

COMMENTARY

Dialogue on maize seeds: Are smallholder farmers' voices heard in building climate-resilient food systems?

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Introduction

From April 3 to 5, 2025, I was very fortunate to attend the scientific days organized by the Faculty of Agricultural Sciences at the University of Lubumbashi, under the theme “Food Diversification and Agricultural Innovation as a Foundation for Food Independence in Haut-Katanga Province” (translated from the original title in French as shown in Figure 1).

Two distinctive features made this event particularly interesting. First, it brought together key stakeholders in local food systems, including officials from the local agriculture inspectorate, scientists, agronomy students, farmer organizations, and major certified suppliers of agricultural inputs such as fertilizers and seeds. Second, the event's location at the Kasapa Experimental Farm of the University

of Lubumbashi added special relevance. At this site, various improved seed varieties of maize, beans, and soybeans—provided by seed stakeholders such as UNILU, Seed Co, and AFRiseed—are currently being tested (see Figure 2). The objective of these trials is to evaluate the agronomic performance and adaptability of improved crop varieties under local environmental conditions, in order to select the best ones to introduce to farmers.

While these trials—especially those with maize—showed promising yields, they also prompted me to ask several fundamental questions. How do seeds contribute to building climate-resilient agricultural systems? Why do smallholder farmers' voices matter in the selection and development of crop varieties? Why does the adoption of improved seed varieties remain low and yields remain poor among smallholder farmers?

High-quality seed is one of the most critical agricultural inputs, especially for maize, which remains one of the key staple crops in the DRC (Kimuni et al., 2018; Ndeko et al., 2025). However, the varieties commonly used by smallholder farm-


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Figure 1. Theme of the Scientific Days at Kasapa Farm, University of Lubumbashi: “Food Diversification and Agricultural Innovation as a Foundation for Food Independence in Haut-Katanga Province”

Professor L. N. Kimuni presenting on maize production in Haut-Katanga.



Photo © A. M. Balasha, April 2025.

ers have degenerated over time, resulting in steadily declining yields (Kimuni et al., 2018). Providing access to better-performing varieties is essential, but without meaningful farmer engagement and consideration of local needs—such as seed trait preferences and affordable costs—these innovations risk remaining disconnected from the realities of small-scale agriculture.

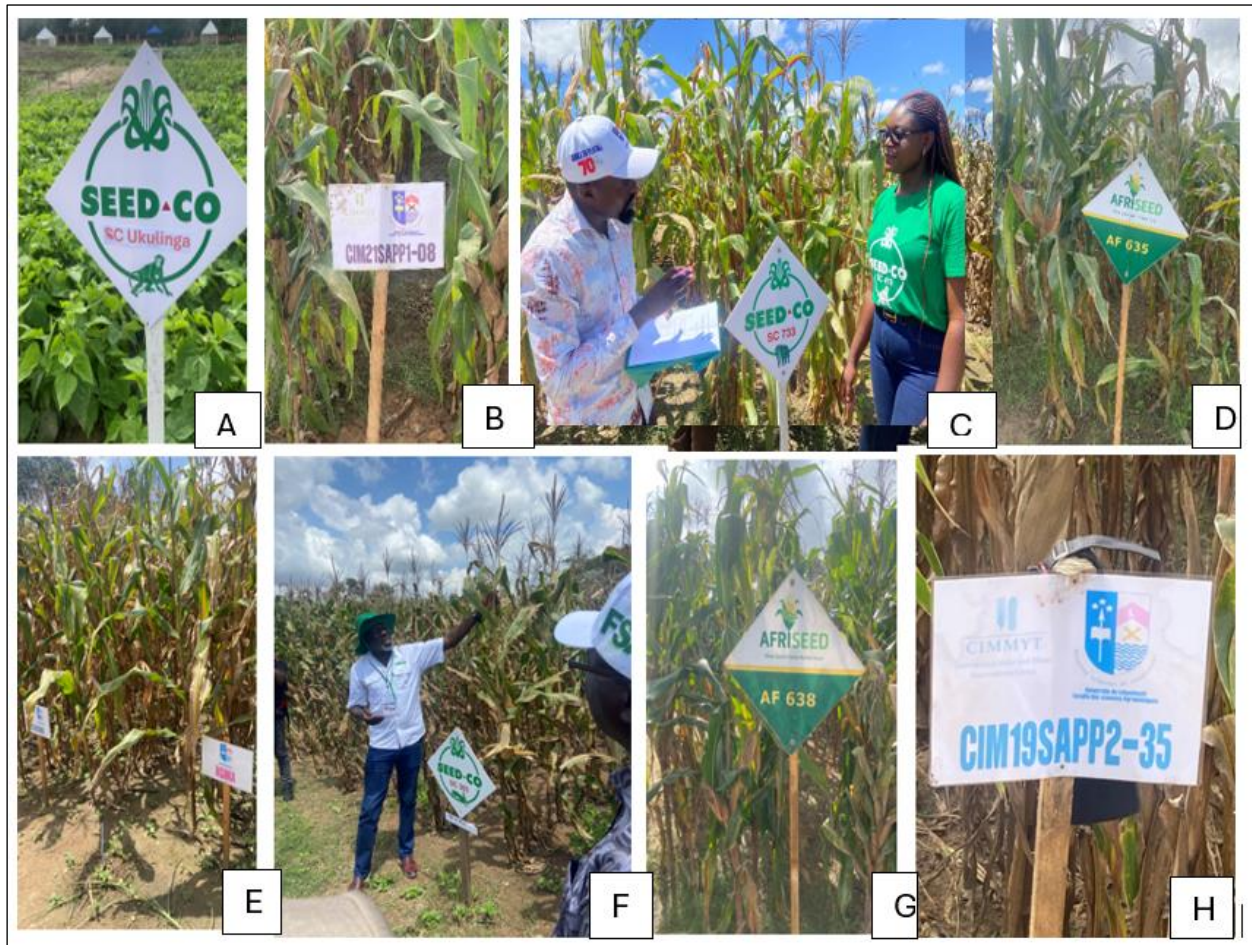
Drawing on interviews with seed experts and farmers, as well as my previous studies on improved maize seed adoption in the Katangese Copperbelt (Balasha et al., 2025), this piece aims to contribute to the debate on agricultural innovation by amplifying farmers’ voices—particularly those facing challenges in accessing the improved seeds essential for adapting farming systems to climate change.

The Role of Seeds in Building Climate-Resilient Agricultural Systems: Why Do Farmers’ Voices Matter?

As climate change intensifies weather variability, degrades soils, and increases the frequency of droughts and floods, the need for resilient agricultural systems becomes ever more urgent, especially in vulnerable regions like the Katangese Copperbelt. Figure 3 illustrates the impact of a prolonged dry spell during the growing season on maize production in Lubumbashi. Seeds lie at the heart of agricultural transformation and resilience for sustained food security. Farmers believe that with adequate government support, the agricultural sector could develop sufficiently to ensure food security for the growing population. A farmer in Lubumbashi stated: “If the government truly wants to pro-

Figure 2. Trials of Improved Seeds from the Three Seed Providers, Including Seed Co, AFRiseed, and UNILU

A: Ukulinga bean variety from Seed Co. C: Dr. Balasha interviews a Seed Co. representative about different varieties during a field visit. B, E, H: Local maize varieties developed and improved by the University of Lubumbashi, through the work of Prof. Kimuni and Deo Mwamba. F: Nicholas, local Seed Co. manager, explaining the potential of the variety SC 303. D, G: Two maize varieties (AF 635 and 638) from AFRiseed.



Photos © A. M. Balasha, April 2025, except C © Dr. Kesonga.

mote food security, it must provide smallholder farmers with technical support, seeds, and fertilizers—they will feed the nation. Rural roads must be improved, and the railway system restored to reach villages in other territories, where harvests rot due to lack of transport, while people go hungry in the cities.”

Improved and climate-adapted seed varieties are promoted as essential tools for increasing yields, minimizing crop failure, and supporting food security and income for farmers (Bernard et al., 2023; Kimuni et al., 2018; Ndeko et al., 2025). Yet the success of such innovations depends not only on their genetic traits but also on the extent to

which they respond to the realities of those who use them: smallholder farmers. In many seed-development and dissemination processes, farmers’ voices are marginal or absent. This disconnect often results in poor adoption rates, low yields, and missed opportunities to strengthen food systems from the ground up.

Understanding and integrating farmers’ preferred seed traits, indigenous knowledge, and lived experiences is not just a matter of equity; it is a strategic imperative for climate-resilient agriculture. Farmers are the key players in food production and know well what they want and expect from good seeds—beyond just high yields. A farmer told me,

Figure 3. Maize Field Wilting along the Kasumbalesa Road in the Agricultural Region of Lubumbashi Following a Prolonged Dry Spell during the Growing Season



Photo © A. M. Balasha, March 2024.

“Beyond yield, I would like a seed that grows quickly and withstands pests, such as fall armyworm.”

With rainfall becoming increasingly sporadic and prolonged periods of drought occurring during the growing season, combined with maize vulnerability to fall armyworms and degraded agricultural land, it is important to emphasize that the potential of seeds alone is not sufficient to ensure adequate production.

Sustainable yields can only be achieved if soil improvement—through sustainable fertilization and pest management—as well as access to water and irrigation equipment are properly addressed. Farmers remain at the center of the entire process: They must be trained, informed, and supported to adopt agricultural innovations and use them effectively.

Why Do Improved Seed Adoption and Crop Yields Remain Low among Smallholder Farmers?

Despite the development and promotion of improved seed varieties across many parts of the DRC, adoption rates among smallholder farmers remain surprisingly low (Bernard et al., 2023; Ndeko et al., 2025). One of the major barriers to

the use of improved seeds in the DRC is their high cost. A recent study in Lubumbashi by Balasha et al. (2025) shows that 71% of farmers perceive the high cost of improved seeds as a major barrier to adoption. Many smallholder farmers operate on very tight budgets and cannot afford to buy certified seeds each season, as a farmer reported, “Improved seeds are too expensive and require a lot of fertilizers. I would like to use them if the government provided support or if I had the means to afford them.” This aligns with Balasha et al. (2025), who found that financial support and off-farm income are key factors influencing the adoption of improved seeds in Lubumbashi.

In the DRC, the seed industry has become very lucrative due to high demand from humanitarian organizations, mining companies, and provincial governments (Mondo et al., 2024). One farmer told me, “High-quality seeds are provided to those [organizations] who pay well. Sometimes you may look for a specific seed variety to buy, and the supplier tells you it is out of stock because it has been ordered in bulk. Many smallholder farmers like me do not have enough money to order large quantities.”

Although some farmers use improved seeds, yields in their fields are often significantly lower

than those achieved in experimental plots or research stations (Kimuni et al., 2018; van Dijk et al., 2017). This is because the full potential of improved seeds is rarely achieved without complementary inputs, such as fertilizers, irrigation, and pest control—resources that are often out of reach for smallholder farmers.

Kalumbu et al. (2019, who compared maize production in Zambia and the DRC, showed that the difference in maize yields between the two countries results mainly from variations in agricultural input use and technical support. In the DRC, farmers apply barely 220 lbs. (100 kg) of fertilizer per hectare, whereas in Zambia, hybrid maize varieties are cultivated with 660–880 lbs. (300–400 kg) of basal fertilizer (NPK) and 550–660 lbs. (250–300 kg) of urea as top dressing. Moreover, Zambian farmers benefit from technical guidance provided by extension officers, which Congolese farmers lack due to the poor performance of extension services in the DRC

Another factor contributing to farmers' lack of interest in using improved seeds is their traditional practice of selecting, saving, and exchanging seeds from their own harvests. This practice is deeply rooted in farming culture and offers a sense of independence, as illustrated by this farmer's quote, "I do as my parents and fellow farmers do, I select and save the biggest ears and use them as seed for the next season." However, the Seed Co manager explained that "...for our certified seeds, farmers' traditional seed selection does not always guarantee good yields season after season."

Additionally, mistrust in hybrid varieties persists among farming communities, largely due to the perception that they represent foreign technology or Western projects, as expressed by a farmer who continues to rely on local seeds: "I don't trust improved seeds—they're too expensive and often imported from Zambia, Europe, or America, with the risk of replacing our local varieties. Local seed can also give high yields like improved varieties, if they are well-nourished with fertilizers." I spoke with many farmers and scholars who expressed concern that the government lacks full control over the seed system and farming inputs, emphasizing that seed represents power, as reflected in the following quote: "Our government does not have a

clear food policy if farmers are not supported and the DRC cannot produce essential inputs such as seeds and fertilizers locally. Whoever controls the seed, controls your food, and whoever controls your food, controls your soul, because we cannot live without eating." This belief, along with fears of dependence on external suppliers, discourages the adoption of improved seeds.

Some farmers prefer local varieties because they meet some criteria, as reported in this quote: "A local variety [seed] is typically one that is not imported, has been cultivated by our grandparents, is well adapted to local conditions, and can be selected and saved for future planting." This farmer's understanding aligns with scientists' opinions, who argue that landraces, or local varieties, may carry valuable genetic traits that can contribute to the development of improved varieties through formal breeding programs (Diallo et al., 2018; Lazaridi et al., 2024). In Mali, farmers' preferred traits from local sorghum landraces were incorporated into breeding objectives to enhance both yield and quality (Diallo et al., 2018). While farmers' criteria for evaluating a local variety closely align with the scientific definition (Lazaridi et al., 2024), seed providers have a different understanding, as explained by agronomist Nicholas from Seed Co: "Local varieties are '*le tout venant*,' in French, meaning any seed that farmers select and replant without necessarily knowing its name or origin."

Conclusion

High-quality seed is crucial for agricultural production. An inclusive and permanent dialogue among researchers, seed providers, farmers, and relevant officials is essential for building climate-resilient food systems. Farmers must be at the center of this discussion and well-connected to research centers and certified seed providers, as they are the end users of agricultural innovations. Their voice matters.

While improved seed varieties hold great promise for boosting productivity and enhancing climate resilience, their potential remains underutilized due to limited farmer involvement and low adoption rates. Farmers' reluctance to adopt improved seeds is not a sign of ignorance or resis-

tance to change, but rather a rational response to high costs, limited access to complementary inputs, and insufficient information about the benefits of these seeds. However, for some reasons tied to conservationism, some farmers prefer their traditional seed varieties or to select seeds from previous harvests.

In the DRC, a country grappling with food insecurity and the looming threats of climate change, empowering farmers must become central to agricultural development and policies. This requires more than making seeds available and affordable; it demands inclusive seed systems

where farmers are cocreators of innovation. Listening to their voices, incorporating their knowledge, and ensuring access to technical guidance, affordable and appropriate inputs are not optional—they are foundational to achieving sustainable food sovereignty, a goal that is often asserted by DRC officials.

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