Assessment of Pesticide Handling Practices, Safety Awareness, and Management Behaviours among Grain Handlers in Dawanau Market, Kano State

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ARTICLE HISTORY
Received Date: 11th April, 2025
Accepted Date: 9th July, 2025

http: www.njphr.nspri.gov.ng
ISSN: 2630-7022

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CONFLICT OF INTEREST: None
ETHICAL APPROVAL: Not Applicable

This is a publication of the Nigerian Stored Products Research Institute (NSPRI)

OPEN ACCESS

Abstract

Pesticide misuse in Kano State poses a threat to both human health and agricultural trade. This is partly because grain handlers often lack training and overlook safer integrated pest management (IPM) practices. A purposive multi-stage sampling technique was employed to select 120 pesticide handlers across 12 market commodity lines, and the collected data were analysed using SPSS and Microsoft Excel. Findings reveal critical gaps in pesticide handling at Dawanau Market, Kano. Although 64.2% use protective gear and 61.7% follow dosage instructions, 57.5% rarely use manuals, and 51.7% mix solutions incorrectly. Limited access to personal protective equipment, illiteracy, and poor exposure response highlighted the need for improved training and stricter regulation. Despite this, nearly half lacked formal training in pesticide use, pointing to a significant training gap. Approximately 81.7% of pesticides used were purchased from licensed vendors and stored properly; however, some handlers still stored them within living spaces, posing health risks. Preliminary awareness of first-aid procedures was evident, whereas understanding of safety label signals demonstrated variability. To address these, tailored training programs, supportive policy measures, and greater engagement in professional organisations are essential. Implementing these measures will help protect the health of handlers and the environment, while also boosting the quality and marketability of agricultural produce from Dawanau Market, Kano State.

Keywords:
Attitude, Grain handlers, Manual, Pesticides, Regulation

Introduction

Pesticide use remains a cornerstone of agricultural productivity in Kano State, safeguarding crops against devastating pests. However, improper handling and over-reliance on pesticides pose significant health, environmental, and economic risks. Misuse not only endangers public health but also threatens compliance with international trade standards due to excessive pesticide residues in exports (Ratana et al., 2023). Despite the growing awareness of Integrated Pest Management (IPM) as a safer alternative (Adeola & Oluwole, 2022), many farmers and handlers continue to disregard essential safety protocols. A major factor contributing to this issue is the inconsistent use of instructional manuals, which are crucial for ensuring proper pesticide application and adherence to safety practices (Adebayo & Ojo, 2022).

Research has shown that inadequate training and limited access to safety information contribute to the improper use of pesticides, increasing health risks and environmental contamination (Lu et al., 2000; Bailey et al., 2015; Christos & Mohammad, 2016). Understanding how frequently and effectively pesticide handlers consult these manuals will provide insights into areas requiring intervention (Mequanint et al., 2019).

Alwang et al. (2019) highlight that, despite the availability of resources, the adoption of

How to cite:
Anugwom, U. D., Awotunde, D. R., Abubakar, A., Adamson, T. O., Bello, I. A., Ahmad, S., Olaleye, O. O., & Dayo, O. (2025). Assessment of Pesticide Handling Practices, Safety Awareness, and Management Behaviours among Grain Handlers in Dawanau Market, Kano State. *Nigerian Journal of Post-Harvest Research*, 3(6), 1-7

safe pesticide practices remains low due to insufficient training and awareness. This study aims to assess the socio-economic characteristics, professional experience, and safety practices of pesticide handlers in Dawanau International Grains Market, with emphasis on their pesticide acquisition, storage, preparation, application, and disposal behaviours. It was also stated that the study sought to identify knowledge gaps and training needs to inform safer and more effective pesticide management strategies. By uncovering critical gaps in pesticide safety, the research findings will inform policymakers on the need for targeted interventions such as training programs and regulatory reforms (Ratana et al., 2023; Soito & Amy, 2023). Establishing a stronger safety culture among grain handlers will not only protect public health but also enhance the sustainability of agricultural practices, ensuring long-term economic and environmental benefits (Mokgadi & Oladele, 2013; Akinmusola et al., 2016; Mwema & Sharp, 2016; Mustapha et al., 2017).

Materials and Methods

The study was conducted at the Dawanau International Grains Market, located in Dawakin Tofa Local Government Area, Kano State, Nigeria. Dawanau is recognised as one of the largest grain markets in West Africa, serving as a central hub for the aggregation, storage, and distribution of agricultural produce across northern Nigeria and neighbouring countries. The market is characterised by a high volume of postharvest grain transactions, widespread pesticide use, and diverse actors in the grain value chain, making it a relevant location for assessing pesticide handling practices.

The target population comprised individuals directly involved in the handling and management of stored grain commodities. For this study, grain handlers were defined as persons who apply, sell, or supervise the use of pesticides in stored grain management. These included pesticide dealers, commercial applicators, and large-scale private users, such as grain merchants and storage facility managers. Eligibility required at least one year of active involvement in pesticide use or supervision within the market.

A multi-stage purposive sampling technique was used. In the first stage, Dawanau Market was purposively selected due to its prominence in regional grain trade and its documented extensive use of pesticides. In the second stage, 12 major grain commodity lines (e.g., maize, sorghum, millet, cowpea, and groundnut) within the market were identified. From each line, 10 respondents were purposively selected based on their involvement in pesticide handling activities, yielding a total of 120 respondents. The sample frame consisted of identified pesticide users and handlers obtained through a preliminary mapping of traders and warehouses, conducted in collaboration with local market authorities.

Data were collected using a pre-tested, structured questionnaire administered through face-to-face interviews. They were coded and analysed using Microsoft Excel and SPSS statistical software (Version 25). Descriptive statistics such as frequencies, means, and percentages were used to summarise the data and describe trends among the respondents.

Results and Discussion

Socio-economic characteristics of respondents

The socio-economic profile of respondents reveals key trends in gender, age, marital status, household size, and education level (Figure 1). Notably, 97.5% of respondents were male, reflecting the labour-intensive nature of grain handling, which men in Kano State predominantly manage. This aligns with findings from Adeola & Akinnagbe (2022), who noted that physical demands often make pesticide tasks a male-dominated field.

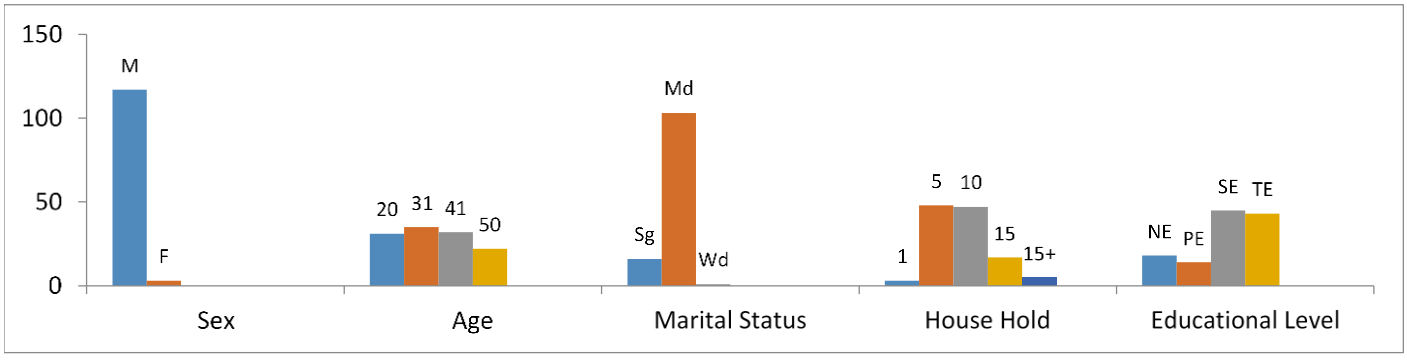

Figure 1: Socio-economic characteristics of respondents

Where M (Male), F (Female), Sg (Single), Md (Married), Wd (Widowed), 15+ (15 years and above), NE (No Formal Education), PE (Primary Education), SE (Secondary Education), and TE (Tertiary Education).

Most respondents were aged 31-40, a demographic capable of handling demanding work. Most were married (85.8%), reflecting societal norms, and household sizes ranged from 5 to 10 members. Education levels varied, with 35.8% having higher education and 37.5% having secondary education, suggesting that literacy may enhance comprehension of pesticide safety instructions, reinforcing the need for education in safe pesticide practices (Akinmusola et al., 2016).

Professional experience of respondents

The Professional Experience of Respondents (Figure 2) outlines the professional background of grain handlers, detailing their roles, association memberships, experience, training, pesticide types, and sources of purchase. A significant 34% were commercial applicators, while 30% also acted as dealers, emphasising their key role in pesticide management. However, only 45.8% of respondents were association members, limiting their access to critical industry information and policies, as was also emphasised by Soito & Jankowski (2023). Experience levels were low, with 58.3% having less than 10 years of experience, and only 48.3% received formal training, aligning with findings from Adeola & Akinnagbe (2022). Government involvement in pesticide training was notably low, highlighting the need for more decisive regulatory actions, as suggested by Sapbamrer et al. (2023). Most respondents (51.7%) handled liquid fumigants, raising concerns about pesticide residue risks.

Pesticide purchasing practices of respondents

Respondents' pesticide purchasing behaviours, presented in Figure 3, showed that 81.7% obtained pesticides from registered dealers, promoting the use of approved products. About 52.5% purchased in bulk, likely reflecting involvement in distribution or large-scale storage. Responsible practices were noted, with 70.8% checking for approved labels and 58.3% verifying registration numbers. However, only 63.3% checked manufacturing dates, while 81.7% confirmed expiry dates. These gaps indicate that although awareness exists, inconsistent attention to critical details may contribute to pesticide misuse. This underscores the need for sustained education and sensitisation campaigns, as emphasised by Akinmusola et al. (2016) and Adeola & Oluwole (2022).

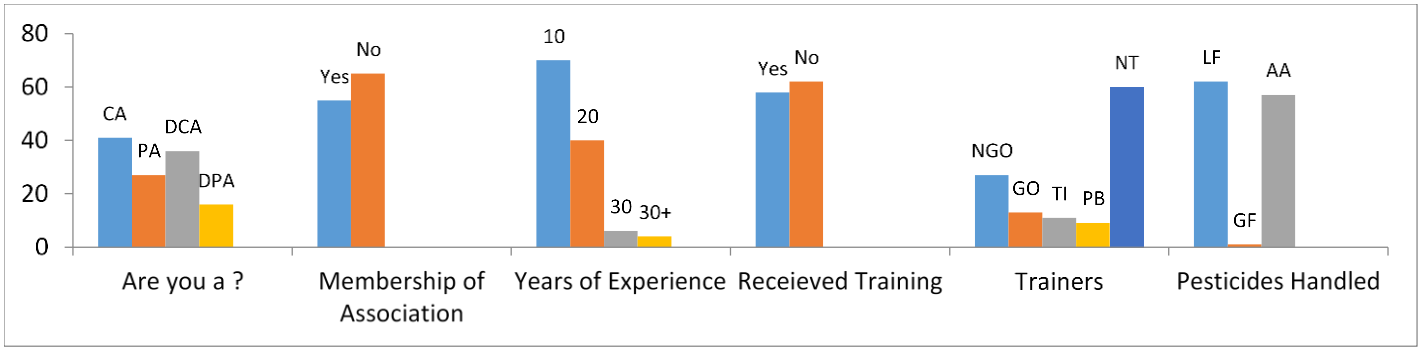

Figure 2: Professional experience of respondents

Where CA (Commercial Applicator), PA (Private Applicator), DCA (Dealer/Commercial Applicator), DPA (Dealer/Private Applicator), 30+ (30 years and above), NGO (Non-Governmental Organization), GO (Government Organization), TI (Tertiary Institution), PB (Professional Body), NT (No Training), LF (Liquid Fumigant), GF (Gas Fumigant) and AA (All of Above).

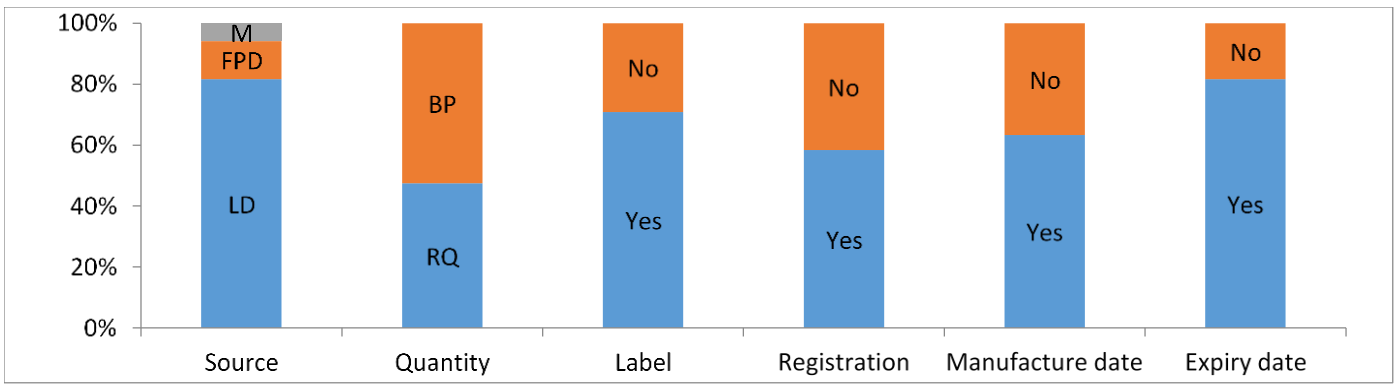

Figure 3: Pesticide Purchasing Practices of Respondents

Where LD (Licensed Dealer), FPD (Foot Path Dealer), M (Manufacturer), RQ (Required Quantity), BP (Bulk Purchase).

Storage of pesticides by respondents

As shown in Figure 4, respondents' pesticide storage practices, covering storage location, use of original containers, organisation, and warning signs, indicate that the majority (79.2%) store pesticides in designated areas outside their homes or in specialised storage facilities. Such practices, as noted by Lu et al. (2000) and Bailey et al. (2015), minimise risks to non-target populations, particularly children. However, a considerable minority (20.8%) still store pesticides within the household, a practice that Bailey et al. (2015) identified as heightening the risk of accidental exposure. Encouragingly, 88.3% reported storing pesticides in their original containers, which helps preserve labelling integrity and reduces the risk of accidental misuse. Nonetheless, 60.0% did not use warning signs in their storage areas, despite evidence that such signage is critical for hazard communication and risk prevention (Mequanint et al., 2019). These findings underscore the need to strengthen awareness and compliance with best practices, particularly the adoption of warning signs, to further reduce pesticide-related risks.

Respondent's practices while preparing pesticide mixtures

The assessment of grain and pesticide handlers' practices regarding personal protective equipment (PPE), adherence to instructional manuals, pesticide solution preparation, and responses to accidental exposure (Figure 5) reveals notable trends. A majority of respondents (64.2%) reported using protective gear, indicating awareness of and adherence to safety measures in pesticide handling. However, others did not, likely due to cost or limited access to PPE, as noted by Mwema & Sharp (2016). This gap underscores the need for improved access to affordable protective equipment to ensure comprehensive safety compliance.

Regarding instructional manuals, only 57.5% of respondents reported having read them, while 33.3% believed they were already familiar with pesticide use, and 35.8% were unable to read them. Christos & Mohammad (2016) emphasise the importance of tailored training to improve comprehension of label instructions. For pesticide solution preparation, 61.7% followed dosage guidelines; however, 51.7% perceived prescribed dosages as ineffective and adjusted the amounts accordingly. Such practices, also observed by Stimamiglio et al. (1998), reflect a broader tendency for handlers at Dawanau International Market to rely on personal judgment rather than label directions. Moreover, 25.8% of respondents did not understand prescription terms, and 18.3% could not read instructions, thereby increasing the risk of misuse and pesticide residues in food and the environment (Mwema & Sharp, 2016).

Most respondents (82.5%) reported avoiding eating, drinking, or smoking during pesticide handling, a practice consistent with Christos & Mohammad (2016) and important for minimising exposure. In cases of accidental exposure, 75% washed the affected area with water, 50.8% ingested palm oil, and 15% sought medical attention. Alarmingly, 22.5% induced vomiting, a practice that can exacerbate harm, as also highlighted by Mwema & Sharp (2016). Overall, these findings underscore the urgent need for enhanced education and training programs to promote safe pesticide handling practices.

Respondents' attitude during and after pesticide application

Pesticide handlers' practices during and after application are presented in Figure 6. The majority (74.2%) used knapsack sprayers, with 65.8% applying pesticides in the morning. Only 31.7% placed warning signs to prevent human exposure to treated grains, a practice that, according to Mustapha et al. (2017), increases potential exposure risks. Regarding equipment maintenance, 63.3% of respondents washed fumigation equipment with soap and water, while 38.3% reused pesticide containers. Disposal practices varied: 35.0% of containers were buried on-farm, 22.5% were discarded in dustbins, and 4.2% were smashed, all of which may result in environmental contamination (Mustapha et al., 2017). For leftover pesticides, 70.0% returned them to original containers, while 13.3% discarded them in fields or soil. Additionally, 70.0% reported re-spraying agricultural produce with leftover pesticide solutions, indicating risks of residue accumulation and contamination. These results suggest the need for improved training on safe pesticide handling, disposal, and storage practices (Mustapha et al., 2017).

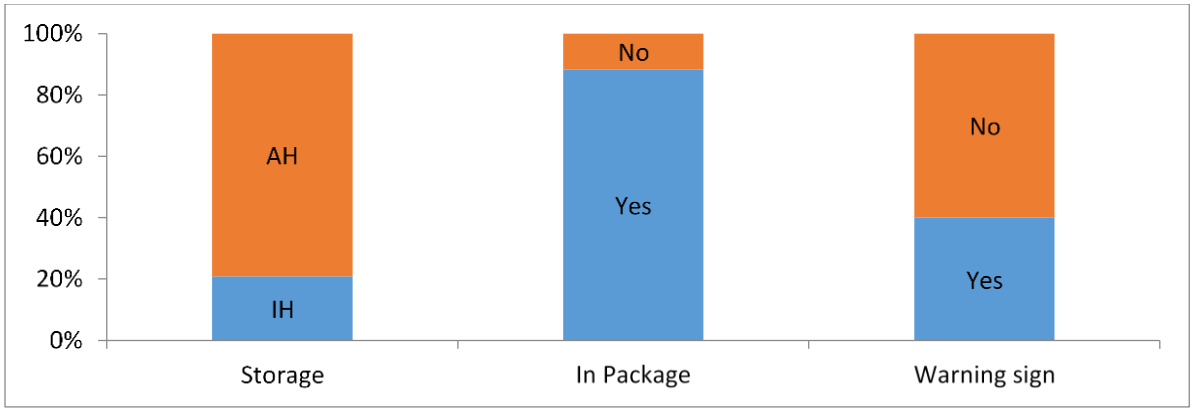

Figure 4: Respondents' attitudes during storage of pesticides

Where IH (In the House) and AH (Away from the House)

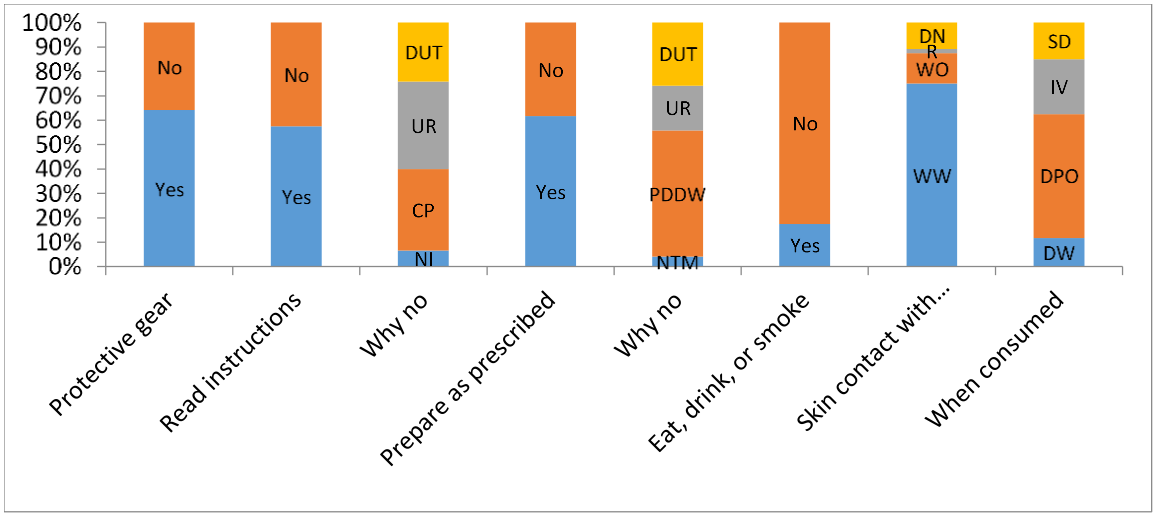

Figure 5: Respondents' attitudes while preparing pesticide mixtures

Where NI (Not Interested), CP (Conversant Product), UR (Unable to Read), DUT (Don't Understand Them), NTM (No Tool for Measurement), PDDW (Prescribed Dosages Don't Work), UR (Unable to Read), WW (Wash with Water), WO (Wipe it Off), R (Rest), DN (Do Nothing), DW (Drink Water), DPO (Drink Palm Oil), IV (Induce Vomiting) and SD (See a Doctor).

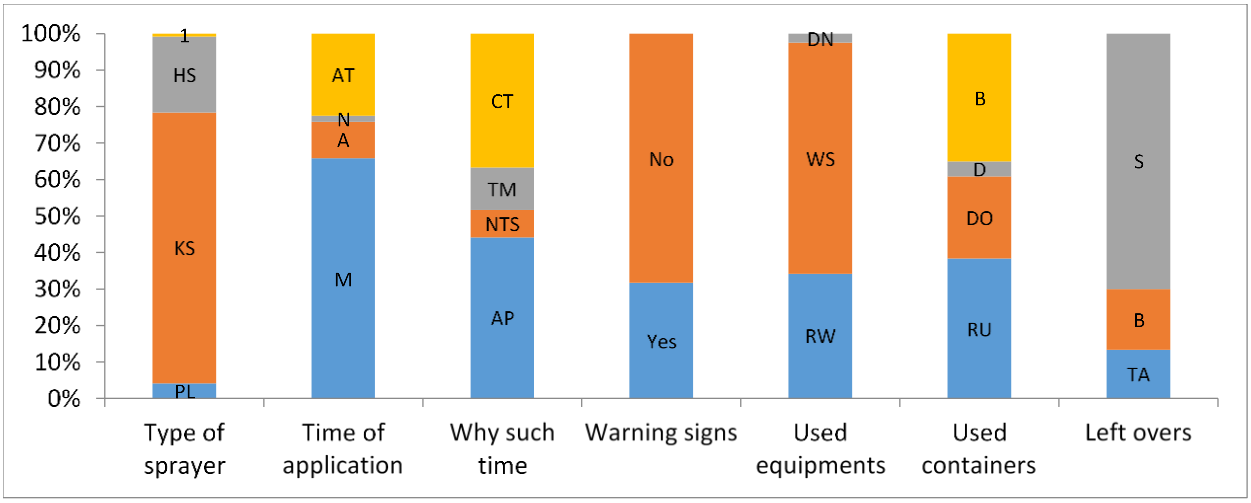

Figure 6: Respondents' attitudes during and after pesticide application

Where PL (Plant Leaves), KS (Knap-sack Sprayer), HS (Hand Sprayer), M (Morning), A (Afternoon), N (Night), AT (Any Time), AP (Availability of Pests), NTS (Non Target Species), TM (Traditional Method), CT (Convenient Time), RW (Rinse with Water) WS (Wash with Soap), DN (Do Nothing), RU (Reuse), DO (Dispose Off), D (Destroy Them), B (Bury Them), TA (Throw Away), S (Store).

Conclusion and Recommendation

This study revealed significant gaps in pesticide handling practices among grain handlers at Dawanau Market, Kano State. Although many respondents reported using protective gear and adhering to dosage instructions, compliance was notably lower regarding the reading of instructional manuals and the correct preparation of pesticide solutions. Contributing factors included limited access to protective equipment, low literacy levels, and inadequate response mechanisms to pesticide exposure. These limitations hinder safe handling practices and increase the risk of health and environmental hazards.

To address these challenges and promote safer pesticide use, targeted and continuous training for grain handlers is essential. Improving access to protective equipment, developing user-friendly instructional materials, and strengthening extension services will enhance knowledge and compliance among healthcare workers. Furthermore, stricter regulatory enforcement and greater adoption of Integrated Pest Management (IPM) practices will support sustainable postharvest grain management and reduce reliance on hazardous chemicals. Collectively, these actions will contribute to improved safety, productivity, and long-term sustainability within the grain value chain.

Acknowledgement

We gratefully acknowledge the management of NSPRI for endorsing this research under the 2023 Institute-Funded Project.

Funding Statement

This research was funded by the Nigerian Stored Products Research Institute, which covered the materials and operational costs essential to the study.

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