

## VIEWPOINT

# From hazard to hope: Congolese women farmers' perspectives on reducing pesticide use in vegetable production

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## Introduction

In the Democratic Republic of the Congo (DRC), women play a central role in the market gardening sector, actively participating in crop production, pest management, and vegetable marketing (Balasha & Nkulu, 2020; Food and Agriculture Organization of the United Nations [FAO], 2010; Suka & Alenda-Demoutiez, 2022; Tambwe et al., 2011). Despite the socioeconomic benefits of market gardening as a source of income and food, women engaged in this sector are routinely

exposed to highly hazardous pesticides, whether as part-time laborers or independent producers on their own fields. As observed in other developing countries, Olirk et al. (2025) report that women farmers store and apply pesticides often with limited training on safe handling and without proper protective equipment. This pattern is similar in many low-income countries, such as the DRC, where exposure to pesticides poses serious risks to both farmers' health and the environment (Balasha & Nsele, 2019; Bollmohr, 2023; Eddleston, 2024).


While strict public policies can help to phase out or remove highly hazardous pesticides from


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the market, balancing environmental protection with agricultural productivity also requires farmers to transition to alternative products. However, in the absence or limited adoption of alternatives such as biopesticides, farmers continue to rely on chemical pesticides to control pest pressure on crops, making their use appear to be a necessary evil. Tudi et al. (2021) estimate that, without pesticides, fruit production would decline by 78% and vegetable production by 54%. Although pesticides play an important role in protecting crops and reducing harvest losses, their associated health and environmental risks remind us of the urgent need to promote alternative pest control methods. Assessing market gardeners' willingness to reduce pesticide use is therefore essential, as it provides key information for nongovernmental organizations and government bodies to develop and implement effective integrated pest management strategies.

Drawing on recent interviews with farmers, visits to agricultural shops, and previous studies on pesticide use in the DRC (see Balasha et al., 2023; Balasha & Nsele, 2019; Minengu et al., 2021), as well as data from the EU Pesticides Database and FAO reports, this viewpoint analyzes trends in pesticide use, identifies banned substances that remain in circulation in the DRC, and explores women farmers' perspectives on reducing pesticide use in market gardening. It contributes to ongoing debates on the use of chemical pesticides in agriculture and the associated risks to farmers, consumers, and the environment. It also sheds light on the sources of information used by women farmers to access pest control information, to help improve communication channels and strengthen extension services. Moreover, it provides valuable insights to help policymakers and agricultural stakeholders

phase out highly hazardous pesticides and promote safer, more sustainable alternatives.

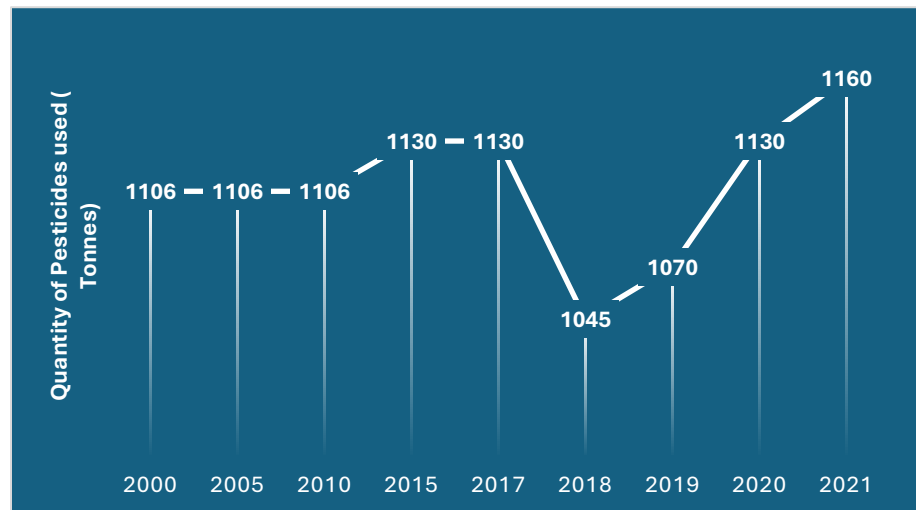
### Pesticide Use Trend in the Democratic Republic of the Congo

In the DRC, pesticide use has slightly increased over the past decade, as illustrated in Figure 1 by the FAO (2023). The quantity of pesticides used has increased from 1,130 tons in 2015 to 1,160 tons in 2021. However, these FAO data may be limited due to the informality of the agricultural input market; for example, Minengu et al. (2021) reported that there is no clear information on the licensed agrochemical suppliers approved to import and distribute pesticides in the DRC. We do not discuss herbicides here, as vegetable producers primarily use insecticides and fungicides, as shown in Table 1.

### Pesticides Sold and Used by DRC Farmers

Drawing on studies by Balasha & Nsele (2019) and Minengu et al. (2021), as well as recent visits to agricultural input shops in Lubumbashi, Idjwi, Likasi, and Bukavu, we compiled a list of pesticides currently used in the DRC, as presented in Table 1. Among the 15 insecticides identified, only five remain authorized under European Union phytosanitary regulations, which we referred to in this study due to the absence of equivalent stand-

**Figure 1. National Trend in Pesticide Use in the Democratic Republic of Congo**



Source: Designed by the authors using data from the World Food and Agriculture (FAO, 2023).

ards in the DRC. This suggests that about 67% of the insecticides identified in markets are no longer approved. This corroborates a study by Bollmohr (2023), showing that many pesticides in Africa are obsolete and even prohibited in other parts of the world, effectively making the continent a dumping ground for dangerous pesticides. As shown in Table 1, the authorized insecticides include cypermethrin, lambda-cyhalothrin, and deltamethrin. The other 10—including dichlorvos, profenofos, and chlorpyrifos—are no longer approved, yet they remain widely available under various trade names and continue to be used in vegetable production in the DRC. For example,

dichlorvos is marketed under diverse trade names such as *Lava*, *Doom*, and *Roach*. For fungicides, mancozeb and hexaconazole, which are widely used in tomato protection, have also recently been banned, yet they remain available in agricultural supply shops. Azoxystrobin, difenoconazole, and copper oxychloride are still authorized for use.

Although we refer to European Union regulations, not all pesticides come from Europe. In fact, many of the products sold in the surveyed shops originate from India and China. The sources of information on pesticides used by women farmers are presented in Table 2.

**Table 1. Pesticides Commonly Available on the Market and Used by Farmers in the DRC**

**Class Ib:** Highly hazardous; **Class II:** Moderately hazardous, **Class III:** Slightly hazardous, **U:** Unlikely to present acute hazard in normal use

No.	Active Substance	WHO Class 2025)	EU Status (June	EU Regulation Reference
<b>Insecticides</b>				
01	Cypermethrin 5%	II	Approved	<a href="#">EU Pesticides Database</a>
02	Deltamethrin 25 g/L	II	Approved	<a href="#">EU Implementing Regulation 540/2011</a> , amended by <a href="#">Regulation (EU) 2024/1342</a>
03	Lambda-cyhalothrin 15 g/l	II	Approved	<a href="#">Implementing Regulation 540/2011</a> , amended by <a href="#">Implementing Regulation 2016/146</a> and <a href="#">Implementing Regulation 2023/114</a>
04	Abamectin 20 g/L	II	Approved	<a href="http://data.europa.eu/eli/reg_impl/2023/515/oj">http://data.europa.eu/eli/reg_impl/2023/515/oj</a>
05	Imidacloprid 30 g/l	II	Approved	<a href="http://data.europa.eu/eli/reg_impl/2018/783/oj">http://data.europa.eu/eli/reg_impl/2018/783/oj</a>
06	Profenofos 40%	II	Not approved	<a href="#">Delegated Regulation (EU) 2024/3199</a>
08	Dichlorvos	Ib	Not approved	<a href="#">EU Parliament Study 2018</a>
09	Endosulfan 400 g/L	II	Banned	<a href="#">EU Regulation 2011/310</a>
10	Chlorpyrifos-ethyl 480 g/L	II	Not approved	<a href="#">EU Pesticides Database</a>
11	Dimethoate 400 g/L	II	Not approved	<a href="#">EU Implementing Regulation 2019/1090</a>
12	Pirimiphos-methyl 500 g/L	II	Not approved	<a href="#">FreshPlaza Article</a>
13	Fipronil 200 g/L	II	Not approved	<a href="#">EU Pesticides Database</a>
14	Chlorpyrifos	II	Not approved	<a href="#">EU Pesticides Database</a>
15	D-trans-tetramethrin 30 g/L	II	Banned	<a href="#">EPA New Zealand Report</a>
<b>Fungicides</b>				
16	Hexaconazole 50 g/L	III	Not approved	<a href="#">EU Decision 2006/797</a>
17	Mancozeb 80%	U	Not approved	<a href="#">EU Regulation 2020/2087</a>
18	Metalaxyl* 4% + Mancozeb 64%	II, U	Not approved	<a href="https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R2087">https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R2087</a>
19	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	III	Approved	Regulation (EC) No 1107/2009; extended until 31 May 2027
20	Sulfur 80% WG	III	Approved	EU Regulation 2023/2592 <a href="#">agrinfo</a>

### Sources of Information and Pesticide Use Practices among Vegetable Farmers

In the DRC, farmers get information about pesticides mainly from agricultural input sellers (41%) and fellow farmers (34%), who often have limited knowledge of these products themselves. Only 2% of women reported obtaining their information from the radio or online platforms such as YouTube and social media. The low rate of media use can be explained by the limited presence of agricultural programs on local radio, low digital literacy, and limited access to the internet, which remains a major challenge in the DRC. Farmers' organizations also play a crucial role in facilitating the exchange of experiences on pest management products among farmers. As shown in Table 2, 15% of women reported receiving and sharing information on pesticides and pest management practices with other members of their organizations.

Approximately 8% of women farmers received their information from agronomists and extension workers, and the women farmers considered them a credible and reliable source of agricultural information. As reported in other studies in the DRC, very few farmers who had the opportunity to receive support from agronomists during agricultural projects conducted by nongovernmental organizations—particularly those related to fertilizer use or crop protection—reported being satisfied with the information they received (Balasha et al., 2024). This is because direct interactions with agronomists provide more in-depth and technical information about new technologies, which likely increases awareness and farmers' ability to try the technology (Lambrecht et al., 2014).

However, the lack of reliable information and proper guidance has perpetuated poor pesticide use practices that expose farmers to increased risks and undermine the effectiveness of phytosanitary treatments (Figure 2).

During our field visits, the women farmers we observed spraying pesticides did not wear any protective equipment, leaving them vulnerable to pesticide hazard. One woman explained, "I don't have gloves or proper protective clothing, and pesticide retailers don't provide any in their shops. I

only wear a medical mask, but by the end of spraying, my skin, nostrils, and eyes feel irritated, my throat itches, and I can still taste the product in my mouth for long." Women farmers also reported often mixing two pesticides in the hope of increasing effectiveness, which frequently leads to overdosing, as farmers buy pesticides based on brand names rather than active ingredients. For example, one farmer described mixing Judo with Karate to knock out pests, yet both contain the same active ingredient: lambda-cyhalothrin.

Many woman farmers cannot afford a proper sprayer, so they often used buckets and water cans to apply pesticides. As shown in Figure 2, a woman who used a long stick with leaves to apply a pesticide mixture from a basin reported doing so out of desperation: "Look at me well, If I were using a sprayer, I wouldn't get wet. I waste a lot of mixture by using branches and broom. I am afraid that the Thiodan I use to kill pests could make me sick. The sprayer is too expensive; I cannot afford it alone." Minimizing pesticide-related risks depends on farmers' willingness to reduce pesticide use, use personal protective equipment, and adopt alternative methods (Figure 3).

### Women Farmers' Perspectives on Reducing Pesticide Use in Vegetable Production

The case illustrated in Figure 4 focuses on urban women farmers in Lubumbashi. Faced with a lack of protective equipment, the presence of highly toxic pesticides on the market, and limited access to reliable information, 47% of women farmers expressed a willingness to reduce pesticide use. Many of the women we interviewed said they are willing to pay for an alternative to chemical pesticides; as one of them stated,

**Table 2. Sources of Information on Pesticides Among Women Farmers in the Region of Lubumbashi, DRC**

Sources of information	Frequency	Percent	Rank
Agricultural input retailers	102	41	1
Peer farmers	85	34	2
Farmers' organizations	38	15	3
Agronomists/extensionists	19	8	4
Media (radio, YouTube)	6	2	5

My farm is too small, and I am thinking of transitioning to organic farming because pesticide is a poison [It can kill anything]. I often think of stopping using pesticides because there is a growing demand for organic products among my clients. I am willing to spend between 8000 and 14 000 CDF (Congolese Francs) [ $\sim$  3 to 5 US\$ in June, 2025] to buy any natural pest control product, if it is effective.

Understanding farmers' willingness to pay for biopesticides is essential because it determines whether the product is economically viable and

widely adoptable. For researchers developing biopesticides and the small enterprises producing them, this information also guides pricing, production planning, investment decisions, and their overall capacity to compete and grow in the crop protection products market.

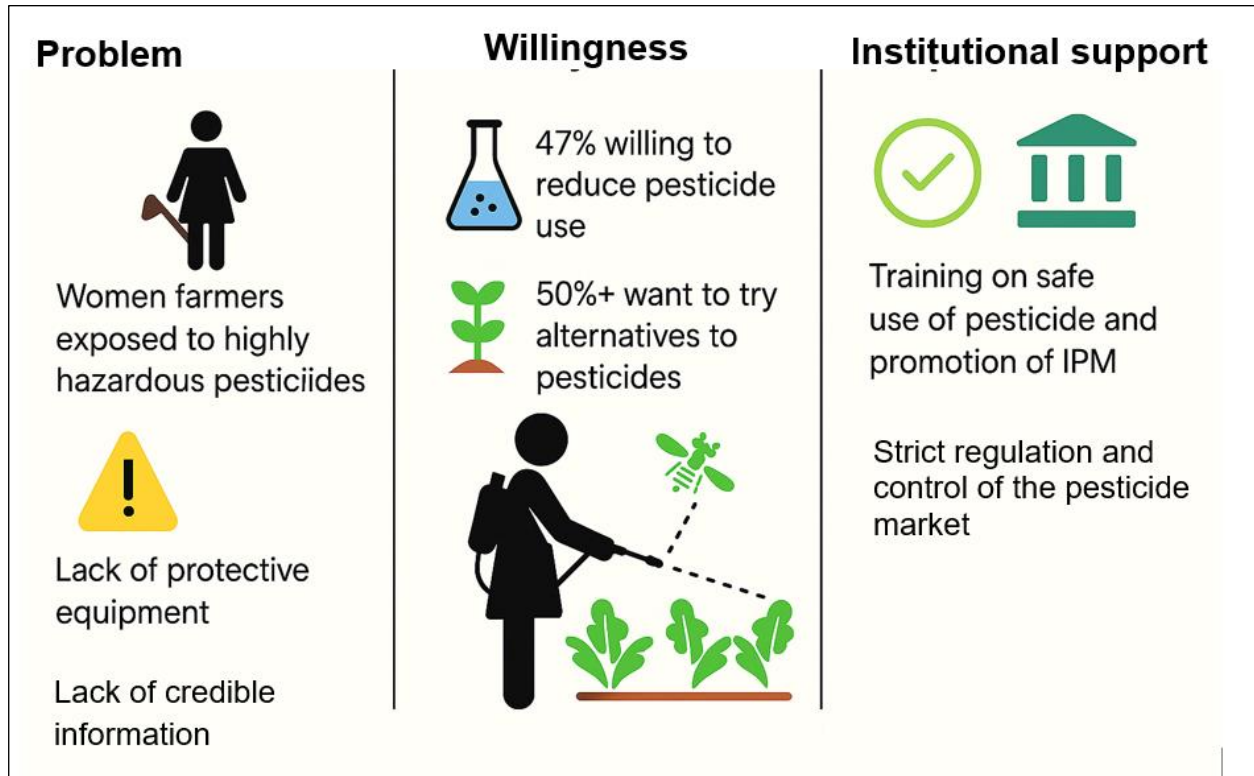
More than 50% reported wanting to try alternative products, such as biopesticides, neem, chili peppers or crop associations, to decrease their reliance on chemical pesticides. These products and practices have been promoted by the FAO under the Integrated Production and Protection techniques for sustainable vegetable production in Congolese cities because they promote on-farm

**Figure 2. Pest Pressure on Chinese Cabbage, a Typical Agricultural Shop, and an Example of Unsafe Pesticide Use Practices**

(a) Chinese cabbage leaves defoliated by pests in Lubumbashi; (b) a woman purchasing pesticides in an agricultural shop in Likasi; (c) a broom and basin used for spraying pesticides on squash crops in marshlands around Bukavu; (d) Lava (dichlorvos), an insecticide widely used in vegetable farms in Lubumbashi; (e) a fungicide made in China used for tomato protection; (f) a woman applying fungicide on ripe, harvested tomatoes without using protection in Bukavu



**Figure 3. Women’s Perspectives on Reducing Pesticide Use in Vegetable Production in Lubumbashi**



biodiversity, reduce dependence on chemical inputs, and enable producers to harvest higher-quality nutritional products (Balasha & Nkulu, 2020; Brunelle et al., 2024; FAO, 2010).

Beyond environmental considerations and the goal of reducing health risks to farmers, there is also a growing motivation among farmers to tap into the market for organic products, which offer attractive prices for vegetable producers. The transition to agriculture with substantially reduced pesticide use requires both public and private investments in affordable biopesticide production and support for farmers in implementing integrated pest management strategies. Such support ideally would be delivered through farmers’ field schools, where observation, training, and experience-sharing among farmers, agronomists and facilitators can foster sustainable and collective changes. Meanwhile, the involvement of relevant authorities in implementing strict policies is crucial for regulating the pesticide market, rather than blaming farmers for the health and ecological crises associated with pesticide misuse (Utyasheva et al., 2024).

### Conclusion and Way Forward

Vegetable production often involves intense phytosanitary treatments, which expose women farmers to highly hazardous pesticides. Women’s vulnerability to these products arises from multiple factors, including the lack of protective equipment and training, the use of inappropriate tools, limited knowledge of the products, and the inherent high toxicity of the pesticides employed. The good news is that women’s growing awareness of pesticide risks and the trending market for organic produce are driving increased interest in safer and alternative practices. Farmers cannot tackle this challenge alone, however, as breaking the cycle of hazardous pesticide use requires coordinated, multilevel action, including regulatory reform, stricter oversight of the pesticide market, and inclusive training through farmers’ field schools to promote alternative pest management methods. Women vegetable farmers are sending a strong signal that they are not just victims of pesticides but are also key agents of change, actively driving the transition toward safer and more sustainable agriculture.

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## Data Availability Statement

Pesticide data used in this viewpoint are available at <https://doi.org/10.4060/cc8166en> and at the links provided in Table 1. Interview data are available upon request.

## References

- Balasha, A. M., Dominique, A. M., Sage, W. M., Shadya, S. M., & Mugisho, J. Z. (2023). Pesticide choice and use patterns among vegetable farmers on Idjwi Island, Eastern Democratic Republic of Congo, *SAGE Open*, 13(4). <https://doi.org/10.1177/21582440231218099>
- Balasha, A. M. & Nkulu, J. N. M. (2020). Déterminants d'adoption des techniques de production et protection intégrées pour un maraîchage durable à Lubumbashi, République démocratique du Congo [Determinants of adoption of integrated production and protection techniques for sustainable market gardening in Lubumbashi, Democratic Republic of Congo], *Cashier Agriculture*, 29(Article 13). <https://doi.org/10.1051/cagri/2020012>
- Balasha, A. M. & Nsele, M. K. (2019). Pesticide use practices by Chinese cabbage growers in suburban environment of Lubumbashi: Main pests, costs and risks. *Journal of Applied Agricultural Economics and Policy Analysis*, 2(1), 56–64. <https://pubs.sciepub.com/jaaepa/2/1/8/>
- Balasha, A. M., Nyumbaiza, A. Kalumbu, J. T. & Nkulu, J. (2024). Women farmers' access to agricultural information in southeastern Democratic Republic of Congo: Challenges and opportunities. <https://doi.org/10.2139/ssrn.4687235>
- Bollmohr, S. (2023). *Toxic business: Highly hazardous pesticides in Kenya*. Route to Food Initiative. Retrieved from Heinrich Böll Foundation website: [https://ke.boell.org/sites/default/files/2023-09/data-and-facts\\_highly-hazardous-pesticides-in-kenya-1.pdf](https://ke.boell.org/sites/default/files/2023-09/data-and-facts_highly-hazardous-pesticides-in-kenya-1.pdf)
- Brunelle, T., Chakir, R., Carpentier, A., Dorin, B., Goll, D., Guilpart, N., Maggi, F., Makowski, D., Nesme, T., Roosen, J., & Tang, F. H. M. (2024). Reducing chemical inputs in agriculture requires a system change. *Communications Earth & Environment*, 5, Article 369. <https://doi.org/10.1038/s43247-024-01533-1>
- Eddleston, M. (2024). Poisoning by pesticides. *Medicine*, 52(6), 390–393. <https://doi.org/10.1016/j.mpmed.2024.03.011>
- Food and Agriculture Organization of the United Nations [FAO]. (2010). Growing greener cities in the Democratic Republic of the Congo. <https://www.fao.org/3/i1901e/i1901e00>
- Food and Agriculture Organization (2023). *World food and agriculture—Statistical yearbook 2023*. . <https://doi.org/10.4060/cc8166en>
- Lambrecht, I., Vanlauwe, B., Merckx, R., & Maertens, M. (2014). Understanding the Process of Agricultural Technology Adoption: Mineral Fertilizer in Eastern DR Congo. *World Development*, 59, 132-146. <https://doi.org/10.1016/j.worlddev.2014.01.024>
- Minengu, J. D., Pangu, S., Meta, V. M., Mbumba bandi, M. (2021). Système de contrôle et de distribution des intrants chimiques (pesticides et engrais) en République démocratique du Congo [Control and distribution system for chemical inputs (pesticides and fertilizers) in the Democratic Republic of Congo]. *Revue Africaine d'Environnement et d'Agriculture, Special 2*, 2–13. <http://www.rafea-congo.com/?pages=article&id=132>
- Olirok, B., Mamuya, S., Mosha, I., Moen, B. E., & Ngowi, A. (2025). Occupational pesticide exposure risks and gendered experiences among women in horticultural farms in Northern Tanzania. *International Journal of Environmental Research and Public Health*, 22(10), Article 1529. <https://doi.org/10.3390/ijerph22101529>
- Suka, D. C. & Alenda-Demoutiez, J. (2022). Being vulnerable in a vulnerable activity: Women market gardeners of Kinshasa. *Canadian Journal of Development Studies / Revue canadienne d'études du développement*, 43(4), 593–610. <https://doi.org/10.1080/02255189.2022.2087055>
- Tambwe, N., Rudolph, M., & Greenstein R. (2011). 'Instead of begging, I farm to feed my children': Urban agriculture—An alternative to copper and cobalt in Lubumbashi. *Africa*, 81(3), 391–412. <https://doi.org/10.1017/S000197201100043X>

- Tudi, M., Ruan, H. D., Wang, L., Lyu, J., Sadler, R., Connell, D., Chu, C., Phung, D. T. (2021). Agriculture development, pesticide application and its impact on the environment. *International Journal of Environmental Research and Public Health*, 18(3), Article 1112. <https://doi.org/10.3390/ijerph18031112>
- Utyasheva, L., Rother, H. A., London, L., & Eddleston, M. (2024). Stop blaming the farmer: Dispelling the myths of ‘misuse’ and ‘safe’ use of pesticides to protect health and human rights. *Journal of Human Rights*, 23(3), 231–252. <https://doi.org/10.1080/14754835.2024.2334802>