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Nexus International University ISSN: *3007-1704;* 11(2): 81-88

Pesticides Waste Disposal Pattern among Users in Floriculture Gardens in Benin Metropolis, Edo State, Nigeria

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Abstract. The study examined Pesticides waste disposal pattern among users in floriculture gardens in Benin Metropolis, Edo State, Nigeria. The study described socioeconomic characteristics of respondents, identified their pesticides disposal pattern, perception on disposal pattern, types of pesticides practices in floriculture gardens in study area, and challenges they faced in pesticides disposal. A multistage sampling techniques were used to select respondents (66) in the study while frequency count, means, and percentages descriptive and Pearson product movement correlation were used in this study. The mean age of respondents was 14.8 years, male respondents were higher (63.6%). Most (94.0%) of them had formal education background, higher (78.8%) number of the respondents disposed their pesticides waste into waste bins and reasonable number (m = 4.64) of they do not perceive that proper pesticide waste disposal to be of great importance. Respondents commonly used Attack" brand of pesticide while lack of adequate information on pesticide waste disposal and lack of training/ expertise were some of the challenges respondents were facing while inferential statistic result showed that empty pesticide waste disposal ($r = -0.613$; $<p0.001$) and pouring/burying pestide waste ($r = -0.421$; $p<0.030$) were negatively correlated while flushing drainage/sewages ($r = 0.417$; <0.05) was positively correlated with respondents' perception of pesticides waste disposal at 0.01 and 0.05% levels of significance. The study recommends that government should create agencies that would regulate the disposal of pesticide wastes; Extension agents should be mobilized to train floriculturists on the proper ways to dispose pesticide waste and to also sensitize the gardeners on the effects of improper pesticide waste disposal; and none chemical pesticide control method alternatives should be considered to minimize and reduce pesticide wastes.

Keywords: Pesticides, Users, Waste Disposal, Floriculture Gardens, Benin Metropolis.

1. Introduction

Insects, weeds, fungi, and other undesired species can be controlled or eradicated with the application of pesticides, which are chemical or biological agents. Their goal is to avoid or control these organisms' harmful impacts in order to save public health, animals, and crops. A vast variety of compounds, including insecticides, herbicides, fungicides, and rodenticides, are classified as pesticides and are used to address certain pest management issues (FAO: Food and Agriculture Organization, 2018).

The Federal Insecticide, Fungicide, and Rodenticide Act of 2012 (FIFRA) defines a pesticide as "any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant, and any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, or weeds, or any other forms of life declared to be pests."

Any material or substance containing pesticide that cannot or will not be used and needs to be disposed of is referred to as "Pesticide Waste". According to Nisheim and Fishel (2005) and Damalas et al. (2008), pesticide wastes include excess spray solutions, pesticide residue that is left in application equipment after use, pesticide-contaminated water from cleaning the equipment or from rinsing empty pesticide containers, pesticide-contaminated materials from cleaning up spilled pesticides, empty (unrinsed) pesticide containers, and outdated pesticide products.

Since ancient times, people have utilized flowers as a representation of perfection, beauty, and purity in both religious and social contexts. Producing flowers of this caliber demands careful attention to detail (Newman, 2019). Nonetheless, pests—particularly fungus and insects—often target flower harvests, and pesticides are frequently employed to stop output losses (Mengistie et al., 2017).

The increased use of pesticides in flower crops is primarily linked to genetic modifications in plants, which frequently lead to the elimination of the wild gene that supports natural defences (Tripp and Van der Heide, 1996) and the demand from the global market for high-quality products that are pathogen-free (Peres and Moreira, 2007).
A great deal of jobs was produced by the labor-intensive sector of floristry. The negative consequences of pesticides are a topic of discussion despite their substantial contribution to the national economy (Kassa, 2017; Tizazu, 2018). While peri-urban areas frequently encounter a blend of urban and rural influences, altering floricultural practices, urban floricultural gardens contribute to green spaces within cities, offering aesthetic value and recreational opportunities (Dunnett et al., 2019; Hassan, 2019). The selling of flowers, decorative plants, and related goods, horticulture in peri-urban and urban regions can boost local economies (Serrat, 2018).

Waste disposal refers to the organized and environmentally responsible management of different kinds of waste, making sure that they are safely contained, treated, recycled, or disposed of in a way that does not endanger the environment or public health (U.S. Environmental Protection Agency, 2020). Additionally, pesticides (such as herbicides, insecticides, and rodenticides) may be among these wastes.

Some pesticide waste disposal patterns include: landfill disposal, recycling, return to retailers, incineration, chemical neutralization, household trash, etc., to mention a few. However, if these patterns are not well handled, they can cause environmental pollutions and health hazards, and so on. (Burgess, 2018; Surigan & Unsworth, 2019). Inadquate disposal of pesticide waste can cause issues and put people and the environment at large at serious danger (Aligbokhan, 2018; Ojo et al., 2020).

According to Carvalho (2017) and Pimentel et al. (2018), inappropriate disposal of pesticide waste can lead to a number of issues, including soil contamination, water pollution, harm to non-target species, and the possible emergence of Pests resistant to pesticides. Furthermore, inappropriate disposal techniques may cause volatile organic compounds to be released, which would increase air pollution (Cox et al., 2019). These problems persist because of users' ignorance and inappropriate waste management techniques, which highlights the necessity for an extensive investigation to solve and lessen the effects on the ecosystem and human health.

The broad objective of this study was to assess pesticide wastes disposal pattern among users in floricultural gardens in peri-urban and urban areas of Edo State, Nigeria, while the specific objectives were to: describe the socioeconomic characteristics of pesticide users in floricultural gardens; examine the patterns of pesticide wastes disposal adopted by pesticide users in floricultural gardens; examine the perception of pesticide users on pesticide waste disposal patterns; identify the pesticides used in the floricultural gardens; determine the challenges facing pesticide waste disposal among users in floricultural gardens in Benin metropolis.

2. Research Methodology

This study was conducted in Egor and Ovia North-East Local Government Areas of Edo State, Nigeria. Egor Local Government Area (LGA) is one of the 18 LGAs in Edo State, Nigeria. It is located in the southern part of the state and has its headquarters in the town of Uselu. A multi-stage sampling technique was employed in selecting the respondents in this study. The first stage was a purposive selection of Egor and Ovia North-East local government areas because these areas have the characteristics needed for this study, i.e., these areas had available and functioning floricultural gardens. The second stage involved the snowballing sampling method for the selection of floricultural gardens in the selected local government areas.

The third stage involved the use of a simple random sampling method to select workers/owners (the respondents) from the located floricultural gardens. Since the population of the respondents was below the considered number of respondents, a census was carried out (i.e., the entire population was sampled). Questionnaire was used for data collection though 71 respondents were interviewed only 66 copies of the questionnaire were analysable representing 93% response. data was found available represent a 93%response

Analysis of data collected was done using descriptive statistics such as frequency distribution tables, mean, and percentages among others, while inferential statistics such as Pearson Product Moment Correlation Co-efficient were also used to analyze the perception of pesticide users and the patterns affecting pesticide waste disposal in floricultural gardens. Where:
r = Coefficient,
n = Number of observations
x = Quantitative value of the first set of observation

A null hypothesis stated for study is , there is no significant relationship between respondents' perception of pesticides and their usage.

3. Results and Discussion

3.1 Socio-Economic Characteristics of Respondents

Table 1: Socio-Economic characteristic of respondents

Variable	Freq	%	Mean	Std. Dev.
Sex				
Male	42	63.6		
Female	24	36.4		
Age (in years)				
20,00-30,00	30	45.5		
31.00-40.00	11	16.7		
41.00-50.00	11	16.7	37.82	14.76
51.00-67.00	14	21.2		
Household size				
1-5	52	78.8		
6-10	14	21.2	4.13	1.54
11-15				
16-20				
20				
Educational qualification				
Non-formal education	4	6.1		
Primary education	1	1.5		
Secondary education	30	45.5		
OND/NCE	10	15.2		
HND/BSC	19	28.8		
Others specify (Masters)	2	3.0		
Marital status				
Single	34	51.5		
Married	32	48.5		
Major occupation				
Business	2	3.0		
Gardener	53	80.3		
Potter	1	1.5		
Student	10	15.2		
Pesticide use experience (in years)				
1,00-5.00	20	30.3		
5.01-10.00	16	24.2		
10.01-15.00	8	12.1	15.00	4.48
15.01-55.00	22	33.3		
Floricultural garden experience (in years)				
1.00-5.00	26	39.4		
6.00-10.00	15	22.7		
11.00-15.00	4	6.1	12.36	1.39
16.00-43.00	21	31.8		
Access to pesticides waste disposal agencies	2	3.0		
If yes, does your access affect your method of pesticide disposal	2	3.0		
Other occupations				
Gardener	9	13.6		
Gardner/forex trader	2	3.0		
Potter-flower pots	1	1.5		
Supply agricultural implements, landscape	3	4.5		
Research /gardener	2	3.0		
Tiling	3	4.5		
Farming/Agriculture	46	69.7		
Estimated annual wages (in naira)				
20,000-50,000	6	9.1		
50,000-100,000	14	21.2		
100,001-200,000	11	16.7		
200,001-300,000	11	16.7	511,584.39	128612
300,001-400,000	5	7.6		
400,001-500,000	9	13.6		
500,001-10,000,000	10	15.2		

Source: *Field Survey, 2024*

Table 1 indicates that there is a male predominance in the floriculture industry, with 63.6% of respondents in the research area being male and 36.4% being female. This was consistent with the findings of Sosan et al. (2020), for management and disposal of pesticides waste. Ahigher proportion (45.5%). A higher proportion (45.5%) of respondents were between the ages of 20 and 30 years, with a mean age of 38years. This indicates that the majority of gardeners and florists in Benin's urban areas were between the ages of 20 and 30, with a mean age of about 38. This demonstrates that younger people are more engaged in gardening and floriculture. The present study's result that the average age of respondents, including floriculturists, was 38 years is in line with the findings of Nchanji et al (2018). for Cameroun. From Table 1, 78.8% of the respondent had household between 1-5 persons. Iheke and Igbokwe (2021) finding for floriculture garden operators in south East Nigeria.

The Table also reveals that 45.5% had completed secondary school education. Given that the majority of gardeners received at least a primary education, this suggests that the majority of them are literate. Olajide et al. (2018) also discovered that the majority of floriculturists had formal, higher education levels, for Oyo state, Nigeria, which may have been linked to their improved access to technology and knowledge and, consequently, to their success in running their gardens. As at the time of this study, 51.5% of the respondents were married, meaning that the majority of respondents were married. These outcomes corroborated Jande's (2002) findings, for Benue State, Nigeria.

Most (80.3%) students of respondent were garden business owners. This indicates that the vast majority of responses work primary in floriculture and are self-employed. These results were consistent with those of Falusi and Adeleye (2002), who found that 75% of people in most developing nations work primarily in agriculture, which includes floriculture.

In addition, the Table 1 reveals that 33.3% of respondents had used pesticides for between 16 and 20 years, with an average of 15.00 years, hence the respondent should be experience in pesticide usage and waste disposal pattern. However, a higher proportion (39.4%) of the respondent for between one and five years, with an average of twelve years in floriculture garden, with a standard deviation of 1.39, is an indication that very minimal variation of statistical difference exist in the various interval groups. As majority (69.7%) of the respondents did not work in any other field. This merely suggests that the majority of respondents don't have any other side jobs and are exclusively engaged in gardening.

With an average yearly wage of 511,584.39 naira, this suggests that the majority of gardeners and floriculturists make at least 500,000 naira a year. Olajide-Taiwo (2010)N claims that depending on variables including geography, work experience, and type of employment, floriculturists' pay in Nigeria fluctuates greatly. According to the survey, some floriculturists earn less than N30,000 annually, while others bring in more over N200,000. These findings negate the present result.

3.2 Methods of Pesticide Wastes Disposal Adopted by Pesticide Users in Floricultural Gardens

Table 2: Methods of Pesticides Disposal used by Users

Method of disposal	Freq	%
Disposing empty pesticide containers/waste in trash cans	52	78.8
Puncture pesticide containers to prevent reuse	31	47.0
Pour pesticide waste down the drain/sewage	27	40.9
Burn pesticide can after use	15	22.7
Pour and bury pesticide in the ground	9	13.6

**Multiple responses obtained

Source: *Field Survey, 2024*

From Table 2 results, majority (78.8%) of the respondents said they disposed of waste or empty pesticide containers in trashcans, and 47.0% said they disposed of them by puncturing them to avoid repurposing. Only 22.7% and 13.6% of respondents said they burned pesticide cans after using them, while 40.9% said they put pesticide waste down the sink or sewage, respectively. This indicates that each respondent may have multiple ways of disposing pesticide waste. According to Sosan et al. (2020) study, some farmers dispose of empty pesticide containers by burning, burying, or putting them in the trash or on the farm. It is, however, in conflict with the Environmental Protection Agency's (EPA) 2010 document that outlines guidelines for the proper disposal of pesticide waste, which emphasizes that pesticides should never be disposed of in regular trash cans or drains and stresses the significance of adhering to the proper disposal methods to protect human health and the environment.

3.3 Perception of Pesticide Users on Pesticide Waste Disposal Patterns

Table 3: Perception of Pesticide Users on Waste Disposal Methods

Perception	Mean	Std.Dev
Do you believe that proper pesticide waste disposal is of great importance	4.65	0.57
Do you believe that pesticide waste disposal should be regulated by the government	3.86	0.68
Do you think the pattern of pesticide waste disposal affects the environment	4.32	0.61
Do you think your perception of pesticide waste disposal is shared by others	3.17	0.60

*Mean >/=3.0=positive perception
Source: *Field survey, 2024*

Based on the fact that every respondent had a grand mean of greater than 3.0, it was possible to infer that they all had a favourable attitude toward the way pesticide users perceived the usage of pesticide waste disposal techniques (Table 3). For example, a large number of people do think that proper disposal of pesticide waste is very important (mean = 4.65), that government regulation of waste disposal is important (mean = 3.86), that waste disposal patterns have an impact on the environment (mean = 4.32), and that people should share their opinions about waste disposal with others (mean = 3.17). According to this, the majority of respondents think that properly disposing of pesticide waste is extremely important. This is consistent with the findings of the study conducted in 2021 by Amujo and Osinem, which also showed that most floriculturists understood the significance of properly disposing of pesticide waste in order to protect human health and the environment.

3.4 Pesticides used in the floricultural gardens

Table 4: Pesticide used

Pesticide uses **	Freq.	%
Attack	50	75.8
Lara force	39	59.1
DD force	41	62.1
Perfect killer	48	72.7
Ultracide	62	93.9
Snipper	37	56.1
Dime force	47	71.2

**Multiple responses obtained
Source: *Field survey, 2024*

An analysis of the different pesticides used by the respondents revealed that 75.8% used Attack, 59.1% used Lara force, 62.1% used DD force, 72.7% used Perfect Killer, 93.9% used Ultracide, 56.1% used Sniper, and 71.2% used Dime force (Table 4). This suggests that most respondents preferred to use Ultracide pesticides, maybe it is due to the fact that majority of the people are using it in the area, and its perceived efficacy among its users.

3.5 Challenges Facing Pesticide Waste Disposal Among Pesticide Users in Floricultural Gardens.

Table 5: Challenges of pesticides waste disposal

Challenges	Mean	Std. Dev.
Poor access to safe pesticide waste disposal	4.42	0.98
Transportation	3.62	1.31
Cost	3.50	1.04
Lack of adequate information of pesticide waste disposal	4.79	0.54
Language barrier	3.14	1.35
Lack of training/expertise	4.56	0.88

*Mean >/3.0=Serious challenges
Source: *Field survey, 2024*

The analysis of the challenges faced in disposing of pesticide waste is presented in Table 5. it was noted that respondents had significant difficulties getting rid of pesticide waste, even though their grand mean was 3.0 for all of them. A language barrier (mean = 3.14), insufficient access to safe ways to dispose of pesticide waste (mean = 4.42), problems with transportation (mean = 3.62), cost (mean = 3.50), inadequate information (mean = 4.79), and a lack of training or experience (mean = 4.56) were among the observations made about the respondents. All this finding shows is that the respondents had different difficulties getting rid of their pesticide waste. Consistent with the conclusions of Sosan et al. (2020), farmers including those in the floriculture industry have reported challenges when it comes to

getting rid of chemical waste. These issues can be linked to insufficient waste management infrastructure as well as a lack of awareness and information about appropriate disposal methods for pesticide waste.

3.6 Hypothesis

Perception of the pesticide users and their pesticide wastes disposal patterns

Table 6: Correlation between perception of pesticide users and their disposal methods

Variable	Correlation Coeff. (r)	P-value	Decision
Disposing empty pesticide containers/waste in trash cans	-0.613**	0.001	S
Puncture pesticide containers to prevent reuse	0.183	0.152	NS
Poor pesticide waste down the drain/sewage	0.417*	0.050	S
Burn pesticide can after use	0.091	0.271	NS
Pour and bury pesticide in the ground	-0.421*	0.030	S

*Sign at 0.05 level; ** Sign. at 0.01 level

Source: *Field Survey, 2024*

Results of Pearson's Product Moment Correlations indicates that empty disposal of containers in trash ($r = -0.613$; $p<0.001$) and pouring/burying pesticide waste in the ground ($r = -0.421$; $p<0.030$) were negatively correlated while pouring down the drainage or sewage ($r = 0.417$; $p < 0.05$) was positively correlated with how the respondents' perceived pesticides waste disposal at 0.01 and 0.05 level of significance respectively as presented in Table 6. This suggests that, at the 1% and 5% level of significance, there is a substantial correlation between the perceptions of pesticide users and the practices of throwing away pesticide containers in the trash, flushing pesticide waste down the drain, and burying or pouring pesticide underground.

The correlation between pesticide users' perceptions and disposal practices found in this study is consistent with the findings of Ntow et al. (2014), which found that many farmers, including floriculturists, dispose of pesticide waste in regular trash due to a lack of knowledge regarding proper waste management. The findings of the study demonstrate a negative association ($r = -0.613$; $p<0.001$) between the quantity of pesticide waste and empty containers disposed of in trash cans and the perception of pesticide users. Sosan et al. (2020) have shown a correlation between the perception of pesticide users and their practice of disposing of pesticide waste by either pouring it into the ground or burying it.

Numerous factors, including the users' degree of knowledge, their awareness of the risks involved, the availability of waste management services, and their general comprehension of the potential drawbacks coming from improper disposal practices, influence this link. The negative correlation ($r = -0.421$; $p<0.050$) also indicates that as the frequency or amount of pesticide waste poured or buried in the ground increases, the value of the perception of the pesticide users decreases, and vice versa.

Ntow et al.'s (2014) research highlights the need to raise awareness and educate pesticide users on proper disposal practices to improve their perception of pesticide waste management. Werf van der (1996) research also implies that if pesticide users perceive pouring waste down the drainage or sewage as a cost-effective, efficient, or low-risk method, their perception may be positively correlated with this disposal practice. The positive correlation indicates that respondents' perceptions of pesticide waste disposal become more accepted or favourable as the amount of waste dumped into the drainage or sewage increases, and vice versa.

4. Conclusion and Recommendations

It can be concluded from this study that majority of the respondents were aware of the various methods of pesticide waste disposal available and also aware of some pesticide practices put to use in floricultural gardens. It was also observed that most of the respondents face quite a number of challenges to dispose pesticide waste and all the respondents had positive disposition to the perception of pesticide users on pesticide waste disposal patterns.

Based on the findings from this study, the following recommendations were made:

- The government should create agencies that would regulate the disposal of pesticide wastes.
- Extension agents should be mobilized to train floriculturists on the proper ways to dispose pesticide waste and to also sensitize the gardeners on the effects of improper pesticide waste disposal.

- Non chemical pesticide control method alternatives should be considered to minimize and reduce pesticide wastes.

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