

AN ANALYSIS OF ADHERENCE TO PRECAUTIONS IN HERBICIDE APPLICATION FOR WEED CONTROL IN SELECTED CITIES OF SOUTHWEST NIGERIA

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Abstract

Unplanned urbanization and development have created spaces for weeds which cause several problems, making streets and built areas unattractive. The use of herbicides in controlling weeds in these areas has become the vogue in recent times. This is done without considering the attendant health effects on human and the environment. This study analyzed precautionary measures adopted in South-western Nigeria when residents apply herbicides for lawn maintenance. Multi-stage sampling technique was used to administer structured questionnaire randomly to 313 selected residents in Ondo and Osun States, Nigeria. Descriptive statistics were used to analyze the data obtained. The study revealed that about 78 percent of respondents received information on the application of herbicides by reading the directions on the labels. The study also revealed that adherence to the directions on the labels of herbicide containers (88.18%) was the most practised health safety precautions followed by washing of hands (77.96%) and taking instant showers after herbicide application (74.76%). Unacceptable attitudes such as eating, drinking and smoking during herbicides application were practised by a smaller percentage of the respondents in the two States. The study concluded that most of the residents in the study area are exposed to health hazards associated with the use of herbicides due to non-strict compliance with safety measures during the application of these chemicals.

Key words: Weeds, Herbicides, Environment, Safety practices

Introduction

Weeds are seen as nuisance (Harper, 1960) and equally reported as plants grown where they are not wanted (Salisbury, 1961). They are found everywhere although, the extent of

urbanization and development creates more spaces for them to emerge and flourish in the environment. Weeds in these urban areas cause several problems and their presence tends to indicate a city or habitation in decline. In parks and

other green areas, perennial weeds, especially, pose serious environmental problems (Rask and Kristoffersen, 2007). However, one of the best ways to control weeds and reduce their associated environmental problems is the use of herbicides. Herbicides are designed to be biologically-active on plants but are often found in the soil, plant parts and ground water (Sondhia, 2005; Sondhia and Dubey, 2006; Janaki *et al.*, 2015).

Up till now in Nigeria, the major concern on the use of herbicides has always been in the agricultural settings. A link established between pesticide exposure and human health showed an estimated one to five million cases of pesticide poisoning occurring every year, resulting in several thousand fatalities among agricultural workers, farmers and their families (FAO, 2004). Most of these poisonings occur in the developing world where safe health standards are inadequate or non-existent. In developed countries, the most hazardous pesticides are either banned or their use is strictly controlled either on the farms or in urban centres (Hansson, 2002; Kristoffersen *et al.*, 2004).

Although precautionary measures such as reading of instructions on the label of the pesticide container, wearing of personal protective equipment during spraying activities, not eating, drinking or smoking when using chemicals etc. are recommended practice to avoid health hazards (Idowu, 1996), it has been observed and documented that such measures are not frequently adhere to.

Ogunjimi and Farinde (2012) posited that the level of knowledge of precautionary measures in agro-chemicals usage among cocoa farmers in Osun and Edo States, Nigeria was low.

They reported that majority (60%) of the farmers in the states claimed health problems with the following symptoms; body itching, cough and difficulty in breathing, which often occurred during and after chemicals usage. According to Sosan and Akingbohunge (2009), factors promoting farmers exposure to insecticide health hazard include eating and drinking during spraying operations, failure to use protective clothing, improper storage and disposal of the insecticides. Frequent fever, strained breathing, sleeplessness and loss of memory were among the symptoms felt by the farmers suggesting chronic pesticide poisoning. Other studies (Oluwole *et al.*, 2009; Doris *et al.*, 2011; Osewa *et al.*, 2013) had shown that majority of farmers are not well informed of the health hazard associated with the use of pesticides hence do not follow precautions measure strictly.

Although a high level of awareness on the risks associated with pesticides was found among vegetables farmers in Ogbomoso in Nigeria (Adeola, 2012) majority of the farmers did not use protective clothes when applying pesticides. Osabuohien and Omoregbee (2017) observed that even though farmers in oil palm farms in Edo, Delta and Ondo States, Nigeria adopted pesticides safety measures during application, the inconveniences of the personal protective clothing and lack of money limited the widespread and proper adoption of such measures.

These actions predispose farmers to risk of exposure to pesticides and associated health hazards. The use of herbicides for weed control in non-agricultural settings, particularly in urban areas may lead to different environmental

issues that do not arise when they are used in agriculture, and this needs separate consideration (Spliidet *al.*, 2004). This practice of applying herbicide in the control of weeds may expose the public to adverse effects through inhalation of volatile herbicides in the air and drinking of contaminated underground water (Watts, 2011). Thus, their widespread use in urban communities over the past years has led to concerns over their potential hazards on the environment and human health.

However, despite the numerous studies on the precautionary measures taking during pesticides usage in agriculture settings in Nigeria, less attention has been paid to the use of such measures in the ambience of habitations (human environment). This study was therefore conducted to identify the sources of information on the mode of spraying of herbicides, describe the common precautionary measures practiced during the use of herbicide for weed control in the ambience of living, and assess the level of user's knowledge of associated environmental hazards, with a view to determine the level of adherence to safety precautions.

Materials and Methods

The study was carried out in selected urban communities in Osun and Ondo States namely, Ile-Ife and Osogbo in Osun State and Akungba, Owo and Akure in Ondo State in Nigeria. Figure 1 shows the Map of Nigeria showing the study sites in Osun and Ondo States alongside the respective towns where the study was carried out.

A general inspection of the chosen communities in Ondo and Osun States of Nigeria was carried out to identify sites where weeds were managed by herbicide application. A simple random sampling technique was used to randomly administer structured questionnaire to select 117 and 196 residents in Osun and Ondo States, respectively in the communities where herbicides were used to control weeds within their surroundings.

The questionnaire elicited information on types of herbicides used, frequency of usage, dosage level, precautionary steps taken, and safety practices and the variables were appropriately measured. In all, 313 respondents were used for the study. Data obtained were described using descriptive statistics such as frequency counts, percentages, mean and standard deviation.

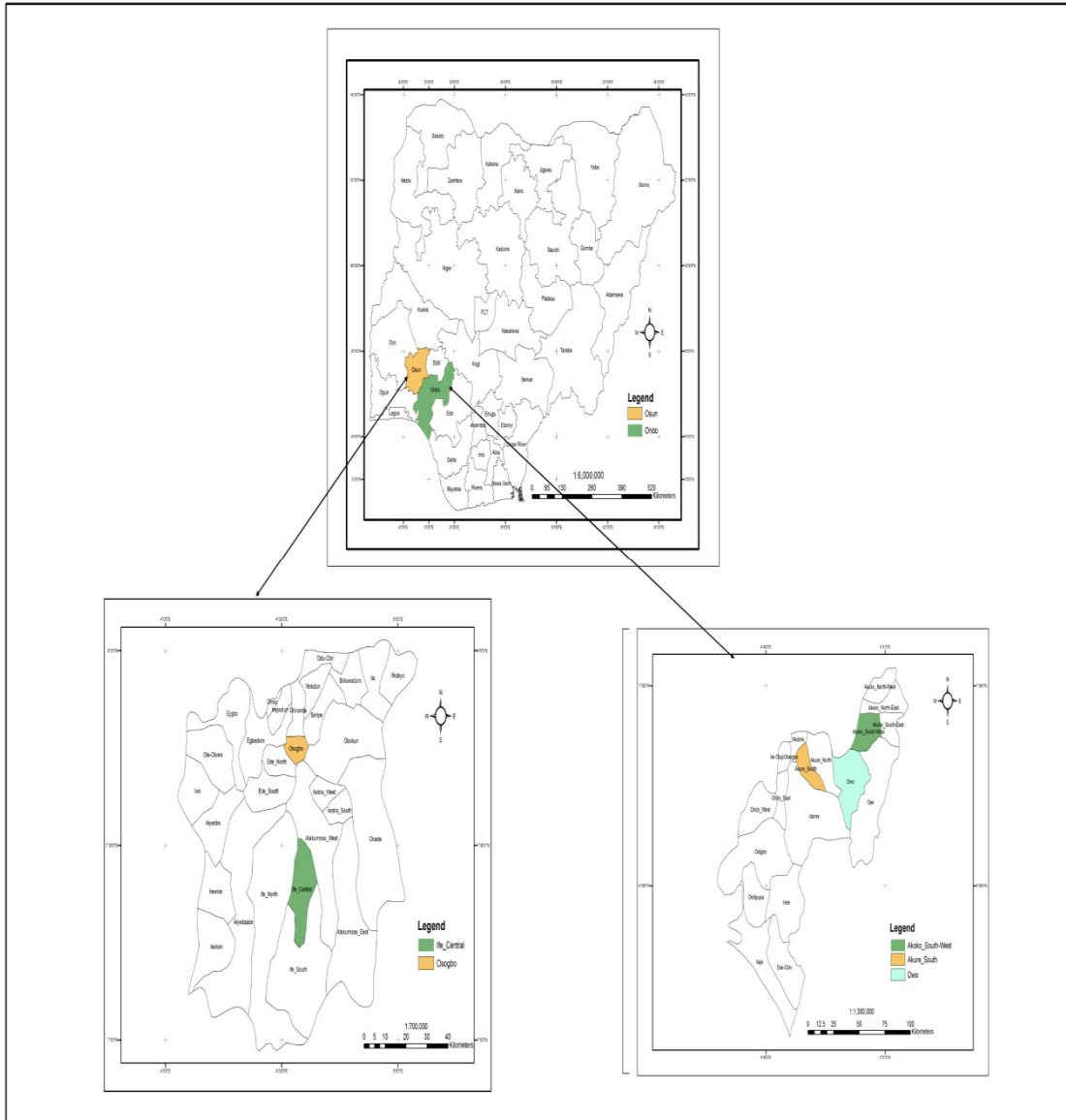


Fig. 1: Map of Nigeria showing the study sites in Osun and Ondo States

Results

Characteristics of Respondents

Table 1 shows that about 60% of the respondents were below the age of 31 years. In terms of education, majority of respondents in both States had completed a minimum of secondary school education viz 80% and 81% for Osun and Ondo States respectively. It was further shown that 47.6% and 48.88% of study

respondents were single and married, respectively. While 40% and 55.6% were single and married, respectively, in Osun State, 52% and 45% were single and married, respectively in Ondo State.

Furthermore, about 30.99% of study respondents were civil servants, 20.45% were into business, 20.77% were artisans and 15.65% were farmers. Finally, majority of the study respondents (61%)

had spent a minimum of 3 years in the commencement of the study. study locations before the

Table 1: Socio-demographic characteristics of respondents in Osun and Ondo States, Nigeria

Variables	Osun State		Ondo State		Total	
	F	%	F	%	F	%
Age range of respondents						
Less than or equal to 20 years	31	26.50	9	4.60	40	12.78
21-25 years	29	24.80	40	20.40	69	22.04
26-30 years	21	17.90	51	26.00	72	23.00
Greater than or equal to 31 years	36	30.80	96	49.00	132	42.17
Total	117	100.00	196	100.00	313	100.00
Sex of respondents						
Male	73	62.40	165	84.20	238	76.04
Female	44	37.60	31	15.80	75	23.96
Total	117	100.00	196	100.00	313	100.00
Marital status of respondents						
Single	47	40.20	102	52.00	149	47.60
Married	65	55.60	88	45.00	153	48.88
Divorced	3	2.60	1	0.50	4	1.28
Widow/Widower	2	1.70	5	2.50	7	2.24
Total	117	100.00	196	100.00	313	100.00
Highest education attained by respondents						
Informal education	2	1.70	7	3.60	9	2.88
Primary education	21	17.90	30	15.3	51	16.29
Secondary education	90	76.90	76	38.8	166	53.04
Tertiary	4	3.40	83	42.3	87	27.80
Total	117	100.00	196	100.00	313	100.00
Occupation of respondents						
Business	22	18.80	42	21.40	64	20.45
Farming	18	15.40	31	15.80	49	15.65
Civil Servant	57	48.70	40	20.40	97	30.99
Artisan	20	17.10	45	23.00	65	20.77
Others			38	19.40	38	12.14
Total	117	100.00	196	100.00	313	100.00
Years spent in community by respondents						
Less than one year	16	13.70	23	11.70	39	12.46
1-2 years	51	43.60	34	17.30	85	27.16
3-4 years	21	17.90	47	24.00	68	21.73
greater than or equal to 5 years	29	24.80	92	46.90	121	38.66
Total	117	100.00	196	100.00	313	100.00

Legend: F = Frequency

Source of Information on the Use and Spray of Herbicides

Table 2 shows the sources of information used by respondents on the mode of spraying of herbicides. In both Ondo and Osun States, it was found that 77.9% of the respondents read through the instructions on the container and complied before applying herbicides in their environment while 69.9% and 54.0% either followed the instructions given by the sellers or friends and relatives, respectively. Some of the respondents (23.4%), however, applied based on their observation of how others applied while 4.47% and 5.75% of the respondents applied based on instructions from media or workshop attended respectively.

Health Safety Precautions Practice Associated with the Use of Herbicides

Table 3 revealed that reading of instructions on the label of the preferred herbicide brand was the most practiced safety precaution (88.18%) taken before spraying of herbicide in the sites studied. This translates to 93.16% respondents in Osun State and 85.20% respondents in Ondo State. Respondents also washed their hands (77.96%) or showered (74.96%) immediately after spraying.

Going for medical check-up (12.46%), wearing of protective glasses (31.95%) and use of nose protectors (43.13%) were practiced by a low percentage of the respondents during herbicide application.

Table 2: Sources of information on the mode of spraying of herbicides

Source of information	Ondo State		Osun State		Total	
	Frequency	%	Frequency	%	Frequency	%
My friend(s)/relative(s) guided me on how to use it	124	63.27	47	40.20	171	54.63
I followed the instructions given to me by the sellers	173	88.27	46	39.30	219	69.99
I read through the instructions on the container and complied	181	92.35	63	53.80	244	77.96
I applied based on the advice I got from farmers	66	33.67	36	30.80	102	32.59
I applied based on my observation of how others apply it	72	36.70	2	1.70	74	23.64
I applied based on instructions from media	14	7.10	0	0.00	14	4.47
I applied based on instructions from the workshops I attended	18	9.20	0	0.00	18	5.75

Table 3: Health safety precautions practice during the application of herbicide

Practice embarked on while applying herbicide	Osun (%)	Ondo (%)	Total (%)
I read the instruction on the label before use	93.16	85.20	88.18
I wear head mask	80.34	35.20	52.08
I wear overall apron	64.10	50.00	55.27
I wear boot only	52.99	53.57	53.35
I wear eyesprotective glasses	50.43	20.92	31.95
I wear hand gloves	52.14	36.73	42.49
I use nose protector	57.26	34.69	43.13
I take instant shower after applying herbicide	59.83	83.67	74.76
I wash my hands after applying herbicide	59.83	88.76	77.96
I go for medical checkup regularly	16.24	10.20	12.46

Consideration of Wind Direction when Spraying

Figure 2 shows the distribution of respondents according to the direction followed when spraying herbicide. While 56.62% of the respondents sprayed in accordance with the direction at which the wind blew in Ondo State, 38.78% did not consider the direction of the wind. Likewise in Osun State, 59% of the respondents claimed that the direction of wind blow was not considered as a factor when spraying. On the aggregate, 46.33% of respondents in both States sprayed herbicide without putting wind direction into consideration.

Awareness of Environmental Hazards Associated with the use of Herbicides

Table 4 shows the level of awareness of respondents to environmental hazards associated with the use of herbicides. An average of 88.18% of the respondents in both States was aware that herbicides have expiry dates. This corresponds to 86.73% of respondents in Ondo State and 90.60% of respondents in Osun State. More than half of the respondents, 59.69% and 66.67%, in Ondo and Osun States respectively were aware that herbicides help to kill non-targeted organisms such as insects in the

environment. A small proportion of the respondents (19.17%) have had the experience of using expired herbicides in the two States; while 20.45% of respondents have employed the assistance of their children in the process of either mixing or spraying of the chemicals. In some cases, children were found playing in just sprayed environment.

Respondents had also received (47.28%) or made telephone calls (43.77%) while spraying herbicides in both States. This practice of receiving and making calls while spraying herbicides is more prevalent in Osun State compared to Ondo State. Smaller percentages of respondents ate (22.36%), drank (18.53%) and smoked cigarette (18.85%) while spraying in both States. Further, 19.17% and 15.02% of respondents scooped and stirred the herbicides with bare hands during the process of application.

Finally, 29.71% of the respondents from both States (Osun, 52.14%; Ondo, 16.33%) claimed that the herbicide containers could be re-used for other purposes when emptied, while leaving of the knapsack container used for spraying unwashed was practiced by 28.12% of

the respondents which corresponds to 55.56% and 11.73% of the respondents in

Osun and Ondo States, respectively.

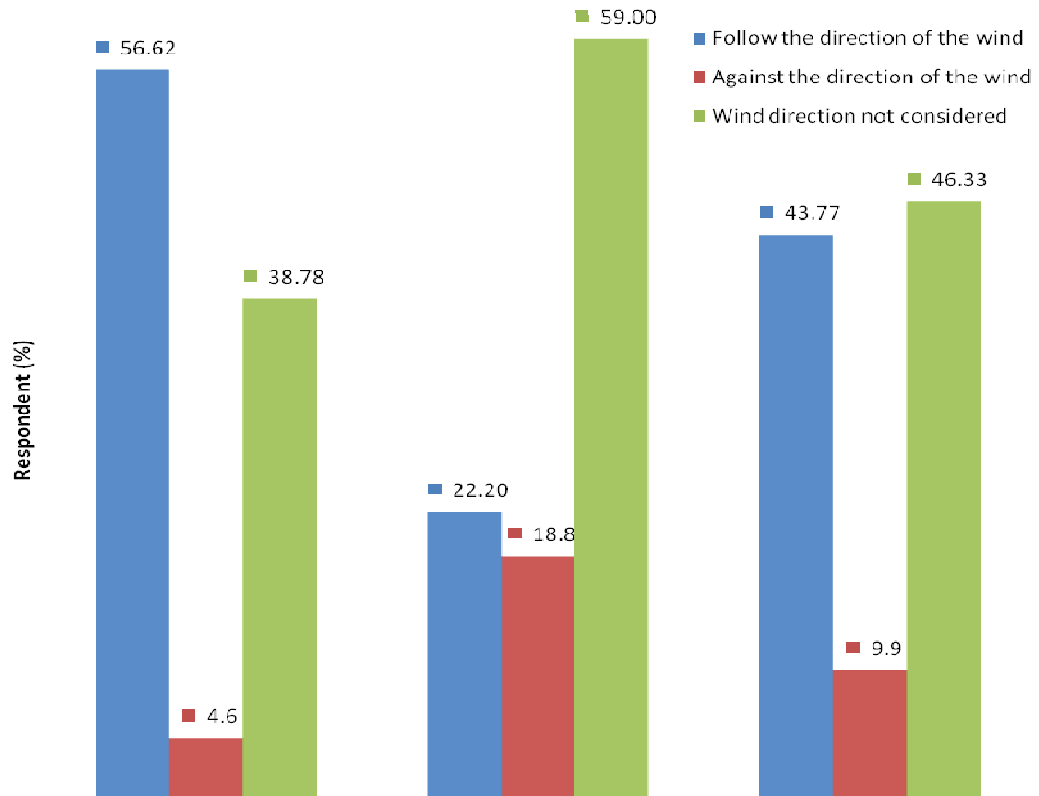


Fig. 2: Distribution of respondents to the wind direction during the spraying of herbicides

Table 4: Awareness of environmental hazards associated with the use of herbicides

Perceptions of environmental hazards	Ondo State		Osun State		Total	
	Frequency	%	Frequency	%	Frequency	%
Do you know that herbicides have expiry date	170	86.73	106	90.60	276	88.18
Have you ever used an expired herbicide	33	16.84	27	23.08	60	19.17
Do you leave your containers unwashed (knapsack) after use	23	11.73	65	55.56	88	28.12
Do you treat your water regularly	76	38.76	64	54.70	140	44.73
Are you aware that herbicides help in killing non-targeted organism	117	59.69	78	66.67	195	62.30
Do you reuse the herbicide container for other purposes	32	16.33	61	52.14	93	29.71
Do your children assist in the application of herbicide (mixing or spraying)	25	12.80	39	33.33	64	20.45
Have you made calls while applying herbicides?	69	35.20	68	58.12	137	43.77
Have you received calls while applying herbicides?	95	48.47	53	45.30	148	47.28
Have you ever received visitors while applying herbicides?	70	35.71	70	59.83	140	44.73
Can you eat while applying herbicide?	21	10.71	49	41.88	70	22.36
Have you drank any liquid while applying herbicide	13	6.63	45	38.46	58	18.53
Can you smoke during herbicide application	11	5.61	48	41.03	59	18.85
Do you scoop herbicides with bare hands	12	6.12	48	41.03	60	19.17
Do you stir herbicides with bare hands	9	4.60	38	32.50	47	15.02

Discussion

From the results of this study, males below the age of 35 years are mostly found to be involved in spraying of herbicides for municipal weed control. The weight of the spraying equipment (knapsack) which required energy could have necessitated that males were found mostly involved in the activities. Most of the respondents also possessed at least secondary school level education indicating that they were fairly educated; they could read and write. This could be attributed to the fact that the study was carried out in the urban setting. This scenario differs from what obtained in the agricultural settings where most farmers

using herbicides for the control of weeds on the farms were uneducated (Torimiro *et al.*, 1999; Lawal *et al.*, 2005; Akeem and Sofoluwe, 2012).

It was established in this study that most users of herbicides in the study area obtained their information on the “mode of use” of the herbicides by reading the labels on the preferred chemical containers. This behavior may be associated with the finding that most users of herbicides in the area are fairly educated. The findings in this study therefore contrast with that of Ogunjimi and Farinde (2012). The authors found low literacy level among majority of the farmers in Osun and Edo States of

Nigeria accounting for a pervasive inability to read instructions stated on the containers of the chemical, which adversely affected farmer's operational habits and health. The findings of this study also do not agree with Torimiro *et al.* (1999) who found that majority of Nigerian farmers were illiterates hence could not read the labels on the chemical containers.

This study had revealed that most of the respondents did not observe the complete health safety precautions like wearing of face masks, hoods, nose protectors, overall apron during herbicide application. This is in line with the observation on farms carried out by Alimi (1999) and Alimi and Ayanwale (2004) that farmers in many parts of Nigeria did not pay attention to the safety measures in the use of chemicals on the farms. The implication of these findings is that the residents in the urban settings studied used hazardous chemicals, with little or no attention to the safety measures, which may have adverse effect on their health. The low use of this personal protective covering may be due to the inconveniences created by putting them on, plain ignorance or indifference to its necessity.

The prevalence of this lack of adequate attention to personal protective covering when mixing and spraying herbicides may also be due in part to the fact that most of the users were insufficiently instructed on the negative consequences of not wearing the protective gears. There is, therefore, a need to properly educate users on the health consequences of protective gears during herbicide application.

Furthermore, the observed low use of the personal protective equipment may

explain why "washing of hands" and "taking instant showers" were found to be prevalent among the users of herbicides for weed control in the study area. This also is in line with the findings of Ogunjimi and Farinde (2012) where majority of the respondents in their study claimed they took their bath immediately after spraying of chemicals. It was also found that most herbicide users did not follow correct directional placement during application thereby increasing the chances of the chemicals getting into their body systems through dermal exposure or inhalation and causing health problems. This could also be linked to the reasons why most people that sprayed herbicide in the urban settings take their bath immediately after spraying.

The study also shows that very few respondents have ever used expired brands of herbicide, suggesting that they were fairly well informed on the expiry status of herbicides purchased. The study revealed that a larger percentage of the respondents were in the habit of making and receiving telephone calls during herbicide application while few of them ate, drank and smoked cigarettes while spraying. These habits could expose them to health related problems (Sosan and Akingbohunge, 2009; Ogunjimi and Farinde, 2012).

Although few of the respondents had employed the assistance of their children and other minors in the mixing and spraying of herbicides, children were found playing in open places that were regularly maintained by herbicide application, sometimes, accompanying their parents who were actively applying herbicide. A lot of children's toxicity resulting from exposure to herbicide has been documented. Children are more

susceptible to chemicals (National Academy of Sciences, 1993) and take in more pesticides relative to their body weight than adults (US EPA, 1996). Children also have developing organ systems that are more vulnerable and less able to detoxify toxic chemicals (US EPA, 1996). Studies had also shown that children exposed to pesticides at early age are at greater risk of childhood leukemia (Lowengart *et al.*, 1987), brain cancer and soft tissue sarcoma (Leiss and Savitz, 1995).

The study had also shown that knapsack sprayers were carelessly kept in the house and herbicide containers are used as domestic receptacles for all kinds of materials. This attitude is in line with the study of Ogunjimi and Farinde (2012) where cocoa farmers in Osun and Edo States washed and re-used empty chemical containers for other purposes. This attitude not only exposed the individuals' spraying the chemicals to herbicide poisoning, other members of the household are also at risk. Finally, a low percentage of the respondents were found in the habit of scooping or stirring herbicides with bare hands in the studied States. These operational habits were also reported by Lawal *et al.* (2005) where cocoa farmers in Ago Iwoye area of Ogun State scooped or stirred pesticides with bare hands.

This study has established that herbicide application takes place in close proximities of human habitation in our urban areas. In some of the visitations where people were found applying herbicide around their premises, animals were found grazing on vegetation that had just been treated with herbicide. Many wells are located in the ambience of buildings where herbicides are

routinely used. The issues of careless disposal of hoods and wears used by handlers and unrestricted contact with herbicide were also documented in the study.

Conclusion

We concluded that the indiscriminate use of herbicides in the urban settings for ambience maintenance pose serious danger not only to soil ecosystem and animals on free-range, but also to humans. These careless and repeated uses of herbicides in the urban settings, particularly the study areas were direct pathways for the physical contact with these chemicals and active contact through breathing of polluted air during the period of application. The indirect contact occurred through the exploitation of plants harvested from home gardens; meat from domestic animals that foraged the already sprayed weeds. Also, the dependence on herbicides for ambience maintenance would increase the uptake of chemicals by weeds and worsened the incidence of pollution in the urban environment.

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