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Analysis of Information on Disposal of Agrochemical Containers among Small Scale Farmers in Gboko Local Government Area of Benue State, Nigeria

P.G[1]*. Kughur, R.A[1]. Damsa and C.T[2]. Beeior
[1]Department of Agricultural Extension and Communication, College of Agricultural Economics and Extension, Joseph Sarwuan Tarka University, Makurdi
[2]Department of Agricultural Education, College of Education, Oju, Benue State.
*Correspondence E-mail: gyandenkughur@gmail.com

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Abstract
The study analysed information on disposal of agrochemical containers among small scale farmers in Goko Local Government Area of Benue State, Nigeria. A stratified purposive and simple random sampling technique was used in selecting a sample size of 125 farmers. Primary data were collected; data collected were analysed using descriptive statistics. Findings established that 84.8% were males, 31.2% were age 40-50 years among them 78.4% were married with 43.3% having household size of 7-9 persons, 39.2% acquired secondary education with 28% who had farming experience of 31-40 years. About 40% of the respondents had farmland of between 3 and 4 hectares, 33.6% earned an annual estimated income of above ₦500,000.0 and 96.6% had no contact with extension agents, 53.6% disposed agrochemical containers using open dump, on perceived negative effects of agrochemicals 68.8% had reduction in soil microorganisms. About 54% perceived long-time negative effects as reduced visual ability, 32.8% disposed an average of 9 containers in a year and 98.4% had the challenge of lack of knowledge on dangers associated with disposal of agrochemical containers. In conclusion, the indiscriminate disposal and reuse of agrochemical containers/sachets have led to contamination of environment which climax to serious human health problems. It is recommended that public enlightenment should be carried out on dangers of indiscriminate disposal of agrochemical containers/sachets and agrochemical containers/sachets collecting points should be established by both the public and private sectors.

Keywords: Effects, disposal, agrochemicals, used containers, farmers

Introduction

The economy of Nigeria is primarily agriculture-based and agriculture contributes more 60 per cent of the gross domestic product (GDP) and more than 40 percent of the labour force is engaged in agriculture and allied areas. Since independence in 1960, the government especially at the Federal and State levels have invested huge amounts of money in developing the agricultural sector. Crop and livestock production as some of the important areas of agriculture has, however, been threatened in different ways including different diseases, weeds and insect/pests among others. To arrest these problems, agrochemicals have become increasingly one of the essential ingredients used in crops and livestock production. Agrochemicals are important agricultural inputs to protect crops and livestock from insect/pests, diseases and weeds. The uses of agrochemicals contribute not only to the healthy growth of crops and livestock but also to improving farm work efficiency and a stable supply of tasty agricultural produce. There are numerous agrochemicals including antibiotics, pesticides, rodenticides, fertilizers and herbicides among others to eliminate the presence of living organisms that causes diseases or injury and improve livestock or crops production.

Agrochemicals refer to substances used to help manage an agricultural ecosystem, or the community of organisms in a farming area [1]. An agrochemical is a chemical substance like hormone, fertilizer, insecticide and fungicide or soil treatment that helps improve crop and animal production [2]. It refers to inorganic fertilizers, antibiotics and pesticides just to mention a few that provide benefits and manage the agricultural ecosystem and is used in farming fields. Agrochemicals include fertilizers, liming and acidifying agents, soil conditioners, pesticides and fungicides, antibiotics and hormones [3]. Agrochemicals are important agricultural inputs to protect crops and livestock/animals from pest/disease and weeds. In a similar way to tractors, ploughs and other implements, agrochemicals have now become an integral part of the complex world of technical inputs required for modern agricultural production and are accepted as a standard tool of a trade by farmers throughout the world.

For several decades human beings have used agrochemicals to enhance crops and livestock production. The first known agrochemical was sulphur-dusting used in ancient times more than 4,500 years ago in Mesopotamia. By the 15th century, toxic agrochemicals such as lead, mercury and arsenic were used. In the 17th century, nicotine sulphate was used; the 19th century saw the introduction of more natural agrochemicals which are derived from the roots of vegetables [4]. Agrochemicals are manufactured in containers which may be plastic bottles and sachets among others and after being used these containers are disposed in different ways. Mismanagement/improper disposal of agrochemical containers are reported in many countries of the world. In Nigeria, there is no available information on the number of empty agrochemicals containers generated annually. The situation is completely different in some developing countries. For instance, Ecuador, managed to collect between 0 and 4 percent of the total empty containers generated in 2004 and 2005, whereas in Uruguay they collected 8.3 percent and 5 percent in 2004 and 2005 respectively. Developed countries like Australia and France managed to collect 35 per cent and 25 per cent of the total empty containers generated in 2003 [5].

The rapid growth that occurred in terms of the application of agrochemicals for both farming and industrial purposes have made containers littered almost everywhere in our environment and the low level of knowledge especially small and medium scale farmers regarding the use and health implications of disposal of agrochemical containers have worsened the disposal methods. It is seen that most of the agrochemical containers are disposed incorrectly and some farmers even used them to store food and drinking water or put them to other uses. The containers may be reused in different ways or disposed in various ways. In Nigeria and Ethiopia for instance, farmers convert the containers to various domestic applications including storage of drinking water and food. In Nigeria, as a consequence of the current patterns of use and disposal of agrochemicals, the volume of empty containers generated has increased tremendously and has become one of the major environmental problems in the country.

The empty containers of agrochemicals still have their residues inside them. So, even after they are used and emptied, they are considered hazardous waste that can cause damage to the environment and human health [6, 7]. There is a danger that empty containers, when reused to store water and food, may lead to poisoning and that those left in the environment will contaminate soils and underground water sources. Numerous studies have shown that people who drink water contaminated with agrochemicals have a higher likelihood of deterioration of the hematopoietic system, nephrotoxic and/or hepatotoxic effects, and reproductive disorders [6, 7].

Improper disposal of agrochemical containers can cause contamination of surface water (from overland flow and groundwater seepage or surface runoff); air (dust emissions and volatilization); groundwater (infiltration/leaching); sediments (surface runoff/overland flow seepage and leaching) soils (due to erosion, including dust deposition/generation); and biota (due to bioaccumulation and biological uptake) [8, 9, 10]. The poor or improper disposal and handling of agrochemicals containers may lead to environmental degradation, destruction of the ecosystem and may cause great risk to public health while agrochemical containers/waste dumped indiscriminately in any environment constitute both short and long-term negative effects to both humans and ecological systems [11]. Improper disposal/mismanagement of agrochemicals plastic packages/containers constitute a major environmental problem, resulting in pollution of soil, air, and water resources and compromising the agricultural produce safety, the protection of the environment, and public health.

In many developed countries, the use of agrichemicals is highly regulated. Government issuance of permits for the purchase and use of approved agrochemicals may be required. Similarly, significant penalties can result from misuse including improper storage resulting in spillage and improper disposal of containers. On farms, proper storage facilities and labelling, emergency clean-up equipment, procedures and safety equipment and procedures for handling, application and disposal are often subject to mandatory standards and regulations [12]. In developing countries, however, little or complete absence of strict regulations and penalties are not observed and this allows users of agrochemicals who continue to mismanage their application and disposal which negatively affects the environment.

Materials and Methods

This study was conducted in Gboko Local Government Area (LGA). Gboko LGA is one of the 23 Local Government Areas in Benue State. It is located between Latitude 7° 0′ and 7° 40′ north of the Equator and Longitude 8° 35′ and 9° 15′ east of the Greenwich Meridian. It is bounded by Gwer East LGA and Konshisha LGA to the west, Tarka LGA to the north, Buruku LGA to the east, Ushongo LGA to the south. It is the traditional headquarters of the Tiv ethnic group, the fourth largest tribe in Nigeria; it is approximately 1920.48km^2. The relief of the area consists of hills prominent among which is Mkar hill and valleys with gently undulating plains. The area lies in the tropical climatic zone and has two seasons: the rainy season which starts from April to November and the dry season which starts from November to March. The rains are mostly convectional with isolated aerographic types around Mkar hill. Temperature varies between 23°°-38°C in the year. The mean monthly rainfall in the area is between 0.77cm and 22.75cm.

The vegetation consists mainly of guinea savannah made up of trees and mixed grasses having average height. The natural vegetation consists of woodland and tall grasses. Burning of the bushes, grazing and hunting have to a large

extent impacted the original forests. The original forest vegetation is now reduced to secondary forest and savannah vegetation. There are pockets of scattered trees that are of economic benefits including mango, shear-butter and locust beans and cashews. The area has an estimated population of 515,244 [13]. The LGA has one of the highest population densities in the State with more than 300 persons per km^2. The people of the area are mainly farmers. Over 80 percent of the total population is dependent on farming for their living, taking advantage of the rich alluvial soils of the Benue valley and the foothills of Mkar. Crops planted in the area include yam, cassava, rice, soya beans, millet, potato, sorghum, groundnuts, maize and sesame to mention but a few. Gboko produces over 40% of the State's soya beans yield [14].

Results and Discussion

Table 1: Socioeconomic Characteristics of the Respondents (n = 125)

Variable	Frequency	Percentage	Mean
Sex			
Male	106	84.8	
Female	19	15.2	
Age (years)			
41 – 50	39	31.2	
At least 30	30	24.0	
51 – 60	28	22.4	
30 – 40	25	20	**1.6**
More than 70	2	1.6	
61 – 70	1	0.7	
Marital status			
Married	98	78.4	
Separated	12	9.6	
Single	8	6.4	
Divorced	7	5.6	
Household size			
7 - 9	52	43.3	
4 – 6	45	36.0	
10 – 12	16	12.8	**2.2**
1 – 3	8	6.4	
12 and Above	4	3.2	
Level of Education			
Secondary school	49	39.2	
Non-formal education	43	34.4	**1.6**
Tertiary education	31	24.8	
Primary school	2	1.6	
Years of Farming			
31 – 40	35	28.0	
41 – 50	24	19.2	
21 – 30	20	16.0	**2.6**
11 – 20	17	13.6	
1 – 10	15	12.0	
Above 50	14	11.2	
Size of farmland (hectares)			
3-4	49	39.2	
1-2	38	30.4	
5-6	26	20.8	**2.9**
More than 6	7	5.6	
At least 1	5	4.0	
Annual income (Naira)			
Above 500,000	42	33.6	
400,001–500,000	39	31.2	
300,00 –400,000	31	24.8	**12.2**
200,001–300,000	7	5.6	
100,000 –200,000	4	3.2	
Less than 100,000	2	1.6	
Contact with Extension Workers			
None	87	69.6	
Once	23	18.4	**0.5**
Twice	11	8.8	
Trice and Above	4	3.2	

Results in Table 1 show that 84.8% of the respondents were male. This means that males were more involved in farming than females in the study area. Manual farming as it is done in Nigeria and indeed Benue State involves the application of physical energy to carry out farm operations, therefore, females may be involved in farm work but to a lesser extent compared to males. Another thing is that in African culture, ladies cannot be household head in the presence of their husbands and since the respondents were household heads, the number of females who were household heads may be small compare to that of males. Similarly, work done by females is under-reported in most cases, in contrast, projecting work done by males only.

Findings on age depicted that a reasonable (31.2%) proportion of the respondents were between 41 and 50 years old. The age of between 41 and 50 years is considered a transition from very energetic to less energetic stage. People of this age category are energetic to some extent to perform farm operations that are associated with manual labour carried out in the study area. Similarly, age is associated with energy; young people are more energetic than old people and can perform more tedious farm operations. Strength to perform farm operations, especially the manual labour diminished with age, the older a person, the lower the strength to carry out manual farm activities especially manual labour.

On marital status, most (78.4%) of the respondents were married. Marriage is assumed to confer responsibility on people. Married persons behave more careful because they have a responsibility to take care of both their nuclear and extended family members. Similarly, married people serve as role models to many people including members of their immediate families. People who are married always want to have a source of livelihood to enable them to get an income and take care of their families. In the rural area where farming is the most simple and available job, married persons can go into farming essentially to earn income for themselves and their families. The finding confirms that of [1] that married people behave more responsible than singles.

Results on household size showed that a reasonable (43.3%) proportion of the respondents had a family size of 7-9 members. The family size of 9 members is large considering the difficulties associated with taking proper care of people in the current economic hardship. For farmers, large household size is very important and it is the wish of most farmers to have it. This is because family members serve as a major source of manual labour on the farm. Farmers with a large population of people in their homes make proper use of them on the farm and this has the potential to increase both their area of land cultivated and possibly increased yield. The traditional African people also believe that having a large family membership is an indication that such a person/farmer is wealthy.

The result in Table 1 revealed that a small (39.2%) proportion of the respondents attended secondary school. This is an indication that the respondents were educated to some extent. Education plays an important role in human beings as it makes people more receptive. It also helps in exposing people to different areas. It broadens peoples' scope in terms of searching for information and been more interactive to mention but a few. Similarly, education is used as an instrument in refining human behaviour. Education can help farmers to read instruction (labels) on agrochemicals, this can help reduce the risk of applying agrochemicals wrongly. Many farmers who are not educated to the level of reading labels of agrochemical instructions on how to constitute and apply agrochemicals seek such information from agrochemical dealers or neighbours. Despite the advice that may be given to farmers by neighbours or agrochemical dealers, many farmers who are not educated still violate such instructions for lack of proper education. Education is very important, especially in handling agrochemicals which may have different instructions for their constitution and application by the manufacturer.

The result in Table 1 indicated that a small (28.0%) proportion of the respondents had farming experience of 31-40. 'Experience is the best teacher'. Experience is an important tool in farming and other areas in life. Farmers in using agrochemicals over the years may have acquired certain experience and knowledge that the inexperienced ones cannot have; this will go a long way in the effective application of agrochemicals for high yield. Agrochemicals are dangerous substances that are handled by farmers on daily basis, especially during the farming seasons. For those farmers who are experienced their constitution and applications are done with proper protection and care, also, following specific directions based on the flow of wind. Farmers who are educated may also be aware of agrochemicals meant for specific crops like cowpea, yam and maize among others. Experienced farmers may also be aware of the type and quantity of agrochemical that is required to be used for specific crops.

Based on the size of farmland, 39.2% of the respondents had between 3 and 4 hectares. This depicts that the farmers were small scale. Nowadays, due to increase in population, farmland that was meant for planting of crops are being utilized for other purposes like construction of residential quarters, roads, schools and hospitals among others. The pressure on farmland for other purposes has continued to reduce farmlands on yearly basis. The farm size of individual holding is also being reduced as a result of fragmentation among family members. Fragmentation of land along family members has led to a reduction in farm size and has plunged many families and communities into communal conflicts culminating in the loss of lives and many properties.

Results on estimated annual income reveal that a reasonable (33.6%) proportion of the respondents earned about ₦500,000.0. This is an indication that the farmers operated on a small scale basis. Most farmers in Nigeria

operate on a small scale basis and this has continued to limit their expansion as they lack some of the basic requirements for the acquisition of formal credit facilities and farm inputs. Some small scale farmers due to poor harvest in the preceding year may not be able to buy a reasonable quantity of agrochemicals which has become one of the essential farm inputs for the cultivation of crops. The rate at which weeds and pest/diseases compete or attack crops have increased over the years because of continued use of land for agricultural production. Similarly, the cost of agrochemicals has also continued to increase on yearly basis due to high demand, making it more and more difficult for farmers to acquire.

Result in Table 1 revealed that the highest (69.6%) proportion of the respondents had no contact with extension workers. Extension workers play an important role in educating farmers to improve crop and animal production. In absence of extension agents, farmers are at a crossroads on what to do about many farm practices including the rate of fertilizer application, planting depth, how to mulch using different materials and management of finances most especially the inexperienced ones. Farmers who have contact with extension agents may get information on certain vital farm matters, farmers who are opportune to meet extension agents may share their experience with other farmers.

Table 2: Distribution of the Respondents by Ways of Disposal of Agrochemical Containers

Way of Disposal	Frequency	Percentage
Open Dump	67	53.6
Landfills	36	28.8
Open Burning	14	11.2
River Dumping	8	6.4
Total	**125**	**100**

Results in Table 2 revealed that the majority (53.6%) of the respondents disposed agrochemical containers in an open dump. An open dump is a place where an open pit is dug and containers/sachets of agrochemicals are dumped inside it. The containers/sachets of agrochemicals may be dumped inside it and left open, in case of heavy downpour agrochemicals and the containers are washed to different streams and rivers leading to contamination of the environment. In places where there are laws regarding the disposal of agrochemicals, open dumping may not be allowed, however, in places like Nigeria where there are no prohibitions concerning the disposal of such materials, the open dump may be regarded as one of the normal ways of disposal of agrochemical containers/sachets. This contradicts the finding of [12] that open dump of agrochemical containers is not accepted and violation in some countries is associated with a penalty.

Table 3: Perceived Short-time Negative Effects of Agrochemical Containers/sachets

Effect	Frequency	Percentage
Reduction in soil microorganisms	86	68.8
Headaches	72	57.6
Body inching	61	48.8
Irritation of the eyes	46	36.8
Fatigue	40	32.0
Poor concentration	23	18.4
Excessive Sweating	22	17.6
Cause nausea	16	12.8
Skin rashes	15	12.0
Damage to some organs	13	10.4
Skin irritation	12	9.6
Dizziness	12	9.6
Vomiting	10	8.0
Impaired vision	9	7.2

*Multiple responses *

Results in Table 3 depicted that reduction in soil microorganisms (68.8%) and headaches (57.6%) among others were some of the perceived short-time negative effects of agrochemical containers on the environment. There are many negative effects of agrochemicals. Agrochemicals are capable of destroying important micro and other living organisms in the soil such as earthworms that help in recycling the soil nutrients. Agrochemicals have both benefits and negative effects. Some of their negative effects include elimination of beneficial insects, harmful to individuals handling it especially when precautions are not properly taken. The finding agrees

with that of [15] that agrochemicals have many short-time negative effects such as headaches, skin discomfort, fatigue, body aches and skin rashes among others.

Table 4: Perceived Long-time Negative Effects of Agrochemical Containers/sachets

Effect	Frequency	Percentage
Reduced visual ability	67	53.6
Other chronic illnesses	52	41.6
Loss of memory	46	36.8
Loss of Coordination	25	20.0
Cause asthma	22	17.6
Reduced motor skills	11	8.8
Cause Cancer	9	7.2

*Multiple responses *

Results in Table 4 revealed that the highest (53.6%) proportion of the respondents had reduced visual ability and other chronic illnesses (41.6%) among others. Reduced visual ability may be caused by the non-use of appropriate protective equipment during handling of agrochemicals. Many farmers/people do not wear any protective equipment before handling or applying agrochemicals and this exposes them to many dangers associated with having direct contact with the chemicals, especially eyes. The reduction in the visual ability of the farmers may be as a result of mist from agrochemicals which directly enter the eyes of a person during handling/application of the chemicals. The mist has serious negative implications on the health of the person involved especially on the eyes which may be immediately or later in life. The reduction in visual ability caused by agrochemicals if not treated on time can result to permanent eyes blindness. The result is in tandem with that of [16] that reduced motor skills, loss of memory and impaired vision were some of the negative effects of applying agrochemicals without proper protective equipment.

Table 5: Number of Agrochemical Containers/sachets Disposed in a Year by the Respondents

Containers/sachets disposed	Frequency	Percentage
7 - 9	41	32.8
10 and Above	39	31.2
4 - 6	32	25.6
1-3	13	10.4
Total	**124**	**100**

Results in Table 5 depicted that a small (32.8%) proportion of the respondents disposed an average of 9 containers/sachets of agrochemicals in a year followed by 31.2% who disposed an average of 10 and above containers/sachets of agrochemicals. This means that the respondents were small scale farmers who may not be able to acquire two or more cartoons of agrochemicals. Small scale farmers have many limitations including access to the formal credit facility, lack of collateral, inadequate access to information on agricultural innovations and use of local varieties of crops and animals to mention just a few. Most small scale farmers, farm mainly for consumption and only sell the surplus. Some of them do not think of increasing their farm enterprise while others plan to increase theirs. Some small scale farmers may require little quantity of agrochemicals less than 10 Kg while others may require more than 20 kg depending on the size of their farmland.

Table 6: Challenges to Effective Disposal of Agrochemical Containers by the Respondents

Challenge	Frequency	Percentage
Lack of knowledge on dangers of agrochemicals	123	98.4
Ignorance	121	96.8
Absence of collecting points	106	84.8
Lack of designated disposal point	102	81.6
Improper waste management generally	98	78.4
Absence or weak legislation	94	75.2
Lack of proper planning	88	70.4
Burning/illegal dumping	72	57.6
Containers put to other uses	67	53.6
Lack of punishment	22	17.6
Lack of space for disposal	18	14.4
Negative attitude of farmers	16	12.8

* Multiple responses *

Results in Table 6 revealed that lack of adequate knowledge on dangers of agrochemical containers/sachets (98.4%) and ignorance (96.8%) and absence of agrochemical containers/sachets collecting points (84.8%) were some of the major challenges to effective disposal of agrochemical containers/sachets. Knowledge is an instrument that liberates people from ignorance and primitive behaviour and creates a better atmosphere for conducive living. Lack of knowledge is capable of destroying an entire nation.

Farmers who do not have adequate knowledge of the dangers associated with indiscriminate disposal of agrochemical containers may act in strange ways including disposal of the agrochemicals anywhere or conversion of agrochemical containers for domestic use. Some farmers convert these containers/sachets to food storage facilities. It is important to note that agrochemical containers contain residue of such chemicals even when they are washed and constitute a danger to human health. The finding confirms that of [5] that farmers use agrochemical containers for storing water, food and other materials.

Conclusion

Agrochemicals have become an integral part of the farming system from time immemorial as they facilitate improvement or increase in the yield of crops and animals. The primary objective of agrochemicals is to reduce the negative effects of pest/diseases infestations on crops and animals and to improve the quality and quantity of yield. Agrochemicals come in various containers/sachets most of these containers/sachets are non-biodegradable materials and are discharged after used. Some farmers, however, put the containers to different uses including storage of food and water. Agrochemicals may apply on the farm or in the warehouse at different stages and uses including storing farm produce. Due to the frequent use of agrochemicals, the containers/sachets are littered almost everywhere in our environment and this constitutes a serious environmental health challenge. It is recommended that public enlightenment should be carried out on dangers of indiscriminate disposal of agrochemical containers/sachets and agrochemical containers/sachets collecting points should be established by both the public and private sectors.

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