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Perceived Effect of Agrochemicals on Health of Cocoa Farmers in Ikom Local Government Area, Cross River State, Nigeria

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ABSTRACT

Background: The study assessed the effect of agrochemicals on the health of cocoa farmers in Ikom Local Government Area of Cross River State, Nigeria. The specific objectives of the study were to; assess the effect of Agro chemicals on the health of cocoa farmers in the study area and to identify the protective measures that cocoa farmers can adopt to reduce the effects of these chemicals on health in the study area.

Methods: Primary data was obtained with the help of well-structured questionnaire and 120 respondents were selected through a multistage sampling procedure. Descriptive statistical tools such as tables, frequencies, means and percentages were employed for the analysis of the data and interpretation.

Result: The results revealed that the most severe perceived effects of agrochemicals on health of cocoa farmers in the study are were cough (x=3.99%) and the respiratory diseases (x=3.95%) while wearing of chemical resistant overall (x=4.03%) and washing of hands after chemical handling (x=3.96%) were perceived as the most significant protective measures that was adopted by cocoa farmers in the study area. The study recommended that the Nigerian government should incentivize the adoption of organic farming practices and environmentally friendly agro-chemical alternatives, reducing the overall health risks associated with agro-chemical use, while extension providers should supply information and training on sustainable and conservative agriculture to the farmers.

Key words: Agro chemicals, Cocoa, Effect, Farmers, Health.

INTRODUCTION

Certain chemical substances have been employed in controlling insects, pests and weeds. These are called Agrochemicals, some of these chemicals include Primextra, Veto85, Primethrin, Pyrethrum, DDT, Dieidrex, Aldrin, Duse, among others. Chemical control is very effective but hazardous to health (Effiong and Aboh, 2019). Agrochemicals, such as pesticides and fertilizers, are used extensively in cocoa farming in Nigeria. While these chemicals can increase crop yields and improve the quality of cocoa beans, they can also have negative effects on the health of cocoa farmers and their families (Ajayi *et al*., 2020; Da-Costa *et al.,* 2018; Gagic *et al.,* 2017). Food and agriculture organization Effiong and Aboh (2018) report that agriculture contributed 40% of the Gross Domestic Product (GDP) and employs about 70% of the working population in Nigeria. The recent fluctuating climatic condition with the increasing population in Nigeria have prompted the need for an improvement in agricultural production, the quest for possible strategies to meet the ever growing agricultural need has prompted the use of agriculture-chemicals to improve agricultural production and productivity (Okoloko, 2016). Agrochemical produced for cocoa production includes: herbicides, insecticides and fungicides among others. Although many kinds of chemicals are used in agriculture, they can be categorized into simple groups according to the functions they perform (Atreya, 2007). (Effiong and Aboh, 2018) has defined pesticides as any substance intended for preventing, destroying or controlling any pest including vectors of human or animal diseases, unwanted species of plantsand animals causing harm during or interfering with the production, processing, storage, transport or marketing of agricultural commodities, wood products or animal feedstuffs, or substance that may be administered to animal for the control of insect, arachnids or other pest in or in their bodies Keifer *et al.* (2018); Oludoye *et al.* (2023): Saghir *et al.* (2012). In Nigeria, cocoa production is still dependent on pesticides

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to attain acceptable level of crop production. Coca unquestionably has played a dominant role in the pace of economic development in the Western Region during its peak, providing employment opportunities for more than one million Nigerians Tijani (2006). These same authors also reported that cocoa plant like all living organisms is susceptible to attack by a wide range of pests and diseases (Effiong *et al.,* 2016); (Effiong, 2013); (Effiong, 2024a) and (Effiong, 2024b). Preventive and curative measures are therefore necessary in the cocoa industry to maintain and even increase output, while non-chemical means of managing pest and diseases in the industry are widely recommended for health and environmental reasons, the use of agrochemical in the form of herbicides, insecticides, fungicide and foliage fertilizers is unavoidable in the effective management of cocoa farms. Pesticides are routinely applied by cocoa farmers to enhance cocoa production, which is threatened by pest infestations and diseases. However, the undesired health implications of pesticide applications on the farmers are yet to be fully elucidated especially among cocoa farmer's despite being the hub of cocoa production in Nigeria (Adedire *et al.,* 2023). Despite the usefulness of agrochemicals, the side effects the soil and health hazards they pose to cocoa farmers in Nigeria are high and maybe quite unbelievable (Effiong and Aboh, 2024). over time studies has proven that long-term, low-dose exposure to agrochemicals pose serious health challenges on cocoa farmers leading to health issues like respiratory diseases such as cough and asthma (Aboh and Effiong, 2019). This agrochemical are highly toxic and have associated with serious human health damages. According to Konradsen *et al.* (2006) about one half of human poisoning occurs more less developed areas, even though these places account for only 20% world's use of pesticides.

Cocoa farmers are exposed to agro-chemicals on a daily basis, if they don't observe proper precautions, illness or even death may ensue (Effiong and Iheme, 2024). AGRO-chemicals can enter the body through many routes but the most common ways are through the skin contacts and inhalations among farmers (Effiong and Aboh, 2018). According to Effiong and Aboh (2018), pesticides harm human through poisoning or injuries, poisoning is caused by pesticides that affect organs or systems inside the body whereas injuries are usually caused by pesticides that are external irritants. This same author reported that toxic effects of pesticides exposure can range from mild symptoms like; minor skin irritation or other allergic symptoms, to more severe symptoms like strong headache, dizziness or nausea, convulsions and even death Effiong, (2012): Effiong and Aboh, (2018); Effiong and Aboh, (2024); (Effiong *et al*., (2024): Effiong, Abohand Aya, (2021); Effiong and Asikong, (2013). Studies have shown that pesticides can enter the human body by three (3) common ways; through the skin (contact), the mouth (ingestion) and the lungs (inhalation) Aboh and Effiong, (2019a): Singh *et al.* (2020). (Aboh and Effiong, 2019b). Also the state of chemical (*i.e.* solid, liquid or gas) affects the chances of pesticides penetration into the body (Effiong and Enenyi, 2023). The most common pathway for pesticide poisoning among farmers is absorption through the skin which may occur as a result of splashes and spills on the body when handling, mailing, loading or disposing of pesticides (Effiong and Effiong, 2015); (Effiong and Etim, 2025).

Some unhealthy and unprofessional habits associated with the of agrochemicals by cocoa farmer includes; eating, drinking or smoking during applicatiousens, not wearing safety wears like gloves, goggles and boots (Ogunjimi, 2012). Integrated pest management (IPM) is an ecological approach to pest management as it discourages the use of pest control methods that have negative effect on the non-target organisms. Over 95% of observed farmers did not comply with minimum standards for safe pesticide useand 80% of respondents reported that they stored pesticides in their homes without personal protection measures, Keifer *et al.* (2018); Oludoye *et al.* (2023): Saghir *et al.* (2012). Education and literacy level were not significantly associated with personal protective equipment (PPE) use. Additionally, 90% of respondents had experienced adverse health effects after using pesticides including intense headache, dizziness, stomach cramps, skin pain and itchingand respiratory distress (Ndayambaje *et al.,* 2019) Vast majority of these pollinators are insects such as bees. moths etc and inappropriate use of these agrochemicals in farming systems could cause harm to non-target organisms including these pollinators. (Effiong and Aboh 2019); (Effiong, Etuk and Iyamah, 2023) reported that investigating farmer's awareness of agrochemical residues and their behavior regarding application is important in order to reduce human factor that negatively affect farmers.

Statement of problem

Agrochemicals are used by farmers to improve crop yield and quality. However, despite the usefulness of the agrochemicals, they pose serious risks to farmers who are exposed to them thereby leading to serious health challenges such as coughing, headache, dizziness, nausea, convulsion, diarrhea skin irritation stomach ache *etc*., Singh *et al.* (2020). Base on the low level of education of farmers in Nigeria, agrochemicals among cocoa farmers have been a matter of great concern (Effiong and Effiong, 2012). (Etim *et al.,* 2022); (Etim and Effiong, 2022). Ijioma *et al.* (2014); Nkang and Effiong, 2015); (Effiong *et al*., 2023). This has often been attributed to the low level of education, low knowledge of precautionary measures and improper use of agrochemical during Agricultural production process amongst farmers. Cocoa farmers tend to rely on pesticides as the primary pest control measure for Agricultural production (Aboh and Effiong, 2019). While stringent measures are enforced during formulation, manufacture and registration of pesticides, it is the responsibility of the buyer at the retail level to ensure these chemicals are being used as prescribed. However, according to Effiong and Etim, (2025); Effiong and Iyamah,

(2022) increase use of Agrochemicals and associated input have negative effects on health of farmers in Nigeria. The increased use of these chemicals and inappropriate application methods may be harmful to humans and the environment at large. It has been observed that cocoa farmers are often exposed agrochemicals without precaution, for instance, some keep these chemicals at homes amongst foodstuffs. It is therefore on this regard that this study was conceived to assess the effect of agrochemical on health of cocoa farmers in Nigeria precisely Ikom Local Government Area, Cross River State, Nigeria.

Objectives of the study

The general objective of this study were to:

1. Assess the effects of Agro chemicals on the health of cocoa farmers in the study area.
2. Identify perceived measures cocoa farmers can adopt to reduce effects of chemicals their health in the study area.

MATERIALS AND METHODS

Study area

The study was carried out in Ikom Local Government Area, Cross River State. Ikom is bounded to the south by Obubra local government area and on the East by Etung Local Government Area. The area lies in latitude 5°57′ 40″N and longitude 8°39′E of the equator. Ikom lies approximately 25 m above sea level with an average seasonal temperature of 28°C. The soil type is largely loamy clay, suitable for the cultivation of wide range of arable and tree crops. Some of the crops grown in the area include; cassava, melon, cocoyam, banana/plantain, vegetable and cocoa. The population of the study consists of all cocoa farmers in Ikom Zone.

The study adopted multi-stage random sampling techniques. The first stage involved a Random selection of Ikom block, because the bulk of cocoa is grown in Ikom Local Government Area of Cross River State. Stage two involved Purposive sampling of four out of eight cells that make up the block. Primary data was obtained through the use of structured questionnaires. Descriptive statistics such as frequency counts, percentages, ranking, means and standard deviation. Both primary and secondary data was used. Primary data was obtained through the use of structured questionnaires. Data obtained from Cross River State Agricultural Development Programme (CRADP) showed that the number of registered cocoa farming households in the selected cells for the study area was 1,200. Ten per cent (10%) of household heads were randomly selected giving a sample size of 120 respondents used for the study.

Table 1 showed sampling and sample size for the study.

RESULTS AND DISCUSSION

Demographic characteristics of the respondents in the study area

The demographic characteristics of the respondents as shown in Chart 1 below revealed that 71% of the respondents were males and 29% were females, indicating male dominance in the population. Majority of the respondents were between the ages of 30-39 (35%) and 40-49 (25.8%), with smaller proportions in the 20-29 (16.6%) and older age groups (≥60 at 4.2%). Educationally, 26.7% of the respondents have OND/HND qualifications, followed by 23.3% with SSCE and 15.8% with FSLC, while 13.4% have no formal education. A smaller groups, 15%, have BSc/HND and only 5.8% hold MSc/PhD degrees, highlighting moderate educational attainments within the population. Cocoa farming experience showed that 39.2% have 11-15 years experience, followed by 29.2% with 3-10 years and 20% with over 15 years experience, indicating a seasoned farming population. Farm size and income distribution reflected smallholder farming practices and moderate earnings. The majority of the farmers operated on small plots, with 31.7% managing 3.01-6 hectares and 30% cultivating 1-3 hectares, while 17.5% cultivated less than 1 hectare. None of the respondents own farms larger than 9 hectares. Annual income levels showed that 26.7% earn between N600,001-800,000, with a similar proportion earning N800,001-1,000,000, while 23.3% earn N200,001-400,000. A smaller group, 15.8%, earned between N400,001-600,000 and 7.5% reported incomes below N200,000, with no respondents earning over N1,000,000. This highlighted the concentration of farmers in mid-income brackets and underscores the challenges of scaling production for higher economic returns and productivity (Effiong and Enenyi, 2023).

Table 1: Sampling procedure.

Agricultural zone selected	No. of blocks selected	No. of cells in the block	No. of cells selected from block	No. of cocoa farming household per cell	10% of house-hold heads
Ikom	Ikom	Ekukunella	Okuni	400	40
		Okuni	Akparabong	200	20
		Ikom-urban	Edor	350	35
		Nde	Nta Nselle	250	25
		Edor			
		Nta Nselle			
		Nnam			
		Akparabong			
Total				1,200	120

Moreso, Chart 2 below showed the distribution of cocoa farmers based on the agrochemicals they used, highlighting the frequency and percentage adoption for each category. Among herbicides, Premaiz was the most widely used, with 77.5% of farmers applying it, followed by Paraq (60%) and Diutop (56.7%). For insecticides, Delthrin leads at 65%, while Zap was the least adopted at 25.8%. Capsida and Termicid were used by 61.7% and 45% of farmers respectively. In the fungicide category, Mycothrin Super was applied by 59.2% of farmers, which was the same percentage for its use in seed treatment. Cocoa Boost, a foliar fertilizer, had the highest adoption overall at 95%. Regarding storage chemicals, Protex was used by 78.3% of farmers, outperforming Devalp at 55%. Additionally, Seedrex was employed by 52.5% of farmers for seed treatment. This distribution reflected the diverse agrochemical usage patterns tailored to specific farming needs in cocoa production.

Perceived effects of agro-chemicals on health of cocoa farmers in the study area

The results in Table 2 highlighted the perceived health effects of agro-chemicals on cocoa farmers in the study area, as indicated by mean scores and rankings. Cough emerged the most prevalent health effect with the highest mean score of 3.99, followed closely by respiratory diseases at 3.95, which ranked 2nd. This suggested that prolonged exposure to agro-chemicals significantly affected the respiratory systems, possibly due to inhalation of chemical fumes or particles during applications. Skin itching ranked 3rd with a mean score of 3.86, indicating frequent dermatological reactions likely caused by skin contact with agro-chemicals. Dizziness and sneezing both shared the 4th rank with a mean score of 3.70 and 3.68, respectively, reflecting neurological and allergic responses that many farmers experience when handling these chemicals. Other notable effects included throat irritation

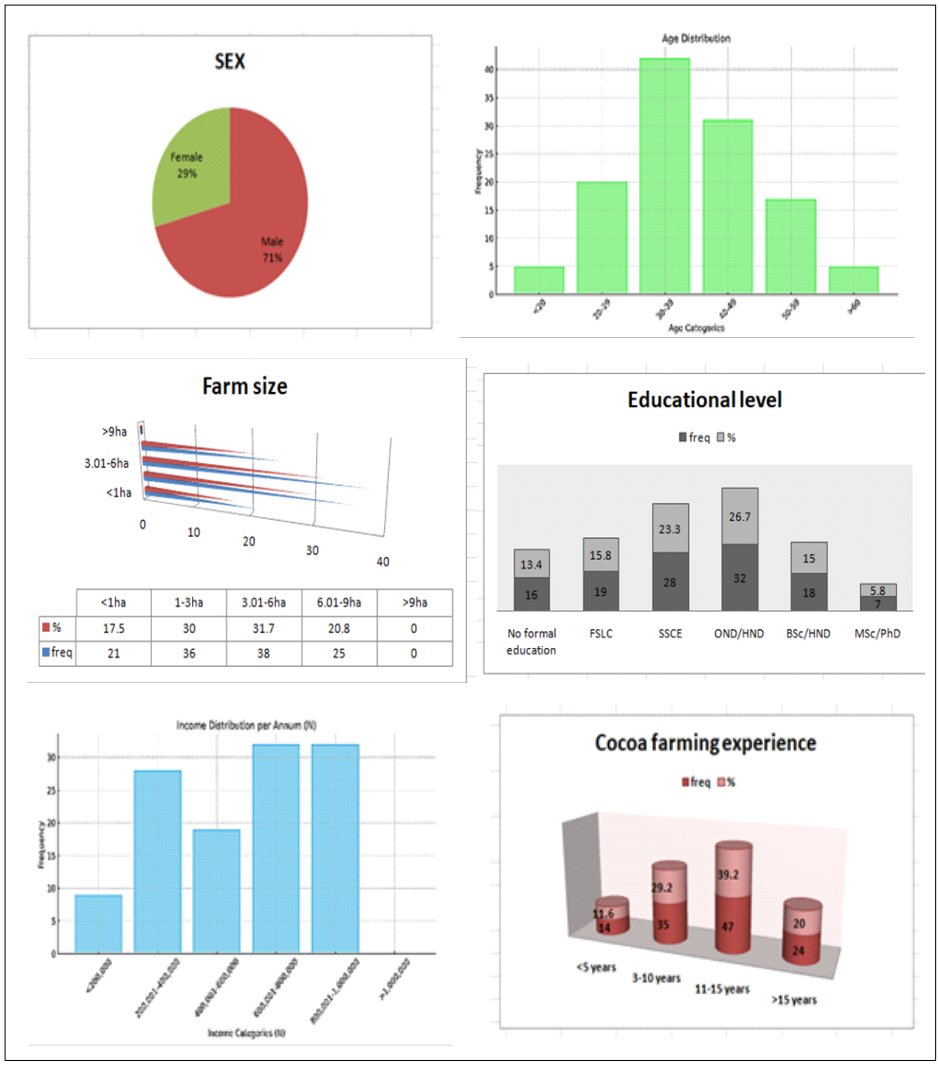


Chart 1: Distribution of respondents according to their demographic characteristic.

(3.20), ranked 8th and eye reddening (3.15) ranked 9th, alongside lacrimation (teary eyes) and headache, both scoring around 3.17-3.14 and sharing the 9th rank. These symptoms likely stem from chemical exposure through vapour or physical contact with sensitive organs like the eyes and nose. While cancer (mean score 3.29) ranked 7th, indicating concerns about long-term exposure risks, death of farmers ranked 6th at 3.63, highlighting the perceived severity of agro-chemical hazards over time. Meanwhile, lower-ranked effects like vomiting (3.05, 12th), excessive sweating (3.03, 12th) and renal diseases (2.65, 15th) suggest that these symptoms, although present, are less frequently experienced or perceived compared to others. The overall grand mean of 3.36 indicated a generally high level of awareness among farmers regarding the health risks posed by agro-chemicals. The wide range of perceived effects, from respiratory and neurological symptoms to life-threatening conditions like cancer and death, reflected the significant health challenges farmers faced due to improper handling, insufficient protective measuresand prolonged exposure to agro-chemicals.

The results of this study are similar to those of a study conducted by Effiong (2012) who reported that exposure of the body to pesticides could lead to damages on the nose, throat and lungs resulting in respiratory problems, renal diseases and death.

Perceived measures to reduce effects of agro-chemical on cocoa farmer's health in the study area

The results in Table 3 outlined the perceived measures to reduce the health effects of agro-chemicals on cocoa farmers in the study area. Chemical-resistant overalls ranked highest with a mean score of 4.03, reflecting its perceived effectiveness in minimizing direct skin contact with harmful chemicals. This was followed closely by washing hands after handling chemicals (3.96) and the

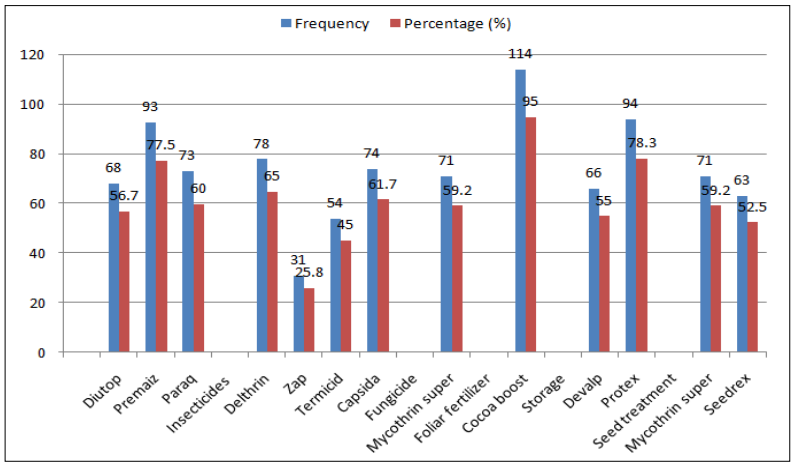


Chart 2: Types of Agro-chemicals used by Cocoa farmers in the study area (Based on frequency and percentage).

Table 2: Distribution of respondents according to perceived effect of agro-chemicals on health of cocoa farmers in the study area.

Perceived effects	Mean scorex	S.D	Rank
Cough	3.99	0.133	1st
Dizziness	3.70	0.128	4th
Eye reddening	3.15	0.118	9th
Sneezing	3.68	0.128	4th
Skin itching	3.86	0.131	3rd
Headache	3.14	0.118	9th
Body pain	2.9	0.115	14th
Vomiting	3.05	0.116	12th
Throat irritation	3.20	0.119	8th
Excessive sweating	3.03	0.116	12th
Lacrimation	3.17	0.118	9th
Respiratory diseases	3.95	0.132	2nd
Cancer	3.29	0.121	7th
Renal diseases	2.65	0.109	15th
Death due to skin cancer	3.63	0.127	6th
Grand mean	3.36		
Total number of respondents: 120			

Table 3: Distribution of respondents according to perceived measures to adopt in reducing effect of agrochemical on health of Cocoa famers in the study area.

Perceived measures	Mean score (x)	SD	Rank
Gloves	3.84	0.131	6th
Boots	3.58	0.126	10th
Hats	2.98	0.115	15th
Long sleeve shirts	3.74	0.129	7th
Chemical resistant overalls	4.03	0.134	1st
Googles	3.49	0.125	13th
Masks	3.95	0.132	3rd
Coat	3.28	0.121	14th
Checking expiry dates	3.86	0.131	5th
Asking dealers	3.93	0.132	4th
Burning empty chemical containers	3.68	0.128	9th
Burying empty chemical containers	3.51	0.125	11th
Washing hands after handling chemicals	3.96	0.133	2nd
Not using empty containers to store food items	3.69	0.128	8th
Technical know-how of chemical handling	3.51	0.125	11th
Grand mean	3.67		
Total respondents: 120			

use of masks (3.95), which were ranked 2nd and 3rd, respectively. These measures highlighted the importance of personal protective equipments (PPE) and proper hygiene practices in mitigating chemical exposures. Additionally, asking dealers about chemical safety scored 3.93 (ranked 4th) and checking expiry dates of agro-chemicals had a mean score of 3.86 (ranked 5th), indicating that farmers recognized the role of chemical quality and safety information in reducing health risks. The use of gloves (3.84, 6th) and long sleeve shirts (3.74, 7th) were also highly ranked, emphasizing their importance in providing protection against skin contact. Measures such as not using empty chemical containers to store food items (3.69, 8th) and burning empty containers (3.68, 9th) highlighted the need for proper chemical waste management to avoid secondary exposure. However, practices like burying empty chemical containers and acquiring technical know-how of chemical handling both scored 3.51, placing them in the 11th rank, while the use of boots ranked 10th with a mean score of 3.58. Lower-ranked measures included wearing goggles (3.49, 13th), coats (3.28, 14th) and hats (2.98, 15th), suggesting that farmers perceived these as less critical for protection. The grand mean of 3.67 indicated a high level of awareness among cocoa farmers regarding the need for protective measures and proper handling practices to mitigate agro-chemical-related health risks. The results highlighted the prioritization of PPE, safety practicesand chemical management as essential strategies for mitigation system in Agro chemicals.

This result is in line with that of Singh *et al.* (2020) who reported that whenever agro-chemicals are used, operative and well maintained spraying equipment and necessary precautions at all stages of chemical handling were essential for reducing farmer's exposure to agro-chemical effects and related risks.

Summary

This study assessed the effects of agro-chemicals on health of cocoa farmers in Ikom Local Government Area, Cross River State, Nigeria. The specific objectives were to assess the effect of these chemicals on health of cocoa farmers in the study area and identify the protective measures cocoa farmers can adopt to reduce effects of these chemicals on their health respectively. The study employed primary data which was collected with well-structured questionnaires from the respondents. The study made use of 120 respondents who were selected through a multi stage random sampling procedure. The method of data analysis used for the study was descriptive method with statistical tools such as means frequencies, percentages and ranks were employed to analyze the results. The findings from the two tables revealed the significant health effects of agro-chemicals on cocoa farmers and the measures perceived to reduce these impacts. Farmers reported prevalent health issues such as cough (3.99), respiratory diseases (3.95) and skin itching (3.86), indicating that exposure to agro-chemicals primarily affected respiratory systems, skinand overall well-being. While severe concerns such as skin cancer (3.29) and subsequent death (3.63) of farmers caused by the inhalation of chemicals were observed, other symptoms such as vomiting and renal diseases were less frequently perceived. To address these challenges, farmers identified effective measures, with chemical-resistant overalls (4.03), washing hands after handling chemicals (3.96) and masks (3.95) ranked the most critical. Proper safety practices like checking expiry dates and asking dealers for guidance also emerged as vital points. The overall results emphasized that while farmers weu aware of the health risks associated with agro-chemicals, they also recognized

the importance of personal protective equipment, hygiene and chemical management practices as essential strategies to safeguard their health systems.

RECOMMENDATIONS

Based on findings regarding health effects of agro-chemicals on cocoa farmers in the study area, the following recommendations were made to key stakeholders in Agriculture including the Nigerian government, agricultural extension providersand safety awareness institutions in Nigeria.

1. Farmers are hereby encouraged to use chemical resistant overalls during farming operations, this would reduce the effects of agrochemicals on their skin in particular and their health in general.
2. Farmers must wash their hands thoroughly, after handling agrochemicals, this would reduce direct intake of chemicals into their body.
3. The study also recommends the use of face masks and hand gloves. These measures highlights the importance of proper hygiene practices in mitigating chemical exposures to health of the farmers.

CONCLUSION

The study highlighted the significant health risks cocoa farmers face due to agro-chemical exposure, with respiratory issues, skin reactionsand other ailments being the most commonly perceived effects of Agro chemicals on health. Farmers have identified the use of personal protective equipments (PPE) such as chemical-resistant overalls, masksand gloves, along with proper chemical handling practices like washing hands, checking expiry datesand consulting dealers, as effective measures to mitigate these risks. However, the low prioritization of some safety measures suggested the need for increased awareness, educationand accessibility to safety gears. Strengthening technical knowledge, promoting proper agro-chemical useand ensuring affordable access to protective tools are critical steps toward safeguarding farmers' health and improving their working conditions in cocoa production activities.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

Informed consents were obtained from the respondents and related institutions.

Conflict of interest

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