Vol. 4, Issue 1: RUGIPO Research & Technical Journal
Issues in Science & Agricultural Technology https://elearning.rugipo.edu.ng/Rugipo_Tetfund_Journal_Research_Portal/
ISSN: 2714-3643; September, 2025 TETFund/DESS/POLY/OWO/ARJ/04

LEVEL OF PESTICIDE USE AND SAFETY STANDARD ISSUES: CASE OF RICE (*Oryza Sativa L.*) GROWERS IN ISHIAGU EBONYI STATE, NIGERIA

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Abstract:
This research was conducted to assess the level of synthetic pesticide use and safety standard awareness/compliance among rice growers in Ishiagu, Nigeria. Copies of the questionnaire probing the farmers' experiences in the use of pesticides for rice farming were administered to selected sixty extension Contact Farmers (CF), using Purposive Random Sampling Technique. Data were analysed using descriptive statistics and PEST analysis. Respondents comprised 42% male and 58% female CF; while 60 and 40% were engaged in full-time and part-time rice farming, respectively. More than 66% CF had at least a basic secondary school education, apart from 16.7% with no formal education training. Only 45% admitted use of pesticide always; 15% affirmed non-use of pesticide, while the remaining used it sometimes (21.7%) or occasionally (18.3%). Pesticide uses ranged from insecticides (67%), herbicides (55%), rice diseases (40%) and vertebrate pests (38%) control. 68% CF showed awareness of potential health and environmental hazards associated with handling/use of pesticide, while 43.3% affirmed experiencing pesticide-related hazards. 33.3% CF read pesticide container labels always before use; 23.3% did not border; while the remaining read such information sometimes (28.3%) and occasionally (13.3%). Compliance with safety standards in handling pesticides was largely unsatisfactory as only 18.4, 28.3, 13.3, 43.3 and 51.7% CF had and used hand gloves, overcoat, eye goggles, nose mask and rainboots, respectively. Factors affecting the farmers' disposition to pesticide utilisation and safety standard compliance were identified and solutions proffered.

Keywords: *Contact farmers, protective clothing, PEST analysis, smallholder farmers, Southeast Nigeria, synthetic pesticides.*

How to Cite: Ogbu, J. U; Umeokechukwu, E. C; Haanongon, T.; and Adesina, J. M. (2025). Level of Pesticide Use and Safety Standard Issues: Case of Rice (*oryza sativa* l.) Growers in Ishiagu Ebonyi State, Nigeria. *RUGIPO Research and Technical Journal in Science and Agricultural Technology,* 4(1):27–34. https://elearning.rugipo.edu.ng/Rugipo_Tetfund_Journal_Research_Portal/.

INTRODUCTION

Modern conventional farming relies mainly on many agrochemicals such as fertilisers, pesticides and crop preservatives to produce and preserve food crops from field to store in order to enhance food quality. Pesticides are chemical substances that derive their name from the French word "Peste", which means pest or plague and the Latin word "caedere", to kill (Akunyili and Ivbijaro, 2006). Pesticides, therefore, have been defined as any chemical substance or mixture of substances intended for preventing, destroying, repelling, or

mitigating the effect of any pest of plants and animals, including humans (NAFDAC, 1996). They include herbicides, insecticides, rodenticides, fungicides, molluscides, nematicides, avicides, acaricides, repellents and attractants used in agriculture, public health, and horticulture. Pesticides are widely used in most sectors of agricultural production to prevent or reduce losses by pests, and thus, can improve yield as well as quality of the produce, even in terms of cosmetic appeal, which is often important to consumers (Oerke and Dehne, 2004). Pesticide use has been viewed in some quarters as the most efficient way of controlling pests as it is less labour intensive and has a higher output per hectare of land, for the improvement of crop yield, protection of crop quality and its reliability, as well as reducing the production cost in some ways (Cooper and Dobson 2007). Aside from pesticides being used in agriculture, it is also beneficial to public health in preventing vector-borne diseases (NAFDAC, 1996).

Though the benefits of pesticide use are enormous, research has shown that their uses are associated with some undeniable environmental and health damages (Aktar *et al.,* 2009; Mahmood *et al*., 2016). In Nigeria, for instance, intensification of agricultural production and food security has led to increased use of synthetic pesticides, and attendant health and environmental concerns (Osibanjo, 2002). The productivity-enhancing effects of such pesticides have been overvalued greatly, as most studies rarely take into consideration their effects on the environment and on farmers' health (Konya, 2005; Adeniran *et al*., 2006). Crop farmers use a wide range of pesticides at different levels to reduce losses from pests and diseases (Akunyili and Ivbijaro, 2006). Despite the popularity and extensive use of synthetic pesticides by farming households, serious concerns about the health risks arising from the exposure of farmers when mixing and applying pesticides or working in treated fields are alarming (Aktar *et al.,* 2009). Chemical residues in food and in public drinking water have been raised. These activities have caused several accidental cum occupational poisonings (Maroni, 2006; Soares and Porto, 2009). The use of pesticides has been noted to pose serious health risks to farmers both in the short and the long run and also degrade the environment (NAFDAC, 1996). In developing countries, moreover, farmers face great risks of exposure to toxic chemicals banned in other developed countries due to poor border regulation/importation, incorrect application techniques, poor maintenance or inappropriate spraying equipment, poor and inadequate storage methods, and often the reuse of old pesticide containers for food and water storage (Ibitayo, 2006; Asogwa and Dongo, 2009).

The goal of this study, therefore, was to contribute to the improvement of agroecological systems and public health preservation in Nigeria through informed and judicious use of pesticides among rural farming households. While its objectives included: to characterise the socioeconomic profiles of rice (*Oryza sativa*) farmers in Ishiagu, Ivo Council Area Ebonyi State southeastern Nigeria; to evaluate level of pesticide use in rice production in the study area; to determine level of pesticide safety standard compliance among selected rice farmers in the area; to identify prevailing factors affecting level of pesticide safety standard adoption among the farmers; and to assess level of awareness of associated health hazards due to pesticides (mis)use and exposure among the study group.

MATERIALS AND METHODS

The research was carried out between May and August 2022 at Ishiagu in Ivo Council Area of Ebonyi State, Southeast Nigeria. Ishiagu is located between longitudes 7°30` – 7°35` E and latitude 5°54` – 5°59` N, at an altitude of 58 meters above sea level (Google Map, 2022). The area is endowed with solid minerals and has a tropical humid climate with annual rainfall of

about 1800 – 1950 mm, a temperature range of 21 - 35°C, and an average relative humidity of 65% (Ogbu *et al.*, 2024). Ishiagu is characterised by a derived savanna agroecosystem (Google Map, 2022). The major activity common in the study area is farming, cultivating rice, okra, cucumber, sweet potato, maize, and groundnut. However, rice production is a prominent farming commodity in Ishiagu than any other agricultural produce.

Agricultural Development Programme (ADP) Contact Farmers were used in this study. The existing structures of (ADP at the Ivo Council Area extension blocks and circles were adopted and followed in reaching out to the target ADP Contact rice farmers in the area. A structured self-administered questionnaire was developed and validated by an Agricultural Extensionist in the Department of Agricultural Extension and Management, Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria. Copies of the questionnaire were administered to the selected ADP Contact Farmers (n=60) who constituted the respondents, using a purposive random sampling technique. The questionnaire obtained information on the socio-demographic profile of the farmers and their knowledge/experience on pesticide usage. The completed copies of the questionnaire were returned for validation and statistical analysis. The data collected were analysed using descriptive statistics. In addition, PEST (Political, Economic, Social and Technological) and GAP Analyses were used to evaluate the various prevailing factors affecting rice agribusiness in relation to the level of pesticide use and compliance with safety standard (best) practices in the study area, as well as to proffer possible solutions to the identified challenges.

RESULTS AND DISCUSSION

Table 1 showed that the socio-demographic characteristics and distribution of the rice growers in Ishiagu, Ivo Council Area of Ebonyi State, Nigeria were made up of 42.0% male and 58.0% female contact farmers; 68.3% of the farmers were within the active age groups of 21 – 50 years. This pattern of distribution could be attributed to the setting of the survey area as a suburban agrarian community where subsistence farming is prevalent. The male-to-female ratio reported in this study corroborated earlier reports by Njoku *et al.* (2017) and Adesuyi *et al. (*2015), that similar Fadama farming systems in some rural areas in Nigeria were dominated by females. Distribution of the respondents' age brackets showed that the majority were within the active labour workforce, which agreed with a similar (Ntow *et al.*, 2006) earlier report.

Table 1: Socio-economic characteristics and distribution of rice growers in Ishiagu, Ebonyi State Nigeria

Variables	Sub-group responses	Percent (%)
Gender:	Male	42.0
	Female	58.0
Age group (years):	21 – 30	18.3
	31 – 40	23.3
	41 – 50	26.7
	51 – 60	23.3
	61 and above	8.3
Educational level:	No formal education	16.7
	Primary school	16.7
	Secondary school	31.7
	Tertiary education	35.0

Variables	Sub-group responses	Percent (%)
Farm size (plot)†:	1 – 5	45.0
	6 – 10	23.3
	11 – 15	11.7
	16 – 20	6.7
	21 +	5.0
Level of farming:	Full time	60.0
	Part time	40.0

Source: Field Survey (2023); †One plot = 450 m^2 = 0.045 ha.

Moreover, 33.4% of the respondents had no formal education, or at most attempted primary school, while more than 66% had secondary and or tertiary education experience. A greater percentage of the farmers possessing at least secondary education could contribute to the farmers' ability to perform some critical technical tasks (e.g. calibration of sprayers, proper mixing of pesticides and a ready understanding of pesticide instruction labels) that required basic educational enlightenment. This would invariably impact the farmers' operational attitudes, ease of communication and efficiency in relation to agrochemical handling and application (Lamberth *et al.,* 2013). Sharma *et al*. (2012) also reported that education has a great influence on the overall behaviour and the dispositions of individual farmers toward the adoption of agricultural-related innovation. About 60% of the respondents were full-time farmers, while the rest were part-time farmers. Most of the farmers (68.4%) cultivated ≤ 4500m^2 (10 plots) farm size, whereas barely 5.0% cultivated more than 9000m^2 farm size (Table 1). Thus, these rice growers were essentially smallholder' farmers by FAO rating/classification, which corroborated the report of Ume and Bahta (2024).

Forty five percent of the farmers admitted using pesticides always in their farming activities (Table 2); 15.0% objected to the use of pesticides, while the remaining used them sometimes (21.7%) or occasionally (18.3%). Sixty seven percent of the pesticides used were as insecticides for control of insect-related pests; followed by 55.0% used as herbicides, among other less frequent uses to control crop diseases (40.0%) and vertebrate pests (38.0%). The present report is in tandem with findings from smallholder' rural farmers in Ezza North, southeast Nigeria, who also used more herbicides and insecticides than other forms of pesticides in handling a range of agricultural pest issues they faced (Ogbu *et al.,* 2023).

Table 2: Frequency and purpose of pesticide use by the rice growers

Variables	Responses	Percent (%)
Frequency of use: always:	Always	45.0
	Sometimes	21.7
	Occasionally	18.3
	None	15.0
*Purpose of use:	To control weeds	55.0
	To control crop insect pests	67.0
	To control crop disease	40.0
	To control vertebrate pests	38.0

Sources: Field Survey (2023); *Multi-choice response

Table 3: Farmers' disposition towards reading/compliance with pesticide safety standard labels and awareness of potential health/environmental hazards associated with pesticides

Variables	Responses	Per cent (%)
Reading safety label:	Always	33.3
	Sometimes	28.3
	Occasionally	13.3
	None	23.3
Awareness of potential hazards:	Yes, aware	68.0
	Not aware	32.0
Experience of pesticide-related hazards:	Yes	43.3
	No	56.7

Sources: Field Survey (2023)

Table 3 showed that the level of understanding of pesticide safety standards was below average as only 33.3% of the farmers cared to always read the pesticide labels before use, while 28.3% and 13.3% considered it to be read sometimes and occasionally, respectively, or were not able to read (23.3%). It is imperative, however, to note that proper and regular training/re-training programmes on pesticide safety and hazards of pesticide exposure should be developed to address gaps in farmers' knowledge about pesticide toxicity and proper handling (Ajayi and Akinifesi, 2007; Adesuyi *et al.,* 2016).

Sixty eight percent of the respondents affirmed knowledge of health and environmental hazards associated with pesticide handling and use, while 43.3% indicated that they had experienced health-related problems due to inadvertent contact and accidental exposure to pesticides (Table 3). Some of the common ill health conditions reported by the farmers included: skin irritation (23.6%); skin burnt (14.2%); burning sensation (10.6%); stomach upset (9.4%); head ache, catarrh, watery eyes, and vomiting (8.3% each); general body weakness (4.7%); feverish feeling (3.1%); and dizziness (1.2%).

Eighty per cent of the rice growers affirmed owning and using a knapsack sprayer, in addition to rain boots (51.7%), hand gloves (18.4%), nose mask (43.3%), overcoat (28.3%), eye goggle (13.3%) and none (17.5%), as shown in Table 4. The relatively high percentage of farmers in the study area who owned and used knapsacks and rain boots is not usual, as it has to do with paddy rice production, which is mostly swamp rice dominated. This is also a pointer to the fact that present conventional rice production, even at smallholder farming systems in rural and suburban communities, is heavily dependent on synthetic pesticides and other agrochemical inputs. However, the other essential components of Personal Protective Equipment (PPE) in relation to agro-pesticide application, like eye goggles, overcoat and nose mask, remained underutilised in proper ways among the rice growers. Obviously, the rice growers were more eager to harness the quick action and results of synthetic pesticide application than border about proper procedure and good agricultural practices that are involved therein. This insidious approach would inevitably lead to abuse and or misuse of agro-pesticides with resultant pollution of the environment, other negative impacts on biodiversity, as well as endanger the health of both the farmer and consumers.

Table 4: Per cent distribution of personal protective equipment owned and used by the farmers in pesticide handling and application

Personal Protective Equipment	Per cent (%)*
Knapsack sprayer	80.0
Rain boots	51.7
Hand gloves	18.4
Noise mask	43.3
Overall coat	28.3
Eye goggle	13.3
None	17.5

Sources: Field Survey (2023); *Multi-choice responses

Results from the PEST Analysis revealed some of the prevailing factors (political, economic, social and technological) that affect the farmers' level of understanding as well as compliance/observation of the pesticide safety standard practices in their locality (Table 5a). When and where these militating factors are addressed as identified in the GAP Analysis, these farmers' lots and livelihoods would be greatly improved (Table 5b). A substantial percentage of the militating factors against proper use of pesticides in crop agriculture are issues beyond the farmers' immediate control, and which invariably need presiding government interventions at various levels, from local, state, up to national. Non-Governmental Organisations (NGOs), National Agricultural Research Institutes (NARIs) and Environmental Awareness pressure groups have relevant roles to play in addressing the observed gaps in the farmers' knowledge and capacity to comply with safety standards in pesticide usage. In the alternative or as a complimentary remedy, the farmers could be encouraged to adopt a more eco-friendly approach in pest management involving the use of pesticidal plants and a trap crop strategy, which does not necessarily require the elaborate protocols as seen in the use of synthetic pesticides only.

Table 5a: PEST analysis of factors affecting farmers' ability to understand and comply with pesticide safety standard practices in Ishiagu, Ebonyi State, Nigeria

Political factor:	*Economic factor:*
- Inadequate extension agent personnel; - Undefined and unregulated policy on the use of pesticides in Nigeria; - Poor or non-enforcement of existing policy, leading to unrestricted availability of expired and banned pesticides to the public; - Poor infrastructure;	- Some farmers are only engaged in farming part-time, and thus cannot invest in it adequately. - Mostly smallholder farmers with ≤ one hectare of farm size to cultivate; - Low capital outlay to procure essential Personal Protective Equipment (PPE);
Social factor:	*Technological factor:*
- Poor awareness of proper use/misuse/abuse of pesticides by relevant authorities; - Misinformation/disinformation about pesticides; - Wide-spread ignorance of many user farmers about issues of pesticide toxicity and implications.	- A relatively high cost of the PPE for pesticide handling and application. - Absence of rental outlets for hiring services of PPE in rural farming communities.

Source: Field Survey (2023)

Table 5b: GAP analysis of proffered solutions to mitigating factors affecting farmers' ability to understand and comply with pesticide safety standard practices in Ishiagu, Nigeria

Identified solutions
- Local and State government intervention in the provision of incentives/subsidies on farming inputs that include essential Personal Protective Equipment (PPE); - National policy regulation on the use of pesticides, including specific sanctions against the use and distribution of expired/banned pesticides; - Active Non-Governmental Organisations (NGOs) roles in relevant information dissemination about issues of pesticide toxicity and implications; - National Agricultural Research Institutes (NARIs) routine extension and campaign programmes on abuse, misuse and proper use of pesticides; - Awareness creation and encouragement of farmers to adopt safer alternative use of pesticidal plants that are more eco-friendly.

Source: Field Survey (2023)

CONCLUSION

In conclusion, rice growers in Ishiagu were not well-informed and equipped for proper use of agro-pesticides, which needs to be addressed. The necessity of understanding and adopting pesticide safety standard information on the product manual/label of such commodity is not just desirable, but a critical requirement for the farmers, consumers and environmental sustainability. Relevant government ministries/departments/agencies, Non-Governmental Organisations (NGOs), National Agricultural Research Institutes (NARIs), and Environmental Awareness pressure groups have vital roles to play in addressing the observed gaps in the farmers' knowledge and capacity to comply with safety standards in pesticide usage.

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