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Perception of Environmental Effects of Weedicide Use in Oil Palm Production by Farmers in Denkyembour District, Ghana

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Authors' contributions

This work was carried out in collaboration among all authors. Author FKMS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author EKMS managed the analyses of the study. Author WOD managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Oil palm farmers 'weed management practices, awareness and their perception about the effects of weedicides' use on the environment were studied. Data were collected from the oil palm farmers in the Denkyembour District of the Eastern Region of Ghana. One hundred and Thirty (130) private and independent small scale oil palm farmers were purposively selected from the communities and were interviewed. The purposive sampling technique was preferred for this study to select the farmers who are using herbicides on their farms. Interview schedule was used to obtain data from the farmers. Data collected were analyzed using descriptive statistics. Findings revealed that a wide variety of weedicides were used by the farmers. A high level of awareness on the risks associated with the use of weedicide was found among the respondents. Most of the respondents (92%) used Glyphosate based weedicides for their weed management activities. However, (60%) of the farmers were not aware that re-entry into a sprayed farm within a short time can expose them to weedicide injuries. Farmers showed favourable attitudes about the risk of weedicide usage.

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The intensification of extension services to educate farmers on safe use of weedicide in oil palm production is recommended. This study serves as a platform to carry out more survey on weedicide usage across the country.

Keywords: *Weedicides; oil palm farmers; perception; safe use; environment.*

1. INTRODUCTION

Weeds have always been and will be a major problem in oil palm production, especially in young oil palm fields. The standard oil palm planting distance of 8.8m triangular promotes weed growth because the lower stratum of the field is exposed to rainfall, sunlight and other climatic factors [1]. Weed populations continue to persist in agricultural fields despite repeated application of weed control practices and pose a recurrent threat to agricultural productivity [2]. Gray and Hew [3] reported yield losses of 20% - 60% in matured oil palm due to weed infestation.

The single highest cost element in oil palm cultivation is related to weed control. To achieve optimum profits with oil palm cultivation, there is the need for effective and efficient weed control. Weeds can be managed by different approaches such as manual methods, mechanical methods, biological weed control and chemical control [4]. Among all these methods, chemical weed control is the most improved weed control technique. This method involves the use of chemicals commonly known as Herbicides or Weedicides. Herbicides, generally known as weedicides, are concoction substances used to control undesirable plants. Chemical weed control is usually easy; highly effective and the most economical alternative to manual weeding [4-7].

Exposure to pesticides is one of the most important occupational risks among farmers in developing countries [8,9]. One of the major factors of weedicide contamination or poisoning in developing countries is the unsafe use or misuse of these products. Overdose application of weedicides such as Glyphosates, Bispyribac Sodium, Isoproturon can cause irreparable damage to the soil quality and health.

The widespread use of weedicides among oil palm farmers in Ghana calls for a study to understand the perception of farmers on the effects of this practice on the environment and on the health of farmers.

1.1 Objectives

The general objective of the study was to assess the weedicide management practices and

perception of environmental effects of herbicides among oil palm farmers in Denkyemba District.

The specific objectives were to

- i. Identify herbicide utilization practices of the farmers in the study area
- ii. Examine farmers' perception of environmental effects of the weedicide

2. METHODOLOGY

2.1 Study Area

The study was conducted between July and August 2019 in Denkyemba District of the Eastern Region of Ghana. The Denkyemba District is located at the South-Western corner of the Eastern Region. It shares boundaries with Kwaebibirem Municipality and Akyemansa District to the North, West Akim Municipality to the South and Birim Central Municipality to the South-West. The climate temperature ranges between a minimum of 26.5°C and a maximum of 27°C. The District lies within the semi-equatorial climate zone with a double maxima rainfall regime. The highest monthly rainfall is 414.0 mm. Denkyemba District lies within the semi-deciduous forest zone and the vegetation consists of low lying species of hardwood. The district has congenial climate for the production of cash crops such as oil palm, citrus and cocoa and food crops such as plantain, cocoyam, cassava and cereals, as well as vegetables. The economy of the Denkyemba District is predominantly agrarian with the production of both food and cash crops on subsistent and commercial bases representing about three quarters of the working population. The main features of the economy are trade, commerce and agro-base business with small-scale oil palm processing engaging many people especially women [10]. The Council for Scientific and Industrial Research (CSIR)-Oil Palm Research Institute (OPRI), Forest and Horticultural Crops Research Centre of the University of Ghana (FOCHREC) and the largest oil palm plantation estates in Ghana, Ghana Oil Palm Plantation Development Company Limited (GOPDC) are all located in the District.

2.2 Sampling Procedures

From a list of communities with high intensity of oil palm production, compiled with the assistance of the District Agriculture Officers and local Agricultural Extension staff six communities were randomly selected. One hundred and Thirty (130) private and independent small scale oil palm farmers were purposively selected from the communities and were interviewed. The purposive sampling technique was preferred for this study to select the farmers who are using weedicide on their farms. There were other farmers who do not use weedicide on their farms, hence they were not considered for this study Table 1.

Table 1. Communities and respondents selected for the study

Community	Number of respondents
Topremang	20
Kusi	25
Okumaning	20
Wenchi	25
Takorase	20
Bamenase	20

2.3 Data Collection and Analysis

The selected farmers were individually interviewed, using a structured questionnaire in July and August, 2019. The questionnaire was used to collect information on socio-demographic characteristics of the oil palm farmers and their knowledge and perceptions of the effects of herbicide use on the environment. Socio-demographic information collected included sex, age, level of education and farming characteristics. The questionnaire was previously tested. Some qualitative information were recorded especially when such information was given by simple majority. Quantitative data collected were coded and subjected to descriptive statistic consisting of frequencies and percentages using the Statistical Package for Social Science (SPSS) Version 21.0.

3. RESULTS AND DISCUSSION

3.1 Socio Economic Characteristics of Respondents

Majority of the 130 oil palm farmers interviewed were males (84.6%) which is far above that of the females (15.4%). This observation agrees with Adjei-Nsiah [11] that oil palm farming is

dominated by males because of their easy access to land. Bani and Damnyag [12] also indicated that gender imbalances in rural settings in terms of use and ownership of natural resources cannot be overemphasized. Over 80% of the respondents have had some form of formal education: 53.8% had Basic Education, 17.8% had Secondary Education and 14.6% had Tertiary Education (Table 2). This has implication on the adoption of best production practices which was observed Anaglo et al. [13]. Barquin et al. [14] also indicated that some level of knowledge and skill are prerequisite for stakeholders who wish to be involved in Reducing Emissions from Deforestation and Forest Degradation (REDD+) activities. About 80% of the respondents have farming experience between 16-35years old with majority of them 66.2% having experience between 16-25years old. The mean age of the farmers was 46.5years old with majority 38.5% within age range of 41-50 years old. It was noted that most of them are land owners, who acquired lands either through inheritance, lease or outright purchase Table 2. Majority of respondents have small parcel of oil palm farms between 0.5-2.0ha.

3.2 Oil Palm Farmers Access to Extension and Weedicide Use Practices

Seventy three percent (73%) of the respondents had contact with the extension agents while 26.98% indicated non-contact with extension agents Table 3. The herbicides commonly used by the farmers were identified as Aniphosate (61.5%) followed by Atrazine used by 54.9% of the farmers. Other weedicides were Sunphosate (46.2%), Asaasewura (40.0%), Condemn (38.5%), 2, 4 D (34.6%) and unknown herbicides (7.7%) Table 4. This is an indication that weedicides play an important role in the control of weeds and increasing crop yields [15]. Table 5 indicated that 78% of the farmers used herbicides to control all types of weeds with only 19.5% using herbicides to control tree or shrubs. This implies that farmers cultivating oil palm in the study area used different weedicides at different level of their production depending on the purpose.

3.3 Farmers' Perception on the Effect of Weedicides

Farmers' perception of weedicides' effects on the environment include, soil destruction (57.7%), harming beneficial insects (30.8%); decrease

biodiversity (63.1%) and contribute to air pollution (51.5%). About 73% of the farmers were of the opinion that weedicides pollute streams, rivers and wells while majority (84.6%) perceived the harmful side effects of weedicides on non target animals, birds and earthworms (Table 6). The study also revealed that oil palm farmers in the study area were aware of various issues related to misuse of pesticides. About 96.1% of the farmers were aware of using banned weedicides as misuse while 88.5% of them had knowledge of weedicide misuse as failure to wear protective devices. Only a small number of farmers (34.6%) were aware that storage of pesticides in living rooms was harmful, while the majority (92.3%) regarded improper disposal of weedicides containers as a misuse. The use of weedicides containers for domestic purposes was regarded as a misuse by 86.2% of the

farmers. Almost 90% of the farmers had knowledge of using leaking equipment as misuse of weedicides and only 39.9% of the farmers indicated re – entry into the sprayed field as a misuse (Table 7). This high level of knowledge about weedicides' hazards by the farmers is important for the prevention of acute poisoning [16].

Results in Table 8 showed that the oil palm farmers were favourably disposed toward the risk of weedicides usage to the environment. This could be seen in their level of agreement with most of the items used to measure their attitude toward the risks posed to the environment by pesticides. This favourable attitude is likely to make them more responsive to training on proper management regarding public health risks and environmental hazards.

Table 2. Description of socio-economic characteristics of surveyed respondents n = 130

Characteristics	Frequency	Value (%)
Age(years)		
20-30	15	11.5
31-40	20	15.4
41-50	50	38.5
51-60	30	23.1
>60	15	11.5
Total	130	100.0
Sex		
Male	110	84.6
Female	20	15.4
Total	130	100.0
Education		
No formal education	18	13.8
Basic education	70	53.8
Secondary education	23	17.8
Tertiary education	19	14.6
Total	130	100.0
Farming Experience(years)		
5-15	25	19.2
16-25	86	66.2
26-35	10	7.7
>35	9	6.9
Total	130	100.0
Farm Size(Ha)		
0.5-2.0	85	65.4
2.5-4.0	20	15.4
>4.0	25	19.2
Total	130	100.0
Land ownership status		
Inheritance	55	42.3
Leasehold	35	26.9
Rent	40	30.8
Total	130	100.0

Source: Authors' Field Survey 2019

Table 3. Percentage of respondents indicating their access to extension services

Contact with Extension Agent	Number of responses	Value (%)
Contact	95	73.10
Non-contact	35	26.90
Total	130	100.00

Source: Authors' Field Survey 2019

Table 4. Percentages of respondents showing the type of weedicide used for weed control

Herbicides	Number of responses	Percentages*
Aniphosate	80	61.5
Sunphosate	60	46.2
Asaasewura	52	40.0
Power	42	32.3
Condemn	50	38.5
Sarosate	20	15.4
Atrazine	70	53.9
2,4 D	45	34.7
Unknown	10	7.7

*Multiple responses allowed

Source: Authors' Field Survey 2019

Table 5. Weedicide use practices of farmers

Purpose of application	Number of responses	Percentage*(N=130)
Control all weeds	102	78.5
Control broad leaf only	96	73.8
Control grasses only	68	52.3
Control of tress/shrubs	25	19.2

*Multiple responses allowed

Source: Authors' Field Survey 2019

Table 6. Percent of respondents indicating their perception of weedicide effects on the environment

Respondents perception	Number of responses	Percentage*(N=130)
Destroying soil by reducing its quality	75	57.7
Harming beneficial insects	40	30.8
Decrease biodiversity	82	63.1
Pollutes water bodies	95	73.1
Contributes to air pollution	67	51.5
Harmful side effects of non targets organisms	110	84.6

*Multiple responses allowed

Source: Authors' Field Survey 2019

Table 7. Farmers' knowledge about misuse of weedicides

Respondents knowledge	Number of responses	Percentage*(N=130)
Failure to use protective clothing/equipment	115	88.5
Storage of weedicide in living rooms	45	34.6
Using banned agricultural weedicide	125	96.1
Improper disposal of pesticide containers	120	92.3
Using weedicide containers for domestic purposes	112	86.2
Eating/smoking during spraying	85	65.4
Use of leaking equipment	115	88.5
Re-entry of sprayed farms	52	39.9
Non adherence to dosage rate	93	71.5

*Multiple responses allowed

Source: Authors' Field Survey 2019

Table 8. Attitude of respondents towards the risk of weedicide usage

Statement	Mean Score	Std. Deviation
Weedicide residues in food can cause death	4.14	0.66
Natural resources can be destroyed when water run-off enter stream or leach into groundwater	3.86	0.81
Farmers exposure to weedicide has effect as dizziness, poor coordination etc	3.98	0.73
Weedicide usage causes resurgence of pest population after removing natural enemies	3.51	0.93
Soil, air and water bodies can be contaminated with poisonous chemical	3.89	0.76
Weedicide causes loss of biodiversity, death of wild life and farm animals	3.76	0.82
Improper use of weedicide can destroy both target and beneficial organisms	3.73	1.07
Weedicide contamination is not caused by unsafe or misuse of weedicide	1.78	0.67
Timing of spraying of weedicide is not important in weedicide application	1.81	0.67

Strongly agree = 5, agree = 4. Undecided = 3, disagree = 2, strongly disagree = 1. Any mean score ≤ 3 suggests disagreement with the item statement. Any mean score ≥ 3 suggests agreement with the item statement

Source: Authors' Field Survey 2019

4. CONCLUSION

It could be concluded from the study that oil palm farmers in the Denkyembaour District of Ghana have knowledge on the risks associated with use of weedicides and its effects on the environment. Hence, their favourable attitude towards the risks of weedicide usage. However, there is still the need for more sensitization and awareness creation to farmers on the effects of weedicides use on the environment and the farmers as well. This study serves as a platform to upscale the studies into other oil palm growing belts in Ghana.

CONSENT

As per international standard, respondents' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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