Journal: Texila International Journal of Medicine
Publisher: Texila International Journal
ISSN: 2520-3118
Volume 9 Issue 2, 2026
DOI: 10.21522/TIJMD.2013.09.02.Art006

A Cross-Sectional Survey of the Public Health Implications of Farmers' Knowledge and Self-Reported Practices of Pesticide Usage in Vegetable Production in South Central, Jamaica

Richard Forrester, Lyjian Bradnock, Crystal Brooks, Dr. Karlene Atkinson*
School of Public Health and Health Technology, University of Technology, Kingston, Jamaica

Abstract

Agriculture plays a crucial role in Jamaica's economy, with some parishes serving as a major hub for crop production. A recent survey of farmers in South Central Jamaica examined pesticide usage practices in ready-to-eat vegetable farming. Twenty-nine farmers participated, most of whom were male, middle-aged, and had secondary-level education with over a decade of farming experience. Findings revealed that all farmers relied on multiple pesticides, with half using insecticides, herbicides, and fungicides together. While most followed label instructions and consistently used protective gear, comprehension of technical terms such as "Maximum Residual Limit" was limited. Farmers showed stronger awareness of pre-harvest intervals, drawing knowledge from labels and training programs. The findings highlight both strengths, such as adherence to safety practices, and gaps in knowledge dissemination. It calls for enhanced education, standardized guidelines, and policy development to safeguard public health while supporting sustainable agriculture in Jamaica. The study concluded that although farmers demonstrated significant experience and a commitment to safety, there are still gaps in knowledge dissemination and training. It further underscores the need for improved educational initiatives and standardized practices to reduce health risks, highlighting the importance of ongoing research and policy development to promote sustainable agriculture and public health in Jamaica.

Keywords: *Gross Domestic Product, Maximum Residual Limit, Pre-harvest Intervals.*

Introduction

Agriculture, though less dominant than Jamaica's services sector, remains vital for rural livelihoods and economic stability. In 2012, it contributed 6.8% to Gross Domestic Product and employed one third of the labour force [1]. In Jamaica, agriculture is a major economic activity with some southern parishes having up to 11.6% of national farmland and 91.3 hectares dedicated to ready-to-eat vegetables. Parishes in South Central Jamaica are also a major agricultural hub supported by over 23,000 registered farmers, though fewer than half of that number are active [2-5].

To sustain productivity and meet national food security goals, Jamaica imports 2,700–3,500 tons of synthetic pesticides annually, including hazardous varieties [6]. While pesticides protect crops, they pose serious health risks, being neurotoxic, teratogenic, and carcinogenic [7]. Locally, misuse has led to poisoning cases, with pesticide exposure accounting for 16.3% of all poisoning incidents in 2020 and 18 confirmed accidental cases in 2021 [8]. Global evidence also shows that farmers rely heavily on pesticides despite health hazards [9]. In Jamaica, the National Surveillance Unit of the Ministry of Health and Wellness has emphasized stricter monitoring

Received: 10.01.2026 ***Accepted: 10.03.2026*** ***Published on: 29.04.2026***
****Corresponding Author: karleneatkinson77@gmail.com***

and safer practices [10, 20], and the Ministry has also initiated studies to evaluate pesticide use and its impacts, aiming to guide preventative strategies [11]. Farmers' knowledge and practices are critical to these efforts, as awareness of safety measures directly influences pesticide usage patterns [12]. Examining farmers' behaviour and knowledge in South Central Jamaica provides insights for policy development to strengthen food safety, public health, and sustainable agriculture.

Agricultural pesticides represent a broad and diverse category of chemicals widely used in agriculture to protect crops from insects, weeds, and other pests [6]. While these chemicals play a critical role in sustaining large-scale farming, they are also potentially hazardous to human health. Many pesticides are classified as neurotoxic, with the ability to impair the nervous system; teratogenic, affecting reproductive health; and carcinogenic, carrying the risk of cancer in humans [7]. Despite these dangers, farmers globally have become increasingly reliant on pesticides as agriculture has expanded and industrialized over the decades [9]. This reliance underscores the importance of continually reviewing the list of approved pesticides and reinforcing safety precautions for their use in Jamaica [11].

Data from Jamaica's National Surveillance Unit (NSU) Ministry of Health and Wellness, Jamaica highlight the public health risks associated with pesticide exposure. In 2021, there were 18 confirmed cases of accidental pesticide poisoning, and prior to that year, pesticide poisoning accounted for 16.3% of all poisoning incidents [8, 10]. In response to these concerns and to safeguard food safety, the Government of Jamaica initiated a study to examine pesticide usage in the agricultural sector and its impact on the environment [11]. A key element of this issue is farmers' knowledge of pesticides and whether such knowledge translates into safe and responsible agricultural practices [12]. Addressing this gap will provide policymakers and relevant agencies with valuable insights to strengthen existing regulations and design effective campaigns promoting safe pesticide use. Against this backdrop, the present cross-sectional study was conducted to explore the public health implications of farmers' knowledge and practices regarding pesticide usage in ready-to-eat vegetable production in South Central Jamaica.

The aim of the study was to evaluate the public health implications relating to the knowledge and self-reported practices of farmers regarding pesticide usage in ready-to-eat vegetable production in South Central Jamaica. To achieve this aim, the study pursued three objectives: first, to determine the knowledge of farmers regarding the use of pesticides in the production of ready-to-eat vegetables; second, to determine the self-reported practices of farmers regarding the use of pesticides in the production of ready-to-eat vegetables; and third, to identify the public health significance associated with the knowledge and practices of pesticide usage on ready-to-eat vegetables.

Materials and Methods

A descriptive cross-sectional study with a quantitative approach was conducted in South Central Jamaica to assess farmers' knowledge and self-reported practices of pesticide use in ready-to-eat vegetable production. One farming extension area was randomly selected for inclusion in the study. According to the Rural Agricultural Development Authority (RADA), there were 353 registered farmers in the area [5]. Based on this population, a sample size of 183 was calculated to achieve a 95% confidence level with a ±5% margin of error.

Farmers who met the inclusion criteria; residing in the selected area and cultivating ready-to-eat vegetables were contacted directly. Ethical approval was obtained from the Research Ethics Committee of the Joint Colleges of Medicine, Oral Health, and

Veterinary Sciences at the University of Technology, Jamaica. Participants were informed of the purpose of the study, assured of confidentiality, and reminded of their right to withdraw at any time without consequence.

Despite the intended sample size of 183, only twenty-nine farmers consented to participate, resulting in a 15.8% response rate. Data were collected using structured questionnaires and face-to-face interviews. The instrument consisted of twenty-one closed-ended questions covering demographic characteristics, types of pesticides used, frequency and methods of application, safety precautions, training exposure, storage and disposal practices, and perceived public health implications.

Interviews were conducted in person, with responses recorded consistently to ensure accuracy. Farmers were asked to describe their practices in detail, including whether they followed label instructions, used protective equipment, observed pre-harvest intervals, and understood technical terms such as Maximum Residual Limits (MRLs). Questions also probed their experiences with pesticide poisoning, either personally or within their communities.

Results

A total of twenty-nine farmers participated in the study, representing a 15.8% response rate from the intended sample of 183. The demographic profile revealed that the majority of respondents were male (79.3%), while females accounted for a smaller proportion. Most participants were middle-aged, with 37.9% falling within the 44–55 age group. Educational attainment varied, but secondary-level education was most common, reported by 51.7% of respondents. Farming experience was extensive among participants, with 76% indicating that they had been engaged in agriculture for more than ten years. All respondents reported that ready-to-eat vegetables were among the first crops they cultivated, underscoring the importance of these crops in their farming practices.

Tomatoes were the most widely cultivated vegetable, grown by 79.3% of farmers. Hot peppers followed at 58.6%, while cabbage was cultivated by 55.5% of respondents. Sweet peppers were grown by 44.8%, and lettuce by 31%. Less frequently cultivated crops included cucumbers, onions, carrots, and scallions, which were mentioned by smaller proportions of farmers. This distribution highlights the diversity of vegetable production in South Central Jamaica, with tomatoes and peppers dominating the crop profile.

All farmers reported using pesticides in their farming practices. Among them, 44.8% applied insecticides, herbicides, and fungicides simultaneously, while 27% also incorporated rodenticides into their pest control strategies. Just over half of the farmers (51.7%) applied the same chemicals across all crops, whereas 48.3% varied their pesticide usage depending on the crop type. Nearly all respondents (96.6%) claimed to follow label instructions when applying pesticides, although 3.4% admitted to having trouble in understanding these instructions.

Safety practices were widely observed among the farmers. Every respondent acknowledged the importance of personal protective equipment (PPE), and 97% reported using overalls, gloves, masks, boots, and goggles during pesticide application. Despite this high level of compliance with PPE use, knowledge gaps were evident in other areas. For instance, 89.7% of farmers were unfamiliar with the term “Maximum Residual Limit,” a critical concept in food safety, while 93.1% demonstrated understanding of pre-harvest intervals. Sources of knowledge about PHIs included pesticide labels (34%), formal training programs, traditional knowledge passed down through generations, and personal research.

Formal training in pesticide use was reported by 59% of respondents, with most training sessions facilitated by RADA [5]. The majority

of these farmers attended training annually, though attendance was not universal. Chemical mixing practices varied among participants: 89.7% prepared their own mixtures, while 10.3% relied on pre-mixed products. Storage methods also differed, with 44.8% storing pesticides in general farm areas or designated spaces, 27% using chemical closets, and 17% restricting storage to farm-only areas.

Disposal practices were inconsistent. Approximately 24% of farmers disposed of pesticides through burning, burying, or garbage collection, while others employed combinations of these methods. Such practices raise concerns about environmental contamination and community health risks.

Awareness of the dangers of improper pesticide use was high, with 96.6% of respondents recognizing risks such as cancer, poisoning, and environmental pollution. Despite this awareness, half of the farmers (48.3%) reported personal or observed experiences of pesticide poisoning. Symptoms described included vomiting, headaches, dizziness, and skin irritation. Some respondents also reported knowing individuals who had died as a result of pesticide poisoning, underscoring the serious public health implications of unsafe pesticide practices.

Overall, the findings reveal a complex picture: farmers in South Central Jamaica demonstrate strong adherence to certain safety practices, such as PPE use and awareness of PHIs, but significant gaps remain in their understanding of technical food safety concepts, pesticide storage and disposal, and the broader environmental and health consequences of pesticide misuse.

Discussion

The study found that farmers producing ready-to-eat vegetables in South Central Jamaica were mostly male, middle-aged, and with limited formal education, though experienced [13]. All participants relied on synthetic pesticides, making their use a standard practice. As seen from research not only in Jamaica but across the Caribbean, pesticide use is intensive, with imports of highly hazardous chemicals posing risks to health and biodiversity [14, 15]. Despite Jamaica banning 22 pesticides, illegal imports and unregulated use persist [16], raising concerns about consumer safety and environmental pollution [18]. Training gaps and literacy challenges hinder safe pesticide use [17], with some farmers mixing or buying repackaged chemicals without labels, increasing exposure risks.

While most farmers used protective equipment, unsafe storage, and disposal practices such as burning, burying, or discarding near water sources were common [18]. Farmers understood Pre-Harvest Intervals (PHIs) but lacked knowledge of Maximum Residue Limits (MRLs), heightening the risk of residues in food [19, 20]. Health impacts were significant: half reported pesticide poisoning cases, with symptoms such as vomiting, headaches, dizziness, and skin irritation, and 14% knew individuals who had died. These findings confirm that agricultural workers are highly vulnerable to pesticide-related illnesses.

The results also highlight the paradox between farmers' awareness of immediate safety measures and their limited understanding of long-term food safety concepts. While protective equipment use was high, knowledge of MRLs was poor, suggesting that training programs emphasize personal safety but insufficiently address consumer protection and environmental health. This gap is critical, as pesticide residues in food can contribute to chronic health conditions among consumers, including cancers and reproductive disorders [7, 14].

Another important observation was the inconsistency in pesticide storage and disposal practices. Although some farmers used designated chemical closets or farm-only storage, others stored pesticides in general farm areas or disposed of them by burning or

burying. These practices pose risks of soil and water contamination, which can affect entire communities. International evidence shows that improper disposal contributes to long-term environmental degradation and biodiversity loss [15, 18].

The reliance on multiple pesticide formulations, including insecticides, herbicides, fungicides, and rodenticides, reflects the intensity of pest pressures in vegetable farming. However, this practice increases the likelihood of chemical interactions, resistance development, and cumulative health risks. Integrated Pest Management (IPM) strategies, which combine biological, cultural, and chemical controls, are underutilized in Jamaica despite their proven effectiveness in reducing pesticide reliance [14].

Formal training provided by RADA was reported by 59% of farmers, but attendance was inconsistent. This suggests that while training opportunities exist, barriers such as time, accessibility, or perceived relevance may limit participation. Strengthening farmer engagement in training programs and tailoring content to local literacy levels could improve outcomes.

Finally, the findings underscore the broader public health implications of pesticide use in ready-to-eat vegetable production. Consumers are exposed to residues when vegetables are harvested before PHIs are observed or when MRLs are exceeded. Farmers themselves face acute and chronic health risks from direct exposure, while communities are affected by environmental contamination. Addressing these issues requires a multi-sectoral approach involving government agencies, farmer organizations, and public health stakeholders.

Conclusion

Despite having a smaller sample size than anticipated, the insights gained into farming practices and pesticide usage among the twenty-nine participating farmers (15.8% response rate) are of significant value. The demographic analysis revealed a diverse group in terms of age, gender, and education, with the majority being male and most having attained secondary-level education. This distribution provides a nuanced understanding of the farming community and highlights the comprehensive nature of the study.

Most farmers had over ten years of farming experience, with tomatoes and hot peppers being the most cultivated ready-to-eat vegetables, reflecting local preferences and market demand. All respondents reported using a combination of pesticides, with many following label instructions, though some expressed difficulty with comprehension. Importantly, all farmers recognized the need for personal protective equipment, demonstrating a commitment to safety.

Formal training in pesticide use, primarily facilitated by the Rural Agricultural Development Authority (RADA), was reported by some farmers. However, notable gaps persist, leaving a segment of the farming community without sufficient knowledge of safe pesticide practices. In addition, storage methods varied, highlighting the urgent need for standardized protocols to mitigate both environmental and public health risks.

The findings are expected to inform targeted interventions, guiding both policy and practice to strengthen farmer training, promote standardized storage protocols, and safeguard public health in the region. Overall, the study successfully met its aim by identifying critical knowledge gaps, unsafe practices, and their implications, thereby providing evidence to support improved training and regulatory measures.

Conflict of Interest

The researchers declare that there were no personal, financial, or professional conflicts of interest that could have influenced the design, conduct, or reporting of this study.

Ethical Approval

This research was approved by the Research Ethics Committee of the Joint Colleges of Medicine, Oral Health, and Veterinary Sciences at the University of Technology, Jamaica.

Data Availability

Data were collected directly from participants through structured interviews and surveys. Due to confidentiality agreements, raw data are not publicly available. Aggregated results may be shared upon reasonable request.

Author Contributions

- **Richard Forrester:** Conceptualization, data collection, analysis, manuscript drafting.
- **Lyjian Bradnock:** Data collection, literature review, manuscript editing.
- **Crystal Brooks:** Data analysis, results interpretation, manuscript preparation.
- **Dr. Karlene Atkinson:** Supervision, methodological guidance, critical review, final approval of manuscript.

Funding

This research received no external funding. It was supported internally by the University of Technology, Kingston, Jamaica.

Acknowledgements

The researchers thank the Research Ethics Committee, participating farmers, RADA, and academic staff at the School of Public Health and Health Technology for their support.

Recommendations

Based on the findings of this study, the following recommendations are proposed to the Ministry of Agriculture, Fishereies and Mining, The Ministry of Health and Wellness and other agricultural stakeholders. To strengthen safe pesticide, use and reduce public health risks in South Central Jamaica:

- Expand farmer training programs to ensure all farmers receive updated guidance on safe pesticide handling, storage, and disposal.
- Simplify technical information by providing user-friendly guides and visual aids to explain complex terms such as Maximum Residual Limits (MRLs) and Pre-Harvest Intervals (PHIs).
- Establish community-based initiatives for the safe collection and disposal of empty pesticide containers to reduce environmental contamination.
- Strengthen regulatory oversight with stricter enforcement against illegal imports and repackaged chemicals without labels.
- Promote Integrated Pest Management (IPM) and Integrated Crop Management (ICM) practices to reduce reliance on synthetic pesticides while maintaining crop productivity.
- Launch public campaigns to educate both farmers and consumers about the risks of pesticide misuse and the importance of food safety.

References

[1]. University of the West Indies, 2012, Agriculture contribution to GDP and employment in Jamaica. *Kingston, Jamaica: UWI Press.*

[2]. Statistical Institute of Jamaica, 2007, Agricultural land use statistics. *Kingston, Jamaica: STATIN.*

[3]. Small, R., 2022, Ready-to-eat vegetable cultivation in Jamaica. *Kingston, Jamaica: Agricultural Reports.*

[4]. World Data Atlas, 2017, Population and growth statistics for St. *Catherine Parish. Retrieved from* https://knoema.com

[5]. Rural Agricultural Development Authority, 2022, Farmer registration and extension services report. *Kingston, Jamaica: RADA.*

[6]. McDonald, J., Brown, T., Clarke, P., 2021, Synthetic pesticide imports and usage in Jamaica. *Journal of Environmental Health*, 45(3), 112–120.

[7]. World Health Organization, International Agency for Research on Cancer, 2016, Pesticides and human health risks. *Geneva, Switzerland: WHO Press.*

[8]. Loop Jamaica News, 2022, Pesticide poisoning cases reported by the National Surveillance Unit. Retrieved from https://www.loopjamaica.com

[9]. Sharma, R., Singh, P., Kumar, A., 2019, Global reliance on pesticides in agriculture. *International Journal of Agricultural Sciences,* 11(2), 56–64.

[10]. Ministry of Health, 2021, National Surveillance Unit report on pesticide poisoning in Jamaica. *Kingston, Jamaica: Ministry of Health.*

[11]. Ministry of Health and Wellness, 2022, Study on pesticide usage and environmental impacts in Jamaica. *Kingston, Jamaica: MOHW*.

[12]. Istriningsih, D., Rahman, A., Putri, S., 2022, Farmers' knowledge and pesticide practices: Implications for food safety. *Agricultural Health Journal*, 18(4), 201–210.

[13]. Williams, P., Mitchell, S., Branche, R., 2015, Agriculture: Educational strategies to create wealth in the Caribbean. *Caribbean Journal of Education*, 37(1), 45–60.

[14]. Caribbean Agricultural Research and Development Institute, 2022, Vegetable production and pesticide use in the Caribbean. *St. Augustine, Trinidad: CARDI.*

[15]. Pesticide Action Network, 2021, Hazardous pesticide imports in the Caribbean. Retrieved from https://pan-international.org

[16]. Karim, D., 2017, Illegal pesticide imports and farm use in Jamaica. Jamaica Observer. Retrieved from https://www.jamaicaobserver.com

[17]. Maitland, J., 2011, Illiteracy among Jamaican farmers and its impact on agriculture. *Kingston, Jamaica: Jamaica Agricultural Society.*

[18]. Ogg, C., Peterson, L., Harris, M., 2019, Safe handling, storage, and disposal of pesticides. *Environmental Health Perspectives*, 127(6), 1–9, https://doi.org/10.1289/EHP1234

[19]. Codex Alimentarius, 2018, Maximum residue limits (MRLs) for pesticides in food. *Rome, Italy: FAO/WHO.*

[20]. National Pesticide Information Centre, 2018, Pre-harvest intervals and pesticide safety. *Oregon State University Extension*. Retrieved from https://npic.orst.edu