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APPLICATION OF HERBICIDES FOR LAWN MAINTENANCE IN SOUTH-WESTERN NIGERIA: BENEFITS AND HEALTH CHALLENGES

ABSTRACT

There is an increasing shift from machete and machine-based lawn mowing to herbicide application in the south-western Nigeria. Although, people have speculated that this practice is less labour intensive and cheaper, paucity of data on its implications on human health exists. This study seeks to provide baseline information on the health effects of this system of lawn maintenance. Structured questionnaire was randomly distributed to 313 head of households from Ondo and Osun States using multi-stage sampling technique. Parameters considered include frequency of usage, perception on activity and probable health symptoms. Data obtained were analyzed by employing descriptive and inferential statistical methods. The study revealed that 88.2% of handlers were untrained and obtained information on usage and handling only from the manufacturers' instructions. About 75% and 94% of the respondents in Osun and Ondo States respectively posited that the use of herbicide was faster than the conventional methods while 73% in Osun and 95% in Ondo affirmed that it was less energy-consuming. In addition, 69% of the respondents affirmed that the use of herbicides contributes to insect and pest around control homes. A number of respondents usually eat (22.4%), drink (18.5%), smoke cigarettes (18.9%) and make telephone calls (43.77%) during herbicide applications. Symptoms associated with herbicide use by respondents were fatigue (57.0%), eyes irritation (35.1%), skin irritation (31.2%) and nausea (29.7%). These results reveal that even though the use of herbicides has some merits, its negative impact on human health cannot be ignored in sustainable environmental management.

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Introduction

The use of chemicals for pest and weed control has increased in recent times on the farms (Aktal *et al*., 2009; Popp *et al.*, 2013). Studies have revealed that the indiscriminate use of these chemicals expose farmers to health hazards such as redness of eyes, headaches, sneezing and breathing difficulty (Lawal *et al*., 2005; Sosan and Akingbohungbe, 2009; Ogunjimi and Farinde, 2012; Olowoyo and Deji, 2017). Other health-related issues include cancer, respiratory health and neurodegenerative diseases such as Parkinson's disease (Van der Mark *et al*., 2012; Freire and Koifman, 2012; Hoppin, 2014). These effects are exacerbated by general lack of precautionary measures to mitigate these health hazards (Ugwu *et al.*, 2015; Jallow *et al.,* 2017). The effects are further enhanced by the characteristics of herbicides which make them spread from point of application to other areas unintended, in the process exposing unsuspecting general public to health hazard.

Although the benefits of herbicides use and the associated health hazard on farmers agricultural have been documented in literatures (Lawal *et al*., 2005; Sosan and Akingbohungbe, 2009; Ogunjimi and Farinde, 2012; Olowoyo and Deji, 2017), information on their health implications when used for lawn maintenance around homestead is sparse. The shift from the use of manual labour to herbicides in controlling weeds in residential areas particularly in the urban settings has increased in recent times and has become the vogue (Bulu *et al*., 2017). In agricultural settings for instance, exposure to pesticides occurs during application, contact with treated crops and when carrying out re-entry activities such as weeding or thinning. This research was therefore embarked upon to provide baseline data on the benefits and associated health issues of herbicide use in maintaining home.

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Methodology

The investigation was carried out in selected urban communities in Osun State (Osogbo and Ile-Ife) and Ondo State (Akure, Owo and Akungba). The detailed characteristics of the study area and the study population have been previously described (Bulu *et al*., 2017). A total of 313 residential homes comprising 117 from Osun State and 196 from Ondo State were selected for the study. The characteristics of the heads of households who responded to the questionnaires varied significantly in terms of age, sex and occupation.

Results

List of Herbicide Brands found in the Study Sites

The list of herbicide brands used by respondents on the study sites are presented in Table 1. Results show that a total of 33 herbicide brands are used for weed control in Osun and Ondo States. Herbicides of common use in both States are the systemic herbicides (58%) and contact herbicides (42%). About 63.2% of the systemic herbicides contain glyphosate as their active ingredients.

Effectiveness of Herbicide Brands used in Controlling Weeds on Sites

Figure 1 shows the time taken for the herbicide brands used to control weeds after application in each State. In Osun State, 25.6% and 39.3% of the respondents stated that the herbicide brands used controlled weeds within 1-2 days and 3-4 days of application respectively (Figure 1A). In Ondo State however, 29.3% and 15.4% of the respondents claimed that the effectiveness of their herbicide brands is noticed after 1-2 days and 3-4 days of application respectively (Figure 1B). Furthermore, 25.6% and 9.4% of the respondents in Osun State (Figure 1A) and 33.5% and 21.8% of the respondents in Ondo State (Figure 1B) affirmed that the herbicide brands applied became effective after 5-6 and after 7days of application

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respectively. About half of the respondents (55.4%) claimed that it takes 4 days or less for applied herbicide brands to effectively control weeds (Figure 1C).

The distribution of respondents in terms of the re-growth time of weeds after herbicide application is shown in Figure 2. In aggregate terms, 38.9% and 35% of respondents reported re-growth of weeds over 5-6 weeks and over 6 weeks after application of herbicide respectively (Figure 2C). In Ondo State (Figure 2B), 39.2% of the respondents reported that the emergence of weeds occurred 7 weeks or more after treating their environment with herbicide; 35.1% claimed this happened 5-6 weeks after application, while 23.2% claimed weed re-growth occurred 3-4 weeks after application. Only 2.6% claimed that the emergence of weeds occurred 1-2 weeks after herbicide application. For Osun State, the corresponding figures were, 28.2% for 7 weeks and over, 45.3% at 5-6 weeks, 19.7% for 3-4 weeks and 6.8% for 1-2 weeks (Figure 2A).

Figure 3 shows the frequency of herbicide application in a year by respondents within the study area. Half of the respondents (54.2%) applied herbicide 3-4 times in a year. 23.4% and 16.2% of the respondents applied herbicide 5-6 times and 7 times or more respectively within a year (Figure 3C). These values were more or less replicated in the two States with majority applying herbicide 3-4 times within a year: Osun State (37.6%) (Figure 3A) and Ondo State (64.4%) (Figure 3B). Approximately 23% of the respondents in each of the State studied applied herbicide 5-6 times in a year (Figure 3A and 3B).

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Table 1: List of herbicide brands used for lawn maintenance in selected communities of Osun and Ondo States, Nigeria

S/N	Herbicide Brand Name	Active Ingredient	Mode of Action	State of Preference
1.	Weed crusher	Paraquat	Contact	Osun, Ondo
2.	Force off	Paraquat	Contact	Osun, Ondo
3.	Weed off	Paraquat	Contact	Osun, Ondo
4.	Clear weed	Paraquat	Contact	Osun, Ondo
5.	Sarosate	Glyphosate	Systemic	Osun, Ondo
6.	Delsate	Glyphosate	Systemic	Osun, Ondo
7.	Bushfire	Glyphosate	Systemic	Osun, Ondo
8.	Fitscosate	Glyphosate	Systemic	Osun, Ondo
9.	Round up	Glyphosate	Systemic	Osun, Ondo
10.	General	Glyphosate	Systemic	Osun, Ondo
11.	Altra force	Atrazine	Systemic	Osun, Ondo
12.	Agroxone	Paraquat dichloride	Contact	Ondo
13.	Slasher	Paraquat dichloride	Contact	Ondo
14.	Paraq	Paraquat dichloride	Contact	Ondo
15.	Ultramine	2, 4-D amino salt	Systemic	Ondo
16.	Aminoforce	2, 4-D amino salt	Systemic	Ondo
17.	Select	2, 4-D amino salt	Systemic	Ondo
18.	Meztraz/Xtravest	Atrazine & Methaclor	Systemic	Osun, Ondo
19.	Diutop	Diuron	Systemic	Ondo
20.	Force diuron	Diuron	Systemic	Osun
21.	Vestalin	Pendimethalin	Contact	Osogbo
22.	Striker	Nicosulfuron	Contact	Osogbo
23.	Lamdanet	Nicosulfuron	Contact	Osogbo
24.	Burner	Glyphosate	Systemic	Ondo/Osogbo
25.	Deep to root	Glyphosate	Systemic	Ondo

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26.	Uproot	Glyphosate	Systemic	Ondo
27.	Razedown	Glyphosate	Systemic	Ondo
28.	Eagrowzone	Paraquat dichloride	Contact	Ondo
29.	Tackle	Glyphosate & imazethapyr	Systemic	Ondo
30.	Crusher	Glyphosate	Systemic	Ondo
31.	Dragon	Paraquat dichloride	Contact	Ondo
32.	Wipe out	Glyphosate	Systemic	Ondo
33.	Rage	Paraquat	Contact	Ondo

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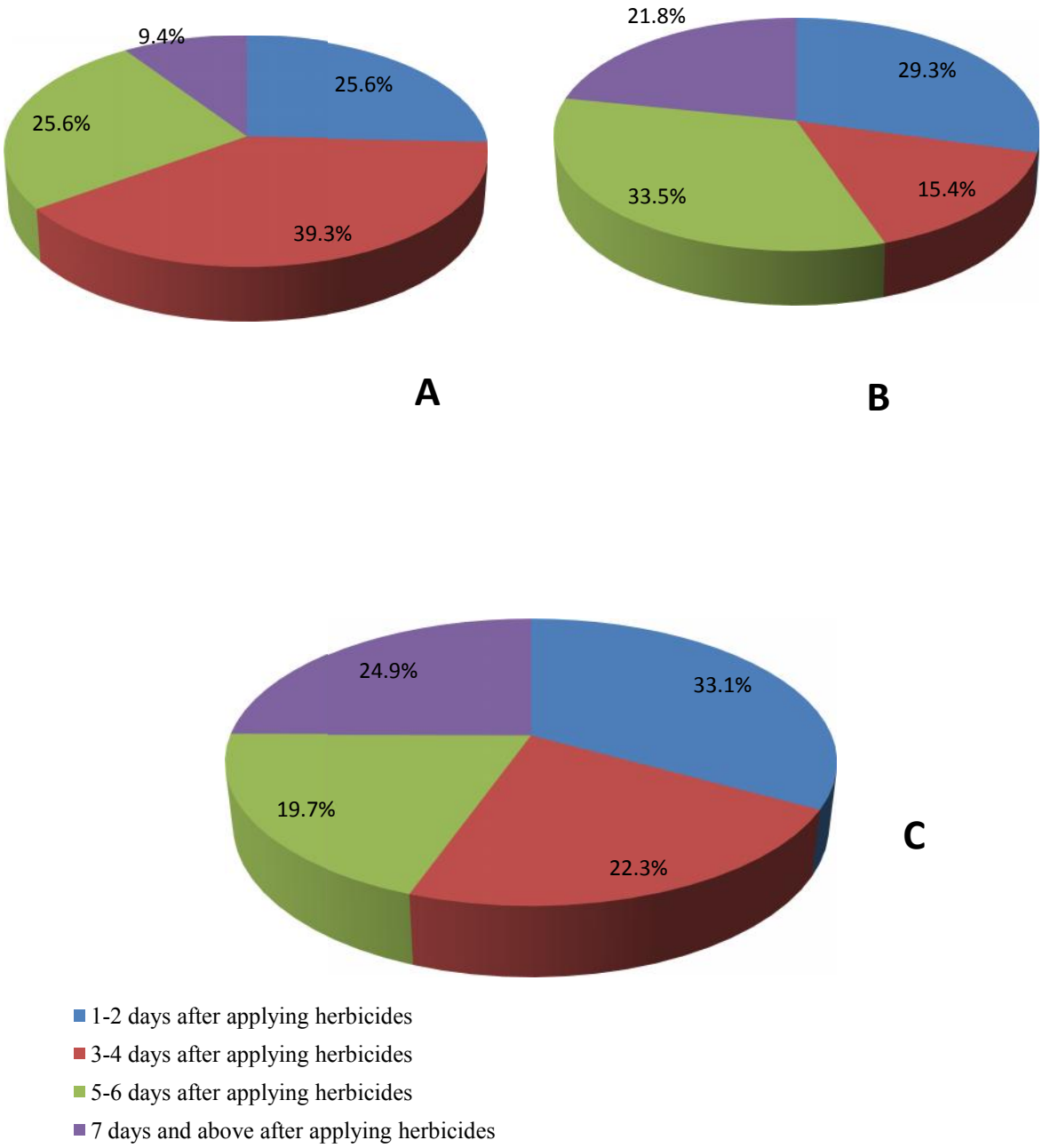

Figure 1: Rate of action of herbicides in lawn maintenance in selected communities of Osun and Ondo States, Nigeria

A = Osun State, B = Ondo State, C = Osun and Ondo States

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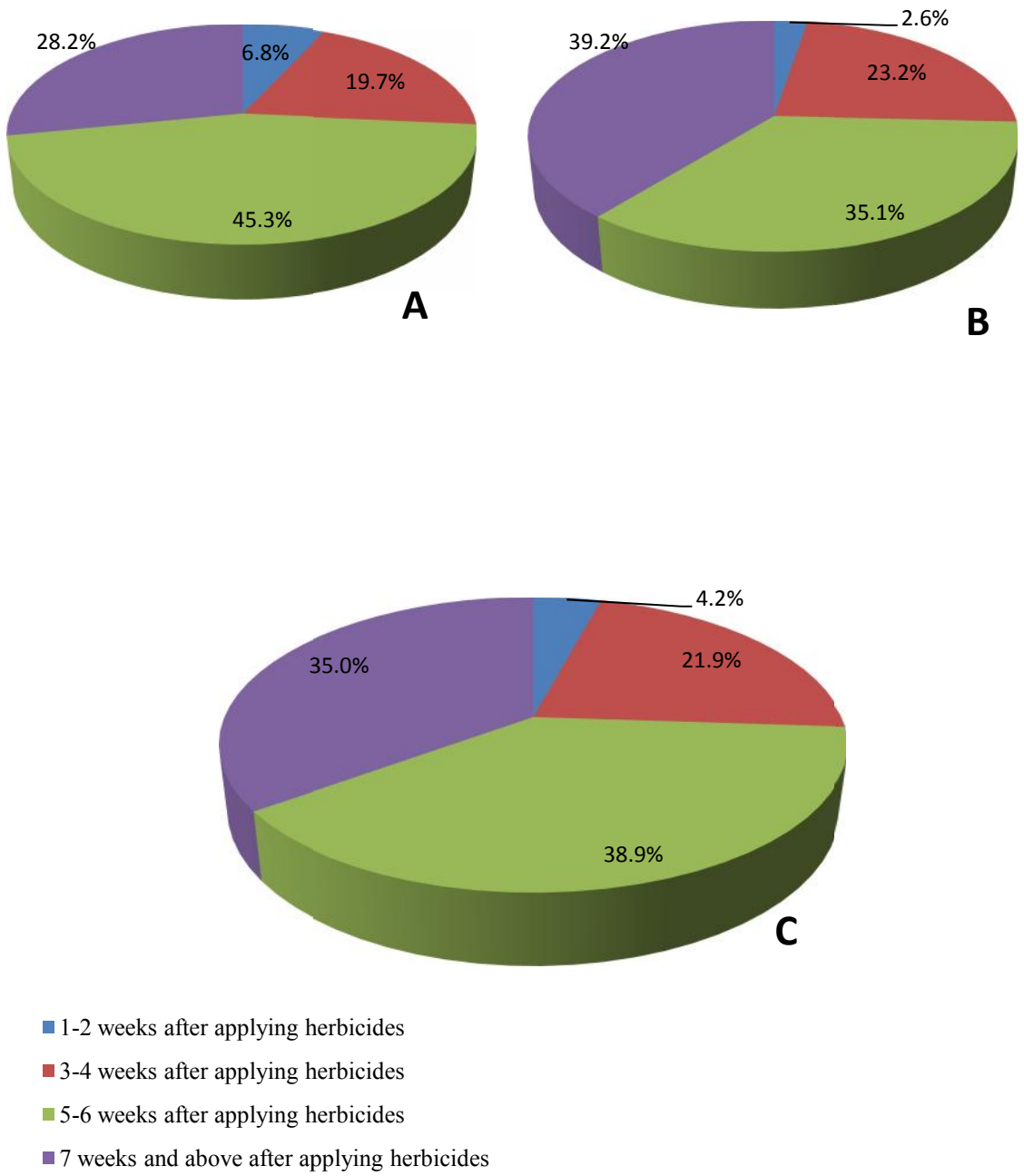

Figure 2: Duration of weed re-growth after herbicides application in lawn maintenance in selected communities of Osun and Ondo States, Nigeria

A = Osun State, B = Ondo State, C = Osun and Ondo States

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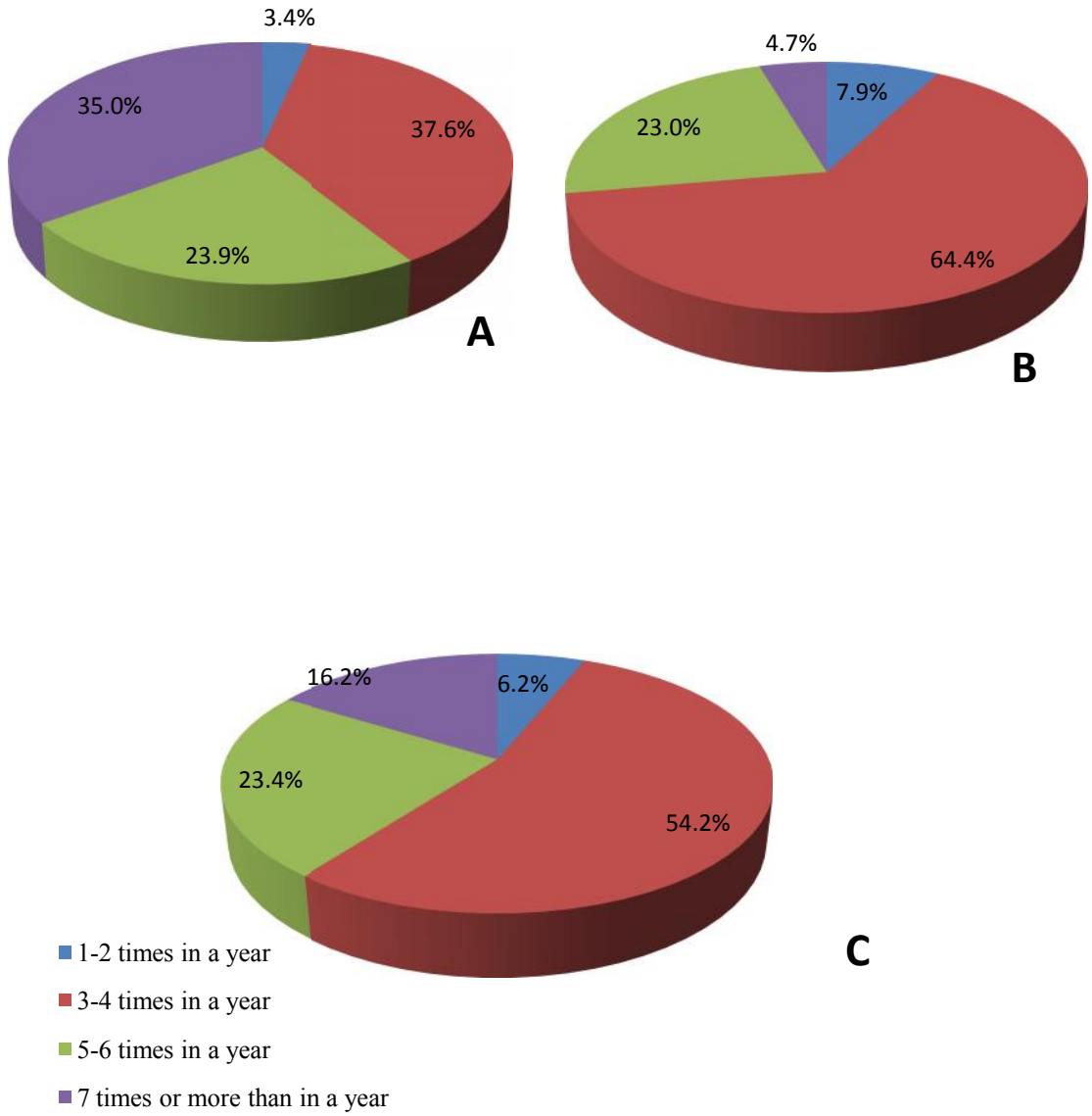

Figure 3: Frequency of herbicides application in lawn maintenance in selected communities of Osun and Ondo States, Nigeria

A = Osun State, B = Ondo State, C = Osun and Ondo States

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Advantage of Using Herbicides in Lawn Maintenance

Approximately 87% of the population under study said the use of herbicides was a faster method of weed control and involved less energy. This corresponds to 75%; 73% in Osun and 94%; 95% in Ondo States respectively. About 69% of the respondents also affirmed that the use of herbicide does not only control weeds but helps in controlling insects and pests around the homes. The respondents' perceptions of the advantages of using herbicide are as described in Figure 4.

Health-related Issues Associated with the Use of Herbicide in Lawn Maintenance

The symptoms felt after spraying herbicides are shown in Table 2. According to the results, the symptoms include fatigue (57.0%), eyes irritation (35.1%), skin irritation (31.2%) and vomiting sensation (29.7%). Other symptoms such as chest pain (10.22%), difficulties in breathing (22.68%), headache (9.27%), throat dryness (8.31%), dizziness (29.07%) and increase in body temperature (6.07%) were also reported by the respondents after spraying herbicide. However, a few respondents reported shaking or tremor in the body (2.56%), difficulty in swallowing (2.56%), slurring or slowness in speech (4.47%), sleeplessness (4.15%) and stiffness in the body (4.15%) as health hazard associated with herbicide application in their immediate environment.

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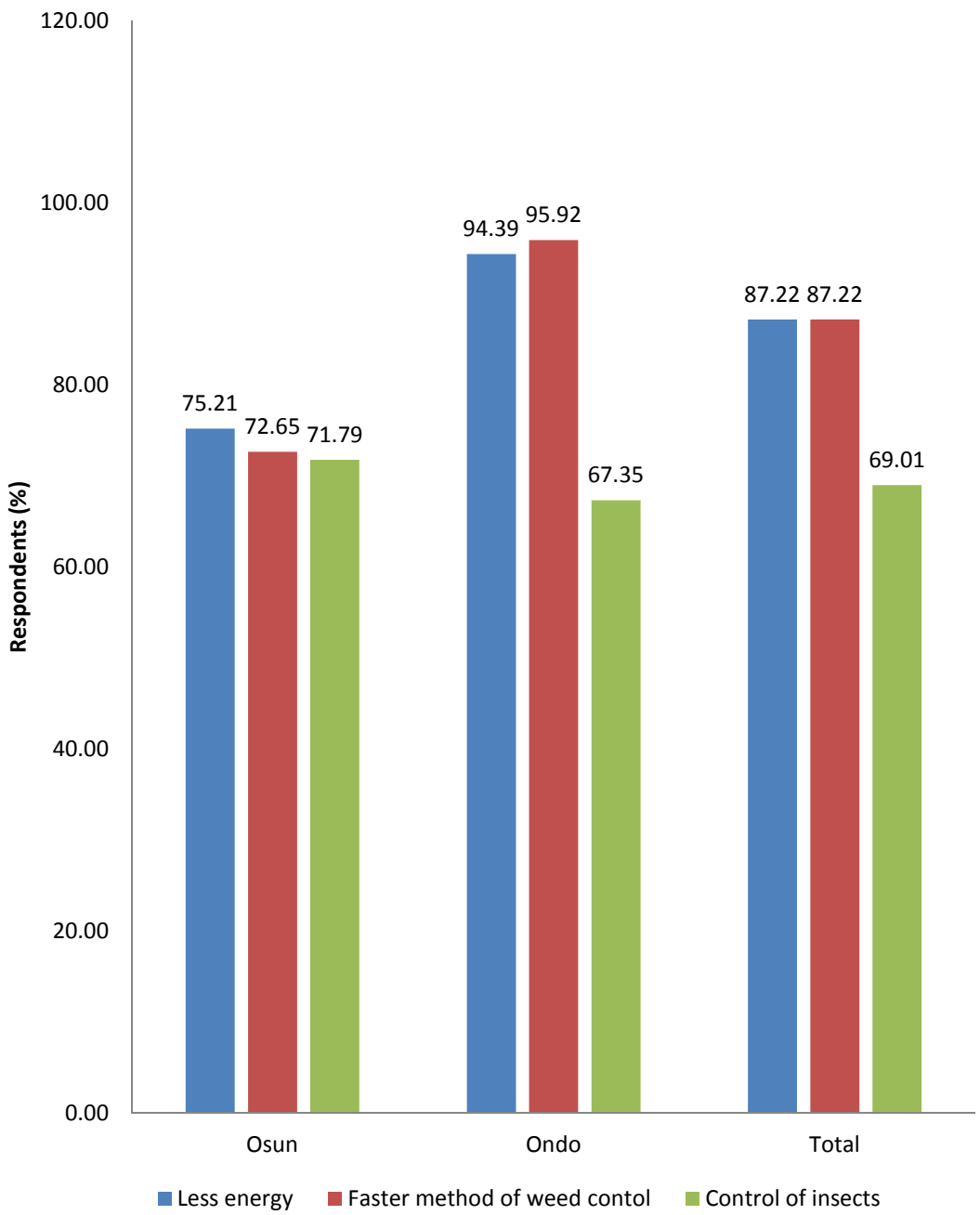

Figure 4: Benefits of herbicide application in maintaining lawn in selected communities of Osun and Ondo States Nigeria.

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Table 2: Health-related issues associated with the use of herbicide

	Ondo State		Osun State		Total	
Health Issues	F	%	F	%	F	%
Fatigue	89	45.41	88	75.21	177	56.55
Eyes irritation	29	14.8	79	67.52	108	34.5
Skin irritation	30	15.31	66	56.41	96	30.67
Dizziness	28	14.29	63	53.85	91	29.07
Vomiting sensation	16	8.16	61	52.14	77	24.6
Difficulties in breathing	16	8.16	55	47.01	71	22.68
Tiredness	74	37.76	0	0	74	23.64
Chest pain	30	15.31	2	1.71	32	10.22
Pepperish sensation on the body	18	9.18	2	1.71	20	6.39
Internal heat in the body	15	7.65	2	1.71	17	5.41
Sleeplessness	11	5.61	2	1.71	13	4.15
Headache	27	13.78	2	1.71	29	9.27
Increase in body temperature	17	8.67	2	1.71	19	6.07
Dryness in the throat	24	12.24	2	1.71	26	8.31
Difficulty in swallowing	6	3.06	2	1.71	8	2.56
Rashes on the body	17	8.67	2	1.71	19	6.07
Stiffness in the body	11	5.61	2	1.71	13	4.15
Shaking or tremor in the body	6	3.06	2	1.71	8	2.56
Slurring or slowness in speech	12	6.12	2	1.71	14	4.47

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Discussion

The demographical data presented in this study are as reported in an early study by Bulu *et al.* (2017). The majority of the herbicides used in the study area were systemic in action with glyphosate as their active ingredient. The choice of the glyphosate brand of herbicide over others might not be unconnected with its wide popularity (Schuster and Gratzfeld-Husgen, 1992) and its effective control of actively growing plants via inhibition of the 5-enolpyruvylshikimic acid-3-phosphate synthase (Franz *et al.,* 1997).

The finding that it usually takes more than 2 days for herbicides applied to be effective in controlling weeds may be connected with the fact that glyphosate brands of herbicide were used by most of the respondents. These are systemic herbicides that take a longer time in acting on weeds when compared with the contact herbicide. The systemic herbicides after initial absorption are transported with the plant sap to other parts of the plant. The chemicals need time to circulate through the entire plant to have their full effect thus lack the quick "knockdown effect" observed when contact chemicals are used (Re).

Furthermore, the time it takes the weeds to re-grow after herbicide application in the environment is an indication of the efficacy of the herbicide used in the study area. The study found that most weed re-growth occurred after 5 weeks and that herbicides were applied less than 5 times a year by most users. This could also be linked to the fact that the herbicides favoured by most of the respondents are systemic with effectiveness in killing the entire plants to the root zone even at low application rates (Franz *et al.,* 1997). This intervention would require that the number of times the herbicides would be applied within a year be reduced.

Apart from controlling weeds in the ambience of living, respondents opined that the use of herbicides is a faster method of weed eradication that saves time and energy. This agrees with

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the findings of Swanton *et al*. (1996) that the use of herbicide increases the energy efficiency in crop production. The review by Pacanoski (2007) also supports this finding that the use of herbicide saves labour necessary for weed control practices and save energy.

The study found that a substantial proportion of the respondents always suffer from severed ailments during and after spraying herbicide. These include fatigue, eyes and skin irritation, nausea, dizziness and difficulty in breathing. The finding is similar to that of Ogunjimi and Farinde (2012) which states that majority (60%) of the farmers in Osun and Edo States, Nigeria, experienced body itching, cough and difficulty in breathing during and after chemical application. Hence, respiratory and dermatosis infections are associated with non-strict compliance with precautionary guidelines during the use of herbicides. The shaking and slurring speech observed among respondents could be linked to early stage of development of Parkinson's disease (PD) which is said to have increased risk in people exposed to pesticides (Van der Mark *et al*., 2012; Freire and Koifman, 2012; Hoppin, 2014).

Results of this study provide evidence that the use of herbicides is an easy and faster method of lawn maintenance. It reduces energy, cost and labour demands. However, health hazards such as respiratory and dermatosis infections are associated with its use. It is therefore recommended that necessary precautionary measures should be put in place to prevent environmental health hazard during herbicide application around homesteads.

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