



Rethinking Farmer Information Pathways for Safe Herbicide Use in Kenya

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SUMMARY

The global agricultural sector faces a triple challenge: ensuring food security, supporting rural livelihoods, and achieving environmental sustainability. This challenge is particularly acute in Africa, where rapid population growth, climate vulnerability, and resource constraints demand urgent yet sustainable agricultural intensification. Effective weed management, especially through herbicide use, is central to this effort. This study highlights the rising importance of herbicides in Kenya's maize, wheat, and rice systems, with glyphosate accounting for 45% of herbicide products sold in 2022. Glyphosate is especially critical in wheat production, where farmers report its absence would make cultivation economically unviable. In maize and rice, it contributes to labour savings, cost reductions, and supports conservation agriculture practices. Despite these benefits, challenges persist: weakened public extension services, inconsistent safety and disposal practices, and limited access to unbiased agronomic guidance. Farmers rely heavily on agro-dealers and private agronomists, who may not always provide guidance that is tailored to local conditions or aligned with best agronomic practices. To address these gaps, the study recommends revitalising extension services, promoting integrated weed management, enhancing farmer training, improving access to reliable information, supporting safe disposal initiatives, and investing in low-toxicity alternatives. These actions will enable Kenya to harness the benefits of herbicides while safeguarding human health and the environment, advancing toward a more resilient and sustainable agricultural future.

Introduction

The global agricultural sector faces a triple challenge: ensuring food security and nutrition for a growing population, supporting the livelihoods of millions in the food supply chain, and achieving environmental sustainability. This challenge is particularly acute in Africa, where rapid population growth, climate vulnerability, and resource constraints place immense pressure on agricultural systems. Addressing these interconnected challenges requires urgent yet sustainable agricultural intensification.

The Green Revolution of the 1950s and 1960s significantly boosted crop yields in Asia and Latin America through the adoption of high-yielding varieties, irrigation, fertilizers, and pesticides. However, Africa's uptake of these technologies was limited to a few countries, and the continent did not experience the same productivity gains. Between 1961–1980 and 2001–2020, Africa's cereal production increased by 172%, but this was largely driven by a 74% expansion in cultivated area, compared to just 17% in South America and 7% in Asia, often at the expense of natural habitats. Several structural and policy-related factors contributed to Africa's limited adoption: wheat and rice were historically less important; rural infrastructure investment was low; many countries are landlocked, increasing input costs; and public spending on agriculture has remained below 6% of total budgets for decades. Additionally, African farmers face competition from low-cost, often subsidised food imports.

With Africa's population projected to double by 2050, the pressure on land, water, and ecosystems will intensify. At current yield levels, agricultural land would need to triple in many Sub-Saharan African countries to meet food demand, potentially resulting in the loss of up to 20% of animal habitats. In response, there is growing consensus around the need for sustainable intensification, an approach that increases productivity without degrading the environment or expanding farmland.

Sustainable intensification focuses on outcomes rather than prescriptive methods, allowing flexibility in technologies, species mix, and farming practices. Conservation agriculture, which promotes minimal soil disturbance, permanent soil cover, and crop diversification, is a key strategy within this framework. However, effective weed management is essential for its success. Herbicides, particularly glyphosate, play a critical role in enabling reduced tillage and improving land and labour productivity. As herbicide use rises across Africa, ensuring safe, informed, and sustainable application is vital to realising the full benefits of conservation agriculture and sustainable intensification.

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Data and Methods

This brief is based on a 2023–2024 study on herbicide use and sustainable intensification in Kenya. A mixed-methods approach was used, combining a literature review with primary data collection. The desk review examined Kenya's pesticide policy framework and herbicide use trends. Fourteen focus group discussions (FGDs) were conducted with maize, wheat, and rice farmers across small, medium, and large-scale operations. Participants were purposively selected to ensure representation of women, youth, county extension officers, agro-dealers, and other value chain actors. This inclusive approach provided insights into herbicide use patterns, perceived benefits, safety practices, and information sources, helping to assess the role of glyphosate in enabling conservation agriculture and reducing production costs.

Global and regional use of herbicides

Globally, herbicides account for the largest share (50%) of pesticides used annually. Despite Africa being predominantly tropical, its pesticide use is comparatively low; for example, Kenya ranked 146th globally in 2022, using 0.73 kg of pesticides per hectare of cropland, significantly less than countries with intensive production systems (Figure 1).

Weed control and herbicide use in Africa

Compared to other regions of the world, Africa's tropical areas experience severe weed problems, which are the most important pest and can lead to staggering crop yield losses ranging from 50% to 100% if not effectively managed during critical periods (Akobundu, 1980; Sibuga, 1997; Gianessi, 2009). Hand weeding is the predominant weed control practice on smallholder farms, consuming 50-70% of farmers' labour time, largely by women and children, and contributing to soil degradation. Herbicides are increasingly recognised as crucial for effective weed management in conservation agriculture, offering an alternative to mechanical tillage for pre-planting weed control, reducing dependence on manual labour, and improving land and labour productivity.

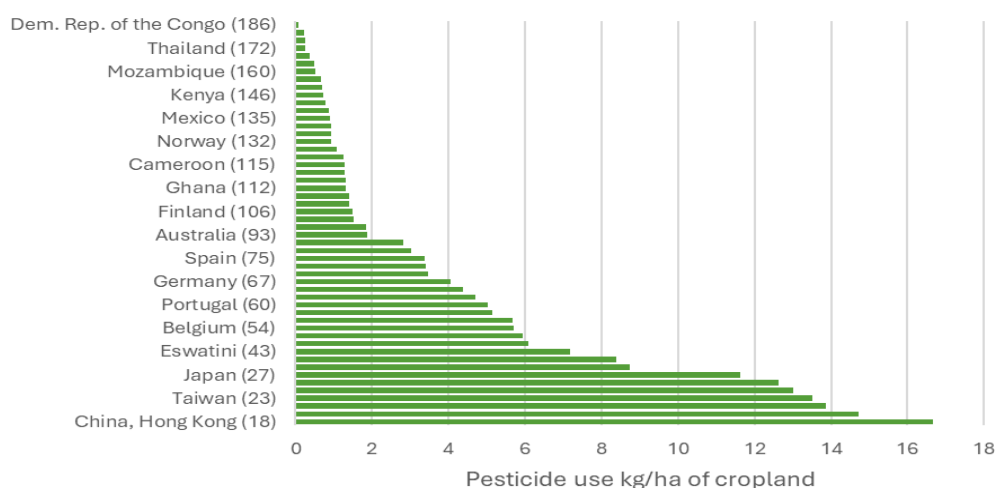


Figure 1: Pesticide use country comparison (2022)

Data on herbicide use in Africa is limited but the historic value of pesticide imports for East, Southern and West Africa indicates that pesticide use is increasing in Africa, and at a faster rate in West Africa. Since herbicides tend to make up about 50% of total pesticide use, it is safe to deduce that herbicide use is also increasing.

Glyphosate, introduced in 1974 and initially marketed as Roundup®, is a broad-spectrum herbicide effective against a wide range of weed species. Its global use expanded after going off-patent in 2000 and with the adoption of glyphosate-tolerant crops. Glyphosate plays a key role in conservation agriculture by enabling no-till and reduced-till practices, which help prevent soil erosion, improve soil health, and reduce carbon emissions. It binds tightly to soil particles and breaks down rapidly, posing minimal risk to groundwater.

Despite concerns about its widespread use and potential toxicity, multiple regulatory bodies have affirmed its safety when used as directed. The United States Environmental Protection Agency, the European Food Safety Authority, and the European Chemicals Agency concluded glyphosate is unlikely to be carcinogenic. Australia's Pesticides and Veterinary Medicines Authority reached similar conclusions, leading to glyphosate's continued approval, including renewal in the European Union until December 2033.

Herbicide use in Kenya

Results from FGDs indicate that maize, wheat and rice farmers unanimously acknowledged the necessity of weed control on their farms. The most significant perceived benefit of weed management is the attainment of high-quality grain, particularly for wheat and rice, leading to cleaner, superior produce, enhanced market value, and better pricing. For maize farmers, weeding also fosters the development of robust stems and minimized nutrient competition. Moreover, farmers ranked achieving high crop yields as the second most significant advantage of weed control. Neglecting weed control can lead to substantial yield reductions: 11-17% in wheat, about 40% in rice (potentially jeopardising the ratoon crop).

All categories of wheat farmers (small, medium and large) employed both selective and non-selective herbicides. In the rice value chain, only three percent used selective herbicides, with the majority opting for non-selective herbicides, predominantly for post-emergence applications. Selective herbicides are more popular amongst maize farmers than non-selective.

Glyphosate was the most used active ingredient in herbicides in 2022, with 45% of herbicides containing it, and about one-third (34%) using glyphosate as the sole active ingredient (Demeter Dynamics, 2022). Maize and wheat were the main herbicide-using crops based on area (Figure 3). Kenya planted an estimated 119,664 hectares of wheat in 2022, which means that, on average, the total wheat area

received three herbicide applications. In contrast, out of an estimated 2.22 million hectares of maize, only 344,000ha (16%) received an herbicide application. Larger farmers mainly produce wheat in an intensive production system, while maize is largely produced by small-scale farmers.

There are several generic glyphosate products in the Kenyan market, with Glycel being the most used herbicide brand for rice, Kausha for wheat and Touchdown for maize (Figure 4). Touchdown and Roundup were the most effective non-selective herbicides, but they were the priciest, prompting farmers to opt for more affordable alternative brands. Farmers also pointed out that broad-spectrum herbicides were effective because they controlled a wide range of weeds, both grasses and broadleaf weeds.

Agro-dealers in the focus group discussions described glyphosate as a broad-spectrum, non-persistent, post-emergent systemic herbicide and crop desiccant and that farmers mainly purchase glyphosate products for use in annual crops like maize, rice, wheat, legumes, sugar crops, and horticultural plants. Further, they indicated that glyphosate is valued for its versatility: it is used to eliminate cover crops and manage weeds at various stages in annual cropping systems; control weeds in and between rows of perennial crops; and in grassland management (terminating temporary grassland, locally eliminating perennial weeds in permanent grassland, and renewing grassland areas).

Focus group participants highlighted several benefits of using glyphosate-based herbicides. The primary advantage across the three value chains was a significant reduction in production costs, especially for smallholder rice farmers in Kisumu, who found glyphosate to be labour-saving and more efficient than hand-hoeing. Glyphosate allowed one person to spray an acre in an hour, compared to six people working two days manually. The herbicides were also highly effective in controlling stubborn weeds, particularly in rice farms. Additionally, glyphosate contributed to minimal soil disturbance, supporting conservation agriculture practices like minimum tillage and enhancing weed control when combined with crop rotation.

Wheat farmers indicated that if glyphosate was to be removed from the market in Kenya, they would consider abandoning wheat cultivation altogether and transitioning to other crops.

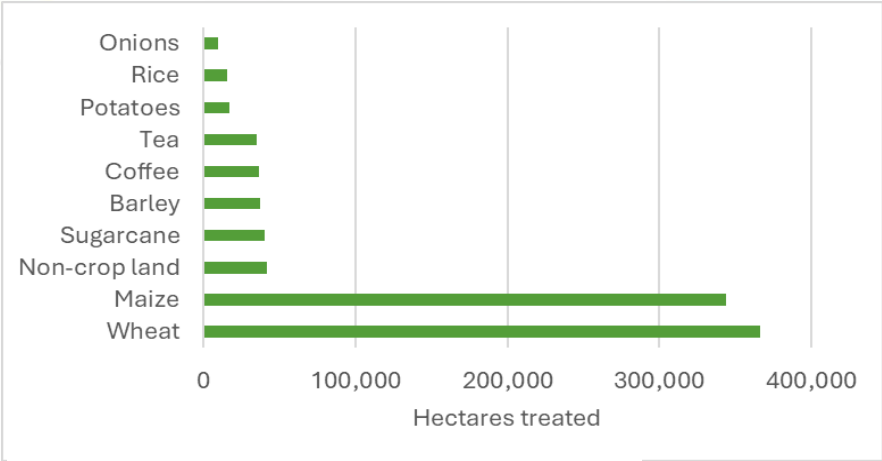


Figure 2: Hectares treated with herbicide, by crop in 2022

Sources of information on herbicides and their usage

Farmers primarily receive information about herbicides from agro-dealers, followed by agronomists from agrochemical companies, extension officers, and lead farmers.

Also, some farmers admitted to mixing herbicides directly in the spraying can rather than using separate mixing containers, indicating gaps in adherence to best practices.

The study found that large-scale commercial wheat farmers used tractors to apply pesticides, which posed lower occupational

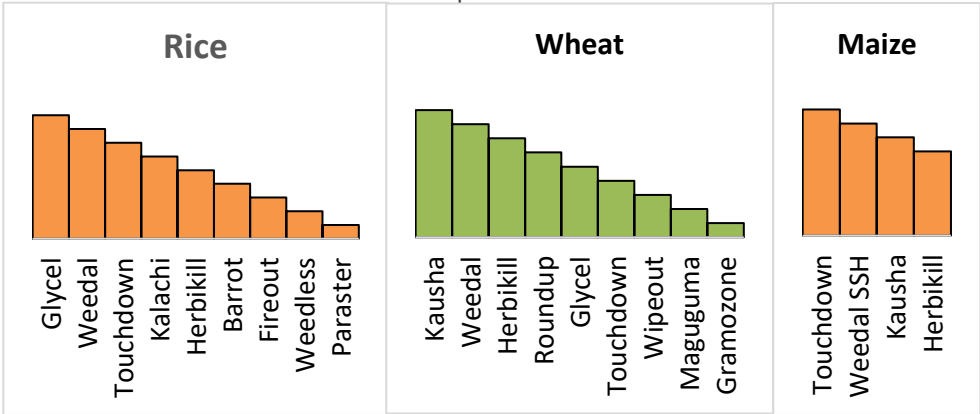


Figure 3: Commonly used non-selective herbicide products for maize, wheat and rice

Other sources include extension officers, user manuals, and traditional media like radio. Reliance on commercial entities raises concerns about potential bias in their recommendations due to conflicts of interest. This challenge is exacerbated by the collapse of the public extension system, which is now managed

Safe use of herbicides

Farmers reported several safe practices in their handling of herbicides, the key one being that pesticides were carefully packaged and transported separately from food items, a practice often assisted by agro-dealers (Figure 5). Despite farmers reporting adoption of some safe practices, inconsistent use of protective equipment during spraying was reported, particularly among contracted service providers.

exposure risks compared to governments and is often seen as unbiased and more trustworthy. When it comes to information on safe herbicide use, agro-dealers remain the most common source, followed by farmer-to-farmer knowledge exchange, instruction manuals, and pesticide companies, while radio is the least utilised source. the use of knapsacks or hand sprayers by small-scale farmers.

The underlying reasons for poor pesticide safety practices are multifaceted, including limited knowledge among farmers regarding safe use and disposal, a lack of appropriate personal protection equipment, a shortage of qualified agricultural extension workers, and inadequate farming infrastructure and regulation (Onyando et al., 2023).

Most farmers do not safely dispose of pesticide containers after use, with the main method of disposal being leaving them in the field to

decompose (which is not a good practice since most of the containers are plastic). Although about 54% of farmers recycle containers (an industry initiative), this is common only for containers larger than five litres, indicating a need to upscale recycling initiatives for smaller containers used by smallholders.

Burning and dumping containers in pits were the least utilized disposal methods.

Main concerns about herbicides

In the FGDs farmers expressed several concerns regarding the adverse effects of herbicide use. These include: (i) elevated risks to human health for applicators and consumers due to direct exposure and pesticide residues; (ii) increased environmental degradation, including water pollution and adverse effects on soil quality due to improper application and disposal of pesticides; (iii) economic inefficiency through the waste of inputs due to overdosing, which increases production costs for farmers.

Conclusions and recommendations

This study highlights the growing importance of herbicides in Kenya's maize, wheat, and rice production systems. While overall herbicide use remains low compared to global standards, adoption is steadily increasing due to its role in enhancing land and labour productivity, reducing production costs, and enabling conservation agriculture practices.

Glyphosate was the most widely used active ingredient in 2022, accounting for 45% of herbicide products sold.

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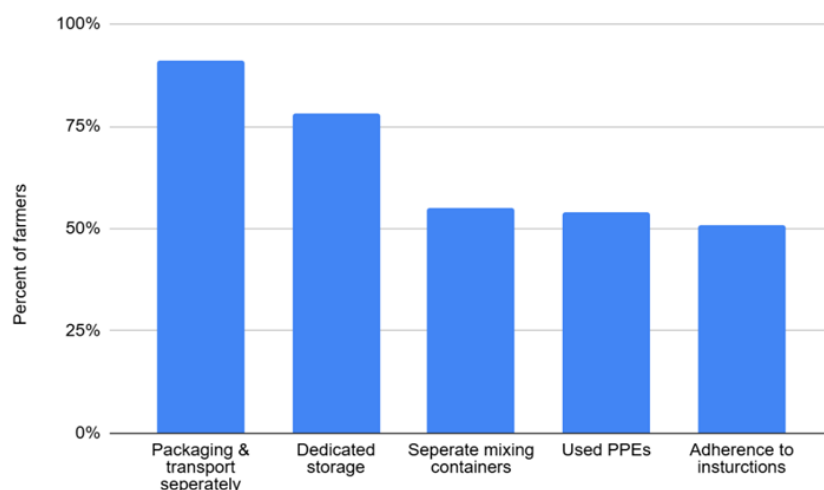


Figure 4: Safe use practices adopted by farmers

Its use is especially critical in wheat production, where farmers report that its absence would make cultivation economically unviable.

Despite these benefits, several challenges persist: limited access to unbiased agronomic information due to weakened public extension services, inconsistent adoption of safe handling and disposal practices, and concerns about environmental and health risks.

To address these issues, the study recommends:

- Revitalising public extension services through government investment and partnerships with the private sector.
- Promoting Integrated Weed Management (IWM) to reduce herbicide dependency and mitigate resistance risks.

- Enhancing farmer training on safe herbicide application, dosage calibration, protective equipment use, and container disposal.
- Improving access to reliable information through demonstration plots, farmer field schools, and community-based platforms.
- Supporting safe disposal initiatives, including expanding container recycling programmes to smallholders.
- Safeguarding environmental and human health by investing in low-toxicity alternatives and precision application technologies.

Implementing these recommendations will help Kenya maximise the benefits of herbicide use while promoting sustainable intensification, protecting ecosystems, and supporting resilient agricultural development.

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