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LEVEL OF KNOWLEDGE AND APPLICATION OF BIOPESTICIDE AMONG MODERN AGRICULTURAL STUDENTS AS PRACTICAL COMPONENTS

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ABSTRACT

Despite the harmful implications in the use of synthetic chemicals to control pests, they are still extensively used in all countries all over the world. The increased social pressure to replace them gradually with other alternative that are safe to humans and non-target organisms has led to increased development of compounds based on the models of naturally occurring active ingredients of biological origin, having various biological activities as "biopesticide". This investigation reviewed the current state of knowledge and application of biopesticide among modern agricultural students as a practical component. The investigation therefore revealed that the modern agricultural students have been using biopesticides during the practical exercise, as it is the most convenient and effective farming system. Beside, out of the respondents interviewed, 50% were male and 50% were female. This revealed that the gender of the students is equal, therefore both males and females study agriculture in modern time. Moreso, some of the students applied different types of biopesticides during their practical exercise; reason is that they make use of any available one. The respondents interviewed equally revealed that they are not highly informed about the application of biopesticides in their studies. Therefore, government, Lecturers and extension agents should try more and educate students well on the knowledge and application of biopesticides in their studies.

INTRODUCTION

Biopesticides are pest management agents and chemicals derived from natural sources such as bacteria, fungal, viruses, plant animals and minerals. It is also known as biological pesticide; they can provide an alternative to synthetic chemicals used to control pest population in agricultural fields and other settings.

Biopesticide can be used by anyone looking for an alternative pest management approach, such as commercial growers, ornamental plant disease, insect, mites and weeds that damage crops and reduce crop yield and quality. Many biopesticides are more environmentally friendly than synthetic pesticide. For instance, many biopesticide target specific pests and have little negative impact on the surrounding ecosystem and human health. (Rikita and Utpal, 2014)). Biopesticide result in effective alternative against conventional pesticides. Modern agriculture is increasingly demanding an alternative means to chemicals for pest control and diseases. In addition, changes in International Laws and regulations and also consumer's demand towards the consumption of food without residues is transforming food biopesticides into an ideal partner in crop protection strategies (Siege, 2001).

Three types of biopesticides are known namely; Microbial, Semichemical and non-conventional pest control products.

Microbial Pesticides are pesticide that contain living microorganism such as bacteria, fungi, viruses, protozoans, algae, mycoplasmas and related organisms that are used to control pests. Many microbials target only specific pests. For example; the codling moth larvae is one of the most serious pests in apples.

Semi chemicals: this message bearing chemicals produced by an organism that causes a behavioural response in another organism of the same or different species. The most common are insect sex Pheromones, which are used in monitoring traps, lure and kill or disrupt the mating of target pests. For example, the Grape Berry moth pheromones when released in large amounts, disrupt the ability of the Grape Berry Moth to perform (Pal. and Kumar, 2013).

Non-conventional Pest control products are substance used by the general public for variety of purposes, but which can also be used as Pest Control Products. They generally pose a low risk to humans and to the environment. Some examples include food item or preservatives such as garlic powder or table salts, Vinegar, Plant extracts and oils such as mineral oils, or fertilizers and plant growth supplements such as mineral salts. For example, vinegar is known to kill

weeds, while mineral oil and powdered sugar is used to control mites (Vidyasagar and Tabassum, 2013). The accidental release of major agricultural pathogen by insect pest would have serious economic effects, resulting in production losses, market decline and increased unemployment in the food and agricultural sector. The control of pest and disease have been a serious problem to farmers; the use of pesticides and cost of buying these chemicals keep arising every day. However, there is need to solve the problem through an alternative means of controlling pest and disease that affect crops (Copping, 2009; Burges, 1998). Modern agricultural is increasingly demanding an alternative to synthetic chemical used to control pest populations and other settings. Therefore, this project work will be very relevant and important to the following categories of people. (a) Commercial growers, specially crop growers, ornamental plant growers, or household gardeners and society as well. (b) Academic community: the research would directly review knowledge in academic area on Biopesticides. Students, Lecturers, Instructors and any other person can make use of it and also make reference to it because it's more environmentally friendly than synthetic pesticides or any other chemical (Brar, *et al* 2006; Benhamou *et al*, 2012). Based on the above, the main objective of the study is to ascertain the level of awareness/knowledge and application of biopesticides in modern agriculture among the agricultural students, as practical component of their studies.

METHODOLOGY AND ANALYTICAL TECHNIQUE

Research Design

The research design for this project was descriptive design which seek to describe the existing status of what is being investigated and it also helps the researcher to know where the variable are gotten and how the objectives could be achieved. This descriptive approach involve the normal gathering, analysis and interpretations of data so as to explain the underlying factors that surround the problems that triggered to the research.

Sources of Data Collection

In the cause of this study, the researcher employed two basic sources of data collection in the process of conducting the research; the researcher used both primary and secondary sources of data collection.

Primary Source

Primary source of data collection are information that are generated specifically for the purpose of this research work. In this study, data were obtained from personal observation, interview and responses on the questionnaire. The questionnaire was designed in a way that, it can permit the respondents to answer (yes or no, agree or disagree and any other options required). The questions were in a closed ended manner in order to ensure accurate statistical evaluation. The data include student's sex,

marital status, Age, their levels in studies, Programme pursued, Student type (that is full time or part time), what farming system/areas do they adopt/practice in their studies, areas of biopesticide application, level of effectiveness and recommendation of biopesticides.

Secondary Source

The secondary data were obtained from existing information that are already written, published and unpublished that are related to the topic which includes textbooks, Journals, newspaper, international publication towards development.

Area of Study

The study area is Federal College of Agriculture, Ishiagu (popularly known as "FCA Ishiagu"), in Ivo Local government area of Ebonyi State, Nigeria. This is a Federal Institution, offering National Diploma and Higher National Diploma as well as certificates in agriculture and some other fields of studies. This is the training wing of the National Root Crops Research Institute, Umudike, in Abia State of Nigeria.

Population of the Study

Population is the number of respondents the researcher is investigating. The population under this study consists of 80 respondents (persons) both National Diploma (ND) and Higher National Diploma students of Federal College of Agriculture, Ishiagu, Ebonyi State. This covered students of core agricultural courses in the institution; namely Crop Production Technology (HND), Pest Management Technology (HND) and Agricultural Technology (ND). The number of students sampled per department was as follows:

- Agricultural Technology Students – 30
- Crop Production Technology Students – 20
- Pest Management Technology Students – 30

The students that constituted the sample were randomly selected based on their various departments. Only those that are involved in Agro-field were selected as said above

Instrument for Data Collection

In this study, the researcher employed most instruments for data collection like personal observation and interview based on questionnaire. The questionnaire were generated in line with the research questions in a simple and clear grammar to enable the respondent understand and respond to the research questions.

Data Analysis

Descriptive Statistics (simple percentage frequency) was computed from the administered questionnaire to determine the level of knowledge and Application of Biopesticide in modern Agriculture among Agricultural students as practical components. Chi-square (χ^2) was equally applied to know the level of significance in the adoption.

RESULT AND DISCUSSION

The result reviewed that 50% of the students were male, while 50% of the students were female. This shows that the gender of the students were equal

(Table 1), showing that both males and females are involved in studying modern agriculture.

Table 2 showed that 97.5% of the students conducted practical in their studies. The result equally revealed that the students applied biopesticides in various fields of their practical work, while 35.16% used biopesticides in field visit, 45.16% in plant protection. These show that the students conducted practical in different fields as their practical components but higher percentage used biopesticides in plant protection, field visit and seed planting. χ^2 -square calculated at 5% probability level revealed that the modern agricultural students are doing practical in their studies and equally using biopesticides as practical components (Table 3a).

On use of biopesticides as plant protection, the investigation (Table 4a) revealed that insect control (25.00%) and weed control (25.00%) featured prominently, followed by storage (17.50%) and disease control (17.50%). Other areas are seed treatment (11.00%), and soil sterilization (8.75%). This shows that biopesticides covered all aspect of agriculture, which is because biopesticides have been approved by scientists as the most valuable and best system of farming as it increases yield, improves soil structure and health. It is also environmental friendly (Tome *et al*, 2015). The analysis showed that the calculated chi-square value, revealed that the adoption of biopesticides among the modern agricultural students is significantly vary high (Table 4b).

It is to be noted that among the agricultural students. 92.50% were aware of biopesticides, while 7.50% are not aware of it in their study. This showed that most of the students are aware of the application of biopesticides in their studies (Table 5). However on level of awareness, only 35% of the agricultural students are aware of biopesticides at a high rate, 35% are aware of it at a moderate rate, while 30% have little knowledge of biopesticides. This could be that the students are not properly informed about the application of biopesticides and its environmental friendly during its application (Table 6a.). Therefore, more sensitization by the lecturers and instructors on the knowledge of biopesticides is expected, because it is a new technology in agriculture (Vidyasagar and Tabassum, 2013) It should equally be noted that only 41.25% of the students have been aware of biopesticides for 2years, 35% of the students have been aware of it for 1year, while 12.50% have been aware of it for 3years. This shows that the students are aware of it just of recent years (i.e. 1-2 years). The reason (Table 7a) being that it is a new technology in agriculture, of which with time the students will be used to it (Vidyasagar and Tabassum, 2013). On the type of biopesticides used, the study also revealed that 37.50% of the students used microbial pesticide, 32.50% bio-chemical pesticide, while 22.50% practised plant Incorporated Protectant, with 7.50% using semi-chemical (Tables 8a and 9). This is clear

indication that majority of the students preferred microbial pesticides and biochemical pesticide. This could be that microbial pesticide and biochemical pesticide are naturally made and they are more environmental friendly and improve the crop yield than other types of biopesticides (Neflic *et al*, 2016).

Different methods of biopesticides application were used by the students (**Table 10**); 31.25% applied biopesticide as seed treatment, 32.25% applied it as seed treatment, 31.25 as foliar on the crops, 20.00% on seedling dipping, 12.50% on soil drenching while 5.00% of them applied it in storage as fumigant (Pal and Kumar, 2013). As regards to this, the students who applied biopesticide as foliar on the crop and used it as seed treatment are significantly very high compared to other methods used (Brar, *et al* 2006; Benhamou *et al*, 2012).

In Table 11a, The result revealed that 12.50% of the agricultural students said that the level of effectiveness of biopesticide is very high, 39.50% said is high, 43.75% reported moderate, while 5.00% said not effective at all. This shows that the rate of effectiveness of biopesticide is moderately high. This is because it is a new technology in agriculture, that is why it is neither high nor too low. But with time they will get to know the proper rate of their effectiveness in modern agriculture (Slame and Jogeni, 2011).

On the rate of recommendation of biopesticide among the students, 41.25% said is highly recommended, 52.50% said is moderately recommended, while 6.25% said that the recommendation is low (**Table 12a**). Based on the result, it shows that most of the students recommended biopesticide use in modern agriculture as a new technology. They are getting well informed in it and understanding the benefit in food production. It will soon be highly recommended in agriculture as more awareness is created (Brar, *et al* 2006; Benhamou *et al*, 2012).

Table 13a revealed the availability of biopesticide; 47.50% said it is moderately accessible, 36.25% reported the availability is high, 12.50% said the accessibility is very hard. That is the reason why the students prefer to use biopesticide because it is easily accessible at a moderate to high rate, compared to that of synthetic chemical which may not be always accessible in local areas (Copping, 2009; Burges, 1998).

SUMMARY

Biopesticides are naturally occurring substances from living organism (natural enemies) or their products (microbial products, phytochemicals) or their by-products (semiochemicals) that can control pest by non toxic mechanisms (Salma and Jogeni, 2011).

The investigation therefore revealed that the modern agricultural students have been using biopesticides during their practical exercise, as it is the most

convenient and effective farming system. The application of biopesticides in crop production will increase the soil nutrient and crop yield. Besides, out of the respondents interviewed, 50% were male and 50% were female. This revealed that the gender of the students were equal, therefore not gender sensitive. Both males and females study agriculture in our institutions.

Moreso, some of the students applied different types of biopesticides during their practical exercise, reason is that they make use of any available one. The respondents interviewed equally revealed that they are not highly informed about the application of biopesticides in their studies. Therefore, government, lecturers, instructors and extension agents should try and educate students well on the knowledge and application of biopesticides in their studies.

CONCLUSION

The increasing concern of consumers at one hands, and government on the other hand about the problems associated with synthetic chemicals for pest control and on food safety has led growers to find new eco-friendly methods to replace the current chemical-based practices. The use of biopesticides as supplement has emerged as promising alternative to chemical pesticides and their demand is rising steadily in all parts of the world. Therefore, this research has provided some information about the potentials of “biopesticides for pest control” and if fully exploited,

could serve as a very effective alternative method for pest control as well as good component for integrated pest management.

RECOMMENDATION

Organizing educational programme for the modern agricultural students; students should be highly educated by the lecturers, instructors and extension agents on the importance and benefits of applying biopesticides. There should be regular practice of the application of biopesticides during the practical exercise. Those instructors teaching practical are important here.

1. Provision of inputs required to carry-out the exercise of biopesticides by the students; The government should make available the inputs needed for the application of biopesticides. This will help to encourage the students and more people to adopt biopesticides in crop production and related fields; this is to ensure safe food, non-pollution of the environment and sustainable development.
2. Government and all stakeholders should ensure that biopesticide is easy to access for the students. This will encourage the students more to applying it during the practical exercise.
3. Lecturers and instructors must carry students along in this new technology that provides alternative to synthetic chemicals.

Table (1): Distribution of respondents according to Gender.

Gender	Frequencies	Percentage
Male	40	50
Female	40	50
Total	80	100

Table (2) Distribution of Respondents on whether they conduct practicals or not in their studies.

	Frequencies	Percentage
Yes	78	97.50
No	2	2.50
Total	80	100

Table (3a): Respondents according to the area practical are conducted.

Area covered	Frequency	Percentage
Field visit	23	28.75
Seed planting	18	22.50
Nursery	5	6.25
Plant protection	25	31.25
Soil amendment	4	5.00
Storage	0	0
Weed control	5	6.25
Seed preservation	0	0.00
Seed treatment	0	0.00
Others	0	0.00
Totals	80	100

Table 3b: X² – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
Field visit	28.75	10	18.75	351.56	35.16	3.841
Seed planting	22.50	10	12.50	156.25	15.63	
Nursery	6.25	10	-3.75	14.06	1.406	
Plant protection	31.25	10	21.25	451.56	45.16	
Soil amendment	5.00	10	-5.00	25.00	2.50	
Storage		10	-10.00	100.00	10.00	
Weed control	6.25	10	-3.75	14.06	1.406	
Seed preservation	0.00	10	-10.00	100.00	10.00	
Seed treatment	0.00	10	-10.00	100.00	10.00	
Other	0.00	10	-10.00	100.00	10.00	
Total	100	100			141.32	16.919

X² Calculated > x² tabulated = significant

Table 4a: Respondents according to the area covered in plant protection

Area covered	Frequency	Percentage
Seed treatment	8	10
Storage	6	7.5
Soil sterilization	7	8.75
Seed preservation	7	8.75
Weed control	18	22.50
Insect control	18	22.50
Disease control	14	17.50
Total	80	100

Table 4b: X² – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
Seed treatment	11.00	14.30	-4.3	18.49	1.29	22.23
Storage	17.50	14.30	-6.8	46.24	3.23	
Soil sterilization	8.75	14.30	-5.55	30.80	2.15	
Seed preservation	8.75	14.30	-5.55	30.80	2.15	
Weed control	22.50	14.30	8.20	67.24	4.70	
Insect control	25.00	14.30	10.70	114.50	8.00	
Disease control	17.50	14.30	3.20	10.24	0.71	
Total	100	100			22.23	

X² Calculated > x² tabulated = significant

Table (5): Respondents according to the awareness to biopesticides use in Agriculture

Awareness	Frequency	Percentage
Yes	74	92.50
No	6	7.50
Total	6	7.50

Table (6a): Respondents according to the extent of awareness of biopesticides

Extent of awareness	Frequencies	Percentage
Little knowledge	24	30
Moderate knowledge	28	35
High (well informed)	28	35
Total	80	100

Table 6b: X² – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
Little knowledge	30	33.3	-3.3	10.89	0.32	
Moderate knowledge	35	33.3	-1.7	2.89	0.86	
High (well informed)	35	33.3	1.7	2.89	0.86	
Total	100	100			2.04	5.991

X² tabulated < x² calculated = non significant

Table (7a): Respondents according to the number of years of awareness of biopesticide

Years of awareness	Frequencies	Percentage
1 year	28	35.00
2 years	33	41.25
3 years	9	11.25
4 years	10	12.50
Total	80	100

Table 7b: X² – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
1 year	35.00	25	10.00	100.00	4.00	
2 years	41.25	25	16.25	264.06	10.56	
3 years	11.25	25	-13.75	189.06	7.56	
4 years	12.50	25	-12.50	156.25	6.25	
Total	100	100			28.37	7.815

X² calculated > x² tabulated = significant

Table 8a: Respondents according to the type of biopesticide known to them

Types of biopesticide known	Frequencies	Percentage
Microbial pesticide	30	37.50
Semio-chemical	6	7.50
Plant-Incorporated Protectants	18	22.50
Bio-chemical pesticide	26	32.50
Total	80	100

Table 8b: X² – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
Microbial Pesticide	37.50	25	12.50	156.25	6.25	
Semio-chemical	7.50	25	-17.50	306.25	12.25	
Plant-Incorporated Protectants	22.50	25	-2.50	6.25	0.25	
Biochemical	32.50	25	7.50	56.25	2.25	
Total	100	100			21.00	7.815

X² calculated > x² tabulated = significant

Table (9): Respondents according to the type of biopesticide they have used

Types of biopesticide used	Frequencies	Percentage
Microbial pesticide	26	32.50
Semio-chemical pesticide	12	15.00
PIPs	18	22.50
Bio-chemical pesticide	24	30.00
Total	80	100

Table (10): Respondents according to the method of application of biopesticide used

Methods of application	Frequencies	Percentage
Seed treatment	25	31.25
Foliar application	25	31.25
Seedling dipping	16	20.00
Soil drenching sterilization	10	12.50
Storage fumigation	4	5.00
Total	80	100

Table (11a): The rate of effectiveness of the biopesticide used by respondents in practical work

Rate of effectiveness	Frequencies	Percentage
Very high	10	12.50
High	30	37.50
Moderate	35	43.75
Low	4	5.00
Not effective at all	1	1.25
Total	80	100

Table 11b: χ^2 – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
Very high	12.50	20	-7.50	56.25	2.81	
High	37.50	20	17.50	306.25	15.31	
Moderate	43.75	20	23.75	564.06	28.20	
Low	5.00	20	-15.00	225.00	11.25	
Not effective at all	1.25	20	-18.75	351.56	14.56	
Total	100	100			75.13	9.488

χ^2 calculated > χ^2 tabulated = significant

Table (12a): Rate of recommendation of biopesticide used to others by their practical work

Rate of recommendation	Frequencies	Percentage
Highly recommended	33	41.25
Moderately recommended	42	52.50
Low	5	6.25
Not recommended at all	0	0.00
Total	80	100

Table 12b : χ^2 – Squire (to determine significance at 5% probability level)

	O _i	E _i	O _i -E _i	(O _i -E _i) ²	$\left(\frac{O_i - E_i}{E_i}\right)^2$	X ² tab
Highly recommended	41.25	25	16.25	264.06	10.56	
Moderately recommended	52.50	25	27.50	756.25	30.25	
Low	6.25	25	-18.75	351.56	14.06	
Not recommended at al	0.00	25	-25.00	625.00	25.00	
Total	100				79.87	7.815

χ^2 calculated > χ^2 tabulated = significant.

Table (13): Respondents according to the availability of the biopesticide for the users

Rate of availability	Frequencies	Percentage
High	29	36.25
Moderate	38	47.50
Low	10	12.50
Very hard	3	3.75
Total	80	100

REFERENCES

- Benhamou, N.; Lafontain, P.J.; Nicole, M. (December, 2012). Induction of systemic Resistance to Fusarium Crown and Root Rot in Tomato Plants by seed treatment with Chitosan. *American. Phytopathological Society.* 84 (12): 1432-44. Doi: 10.1094/phyto-84-1432, ISSN 0031-949X. OCLC 796025684. Retrieved February 8, 2-14.
- Brar, S.K., Verma, M., Tyagi, R.O. and Valero, J.R. (2006). Recent advances in downstream processing and formulations of *Bacillus thuringiensis* based biopesticides. *Processed Biochemistry*, 41:323-342.
- Burges, H.D. (ed.) (1998) Formulation of microbial Biopesticides, beneficial microorganisms, nematodes and seed treatments Publ. *Kluwer Academic Dordrecht*, 412 pp.
- Copping, Leonard G. (2009). The manual of Biocontrol Agents: *A World Compendium. BCPC.* ISBN 978-1-901396-17-1.
- Pal, G.K., Kumar, B. (2013). Antifungal activity of some common weed extracts against wilt causing fungi, *Fusarium oxysporum*. *Current Discovery. International Young Scientist Association for Applied Research and Development.* (1):62-67. ISSN 2320-4400. *Archived from the original* on December 16, 2013. Retrieved February 8, 2014.
- Rikita, B. and Utpal, D. (2014). An overview of Fungal and bacterial biopesticides to control plant pathogens/diseases. *African Journal of Microbiology Research.* 8:1749-1762.
- Salma, M. and Jogeni, C.K. (2011). A review on the use of biopesticides in insect pest management. *International Journal of Science and Advanced Technology*, 1:169-178.
- Siege, J.P. (2001). The mammalian safety of *Bacillus thuringiensis* based insecticides. *Journal of Invertebrate pathology*, 77:13-21.
- Tome, Hudson Vaner Vi, Barbosa, Wagner F.; Martins, Gustavo F.; Guedes, Raul Narciso C. (2015). Spinosad in the native stingless bee *Melipone Auadrifaciata*: Regrettable non-target toxicity of a bioinsecticide". *Chemosphere.* 124: 103-109. doi: 1016/J. *Cehmosphere.* 2014.11.038. PMID 25496737.
- Vidyaagar, G.M. and Tabassum, N. (2013) Antifungal Investigations on Plant Essential Oils: A Review. *International Journal of Pharmacy and Pharmaceutical Sciences*, 2, 19-28.