides are natural, and contain bioactive compounds showing toxicity against pests ravaging crops. This study was carried out to assess pest problems and also to investigate the perceptions of farmers in Ekiti State towards the use of botanical pesticides. Four towns were purposively selected from each of the three ADP zones and ten (10) respondents selected in each town to give 120 respondents. Questionnaires and interview schedules were conducted with the respondents. The major threats to agricultural productivity in Ekiti State are complex problems of interactions between different categories of pests including insects, pathogens, and weeds. Majority of the respondents (41.7%) make use of only synthetic pesticides as the main pest control option while 25.8% of the respondents combine both synthetic and botanicals for pest control. The Likert scale revealed that with the high literacy exposure of the respondents on the hazardous potentials of the chemicals, it was widely utilized for the control of pests on their farms. The drudgery involved in the preparation of the botanicals considering the huge quantities required, coverage on farmers' fields, time factor and labour needed in its preparation may be responsible for the low adoption. We recommend the need for agricultural policies that would promote the commercial production of botanical pesticides and make incentives available to farmers and local institutions. This would in return improve food security and promote environmental safety.

Keywords: Botanical pesticide, ecosystem safety, perceptions, pest management, synthetic pesticide.

Introduction

Ekiti State is situated in the South-western region of Nigeria, with a projected population of 3,270,800[1]. Ekiti State has a land area of over 6,353 square kilometres and is naturally endowed with abundant mineral resources[2]. The land is buoyant in agricultural and forest resources notably different species of timber and the agrarian composition of the state is attested by the involvement of about 70 percent of her populace in farming. As part of the millennium goal, the government of Ekiti created farm settlements in the different ecological zones within the state to attain food sufficiency and boost her economy[2]. Despite the incentives and supports from government for individuals and groups to partake in farming, agricultural productivity is hampered by many challenges. Among the major challenges facing farmers are; inadequate capital and agricultural credit facilities[3], limited access to farm inputs, lack and high cost of labour in rural areas, inadequacy of extension programmes for dissemination of agricultural information[4], lack of infrastructures, and attack by crop pests[5]. Crop pests attack is a major bane to achieving food security and sustainability[6]. In developing countries like ours, losses in crop yields ranging between 20 to 40 percent have been attributed to damages caused by pests, pathogens, animals[7]. Insect pests are serious menace to food security, and as such they must be properly managed. The most commonly adopted control strategy; synthetic pesticide has its shortcomings of posing threats to the environment and human health as well as promoting insects' resistance to pesticides. Alternative pest management strategies such as the use of microbial pesticides[8,9], and botanical pesticides[10,11] have been developed to reduce the misuse and detrimental effects of synthetic pesticides in economic crops. Botanical pesticides are cheap, easy to handle, non-persistence and at the doorstep of farmers. It is with this background that this study was carried out to investigate the perceptions of farmers in Ekiti State toward the use of botanical pesticides and to test the hypothesis that: H_0: there is no significant relationship between the socio-economic characteristics of the respondents and the pest control method adopted by them.

Methodology

The study was conducted in the three Agricultural Development Programme (ADP) zones of Ekiti State during October-December of 2018. Ekiti State lies between latitude 7°15 and 8° 7 North of the equator and longitude 4°47 and 5°45 east of the

Greenwich Meridian. The state enjoys a tropical climate with two distinct seasons: raining season (April-October) and dry season (November-March). Ekiti State has a total annual rainfall of about 1400mm with very low co-efficient variation of about 30% during the rainfall peak months and with an average of about 112 raining days per annum[12]. The temperature ranged between 21^0C and 28^0C. Tropical rainforest exists in the south while the derived savannah occupies the northern peripheries of the state. Ekiti State is divided into three zones, based on the existing Agricultural Development Programme (ADP): Aramoko (Ado, Awo, Ijero, and Okemesi); Isan (Ikole, Isan, Itapa, and Ayegbaju) and Ikere (Igbemo, Ise, Ilawe, and Aisegba).

Sampling technique and data collection: A multi-stage sampling procedure was used to select respondents for the study, the First stage: selection of zone, second stage: selection of four towns from each zone, third stage: selection of farmers from each town. These towns were purposely selected to be those that were relatively far from urban influence. In the final stage, in each town, ten farmers were selected randomly and interviewed with the aid of a structured questionnaire. A total 120 respondents were interviewed for the study. The interviews were focused, conversational and two-way in communication providing information on socio-economic characters, farming history and experience, distribution of pests attacking crops, farmers' pest management approaches as well as their perception on the efficacy of botanically-derived pesticides when compared with synthetic pesticides.

Pearson Correlation Test: Pearson correlation coefficient was used to measure the relationship between socio-economic characters of the respondents and their perception of the pest control method, as stated in the hypothesis.

Data analysis: Data obtained from 120 questionnaires retrieved from the respondents were subjected to descriptive statistical analysis of frequency counts, percentage, mean statistic, and correlation. A list of possible statements was made available about botanicals to ascertain the level of awareness on the use of botanicals. Respondents were asked to indicate the level of the perception and awareness to botanicals on a 5- point Likert-type scale (5 = strongly agree; 4= agree; 3 = undecided; 2= disagree and 1= strongly disagree).

Results and discussion

Socio-economic characteristics of respondents: As shown in Table-1, majority of the respondents were males (90.8%) aged between 30 and 60. Marital status showed that 90.8% of the respondents were married with household size between 4 and 10. The respondents were literate as shown by 96.6%, which had formal education at primary, secondary and tertiary levels.

Farm History and Experience: Table-2 presents the farm history and experience of the respondents. A higher percentage of respondents (79.2%) had been cultivating their farms for more than ten years. This suggests that respondents might have useful information on pest attack of their crops as well as practical experience on the use of pesticides in the control of insect pest on their farms. On the size of the farm, the study revealed that 77.5% of the respondents have less than 3.5 hectares of farmland while about 20.9% had between the ranges of 3.5 to 10 hectares of farmland. Information gathered on crop types revealed that 77.5% of the respondents cultivate both arable and tree crops while 5.8% and 16.7% grow only tree and arable crops respectively.

Table-1: Socio-economic characteristics of respondents.

	Variables	Frequency	Percentages
Sex	Male	109	90.8
	Female	11	9.2
Age	1-29	2	1.7
	30-60	96	80.0
	Above 60	22	18.3
Marital Status	Single	4	3.3
	Married	109	90.8
	Divorced	2	1.7
	Widowed	5	4.2
Household Size	1-3	5	4.2
	4-6	83	69.2
	7-10	25	20.8
	Above 10	7	5.8
Education	Illiterate	4	3.3
	Primary	7	5.8
	Secondary	66	55.0
	Tertiary	43	35.8

Pest Distribution: Table-3 showed that major threats to productivity in the state occurred as a complex problem of interactions between insect pests and weeds (28.3%). This was followed by insect pests alone (27.5%) while the attack by the combination of insect pests, weeds, pathogens and other biotic factors (25.8%) was also observed as significant. Five insect orders were reported as major threats to crop production in the

areas under study. These include orders Lepidoptera, Orthoptera, Isoptera, Homoptera, and Hymenoptera. Interactions between orders Orthoprtera (grasshoppers) and Lepidoptera (caterpillars or worms) were assessed as the most important insect pest order (49.2%). Major symptoms of insect pest problems encountered by respondents were the combined effects of leaf defoliation and tuber holing (50%). This was closely followed by the combined effects of leaf defoliation; tuber holing and fruit rot (35.8%).

Table-2: Farm History and Experience.

Farm	Variables	Frequency	%
Farm Age (Years)	1-9	25	20.8
	10-19	58	48.3
	20-30	32	26.7
	Above 30	5	4.2
Farm Size (Hectares)	<3.5	93	77.5
	3.5-6.0	20	16.7
	6.1-10	5	4.2
	>10	2	1.7
Crop Type	Arable	20	16.7
	Tree Crops	7	5.8
	Arable + Tree Crops	93	77.5

Management of insect pests: As shown in Table-4, the major pest control option practiced by the respondents was the application of synthetic pesticides (41.7%). Another alternative approach to pest management which was next in the ranking was the combination of both synthetic and botanical pesticides (25.8%). Only a few respondents reported the integrated pest management approach of the age-long combination of farm husbandry practices such as weeding, pruning, manuring with little application of synthetic pesticides (13.3%).

Hypothesis Testing: The null hypothesis (H_0): there is no significant relationship between the socio-economic characteristics of the respondents and the pest control method adopted by them. Table-5 shows the Pearson correlation coefficients. There was no significant ($p<0.05$) relationship between the respondents' choice of control method and their socio-economic status. The negative coefficients of correlation between the choice of control method and the age, household size, farm age, and farm size are indications that as the farmers become advanced in age and years of experience in the farm, they tend to have varying opinions about their choice of pest control method. The positive coefficient of correlation between farmers choice of pest control method and their educational status implies that education could play a major role in the choice of pest control adopted by the farmers. However, since the p values of all the variables are higher at $p<0.05$, the null hypothesis is accepted that no significant relationship exist between pest control method and the socio-economic characteristics of the respondents.

Perception of Respondents to the Use of Botanicals: The ranking of the statements and corresponding mean values on the perception of respondents' towards the potentials embedded in the use of botanical pesticides as compared to synthetic pesticides in their descending order based on Likert scale is presented as follow (Table-6): Botanicals were environmentally friendly (5.00), Botanical is cheaper than synthetic (4.983), Synthetic pesticide is expensive (4.95), Botanical plant parts are seasonal (4.917), Botanical increases activity of soil microbes (4.892), Synthetic can easily be accessed (4.858), Synthetic application has lower labour cost (4.858), Botanical requires higher frequency rate (4.325), Botanical is easily degraded (4.73), Botanical has faster decomposition rate and Synthetic has negative impact on the environment (4.717), Synthetic contaminate crop product (4.675), Botanical preparation is complex (4.667), Synthetic is faster in action on insect (4.642), Botanical has slow effect on insects and Synthetic contaminate soil and ground water (4.55), Synthetic produce crop high yield (4.325), Botanical reduces pesticides on human (4.183), Botanical is more effective than synthetic (3.20).

Discussion: Farming activities in the three Agricultural Development Project zones of Ekiti State are driven by active males[13] who fall within the United Nations middle age classification of 40-60 years. The negligible percentage recorded in the age ranking of below 30 years is a wake-up concern that the younger generations are disinterested in farming activities. They show a preference for informal jobs especially city transportation, hustling, and petty trading. This rural-urban migration has negative implication on availability and supply of labour in rural farming. This breaking of the backbone of the rural sector is at the root of the intractable crisis in agriculture and is identified as one of the critical issues which must be addressed to foster crop productivity and food sufficiency in Nigeria[14]. The small to medium household size is an indication of scarcity of farm labour with attendant cost on crop production. This is also a shift from the practice among older generations where large household size was predominant especially for the supply of farm labours in their large hectares of land. The high literacy level in the state is a positive trend that can be explored to enhance adoption of improved technologies and dissemination of information by extension workers[15]. The smallholder sizes of less than 3.5 hectares are an indication that more significant percentages of the respondents were small-scale farmers[16].

Table-3: Distribution of Pests.

Pests	Variables	Frequency	%
Pest Problem	Insects	33	27.5
	Weed	3	2.5
	Insect + weed	34	28.3
	Insect + pathogens	2	1.7
	Insect + weed + pathogens	17	14.2
	Insect + weed + pathogens + others	31	25.8
Insect Orders	Orthoptera	7	5.8
	Lepidoptera	3	2.5
	Isoptera	3	2.5
	Homoptera	1	0.8
	Hymenoptera	1	0.8
	Orthoptera + Lepidoptera	59	49.2
	Orthoptera + Lepidoptera + Isoptera	41	34.2
	Orthoptera + Lepidoptera + Isoptera + Hymenoptera	5	4.2
Pest Symptoms	Defoliation	12	10.0
	Tuber holing	1	0.8
	Fruit rot	2	1.7
	Black pod	2	1.7
	Defoliation + tuber holing	60	50.0
	Defoliation + tuber holing + fruit rot	43	35.8

Table-4: Management of Insect pests.

Variables	Frequency	Percentages
Control		
Synthetic	50	41.7
Botanicals	1	0.8
Synthetic + botanicals	31	25.8
Others	6	5.0
Synthetic + Others	16	13.3
Synthetic + botanicals + others	16	13.3

Table-5: Relationship between respondents' socio-economic characteristics and their choice of pest control method.

Socio-economic variables	Total number	Correlation coefficient	Probability value
Farmers' age	120	-0.096	0.298
Educational level	120	0.168	0.067
Household size	120	-0.053	0.564
Farm age	120	-0.120	0.192
Farm size	120	-0.012	0.896

The Likert scale revealed that the respondents had adequate knowledge about the adverse implication both on humans and the ecosystem as a result of the application of synthetic pesticides on farmlands. It equally showed that the respondents were abreast of the environmental friendliness and less hazardous potentials of botanical pesticides. It becomes worrisome that despite the assumed respondents' high literacy level, synthetic pesticides are more utilized than the botanical pesticides amongst farmers in Ekiti State. Our findings are at variance with the report of Kayode et al[17]. who conducted a survey of the botanicals used by rural farmers in Ekiti State and reported that respondents were enthusiastic in utilizing the botanicals in their farms.

It is possible to be knowledgeable on indigenous pest control approaches, but such knowledge may be eroded over time as a result of improper documentation[18] and "get quick-result syndrome" ravaging our society today. The drudgery involved in the preparation of these botanicals considering the huge quantities required, coverage on farmers' farms, time factor and labour required for the preparation may be responsible for the low adoption by the farmers.

In the past, farmers with their indigenous knowledge of plants depended more on the use of plant extracts for pest control. However, current small-scaled farmers especially want a quick intervention to crop pest problem with improvement in crop production[19]. These modern-day farmers support their views that use of synthetic pesticides is a good agricultural practice which is labour saving, effective and efficient tool in the management of pests[20].

The concern now is looking for the thin line that separates good agricultural practices from the bad. The higher adoption percentage recorded in the use of synthetic pesticides is an indication that the respondents share the views of the modern-day farmers.

Table-6: Perception of respondents to the use of botanical pesticides.

Statements	Strongly agree/ %	Agree/ %	Undecided/ %	Disagree/ %	Strongly disagree/%	Mean value	Ranking
Botanical is cheaper than synthetic	118 (98.3)	2 (1.7)				4.983	2
Botanical is environmentally friendly	120 (100)					5.00	1
Botanical increases activity of soil microbes	109 (90.8)	9 (7.5)	2 (1.7)			4.892	5
Botanical is more effective than synthetic	17 (14.2)	29 (24.2)	39 (32.5)	31 (25.8)	4 (3.3)	3.20	20
Botanical reduces pesticides on human	55 (45.8)	34 (28.3	29 (24.2)	2 (17)		4.183	19
Botanical is easily degraded	93 (77.5)	23 (19.2)	3 (2.5)	1(0.8)		4.73	9
Synthetic is faster in action on insect	88 (73.3)	23 (19.2)	3 (2.5)	1 (0.8)		4.642	15
Synthetic produce crop high yield	62 (51.7)	40 (33.3)	14 (11.7)	3 (2.5)	1 (0.5)	4.325	18
Synthetic application has lower labour cost	104 (86.7)	14 (11.7)	1 (0.8)	1 (0.8)		4.842	7
Synthetic can easily be accessed	103 (85.8)	17 (14.2)				4.858	6
Botanical has faster decomposition rate	90 (75.0)	26 (21.7)	4 (3.3)			4.717	10
Botanical preparation is complex	90 (75.0)	23 (19.2)	4 (3.3)	3 (2.5)		4.667	14
Botanical has slow effect on insects	76 (63.3)	34 (28.3)	10 (8.3)			4.55	16
Botanical require large quantity to be effective	87 (72.5)	29 (24.2)	4 (3.3)			4.691	12
Botanical requires higher frequency rate	96 (80.)	21 (17.5)	3 (2.5)			4.775	8
Botanical plant parts are seasonal	112 (93.3)	7 (5.8)		1 (0.5)		4.917	4
Synthetic has negative impact on the environment	90 (75.0)	26 (21.7)	4 (3.3)			4.717	11
Synthetic contaminate crop product	86 (71.7)	29 (24.2)	5 (4.2)			4.675	13
Synthetic contaminate soil and ground water	76 (63.3)	34 (28.3)	10 (8.3)			4.55	17
Synthetic is expensive	116 (96.7)	2 (1.7)	2 (1.7)			4.95	3

Conclusion

Information sampled from 120 respondents selected from four towns each from the three major ADP zoned in Ekiti State showed that a complex problem of interactions between insects, weeds, pathogens, and other biotic factors was identified as major threats to agricultural productivity in the state. The synthetic pesticide was the main pest control option adopted by most farmers while a few resolved to the combined use of both synthetic and botanicals. Despite respondents' perceptions of the potentials of botanical pesticides, the rate of adoption is still very low due to drudgery involved in its production. This perception emphasizes the need for agricultural policies that would promote commercial production of these botanical pesticides and make incentives available to farmers and local institutions. This would in return improve food security and promote environmental safety.

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