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# Demand for Quality Planting Material of Improved Cassava Varieties in Nigeria

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In many African countries south of the Sahara, farmers depend on the cultivation of vegetatively propagated crops (VPCs) for both consumption and commercial purposes. Yet yields for these crops remain at low levels due, in part, to seed market imperfections that constrain farmers' access to improved varieties and high-quality planting material. Efforts to improve the quality of planting material exchanged in markets or through other channels are often hampered by the unique biological and economic characteristics of vegetative propagation—characteristics that distinguish VPCs from the major cereal crops that drive and shape the policy and investment choices made in many of these countries. This suggests that improving the overall supply of quality planting material at any significant scale in a sustainable and cost-effective manner requires not only continued investment in breeding and innovative seed multiplication systems but also customized quality regulation and marketing strategies.

## Context

Nigeria is the world's largest producer of cassava, accounting for roughly 20% of global cassava production. The crop is primarily produced by an estimated 6 million small-scale farmers as a staple food crop and is valued for its tolerance of drought and its adaptability across the wide range of agro-climatic and soil conditions found in Nigeria (Wossen *et al.*, 2020). It is also quickly becoming a major source of cash income for farmers who sell it as an input to agro-industrial processors preparing cassava flour (*gari*) and other products to meet growing demand from urban and rural non-farm households (Wossen *et al.*, 2020). There are even efforts underway in Nigeria to introduce "yellow" cassava varieties that are enriched (biofortified) with Vitamin A to improve immune system health among consumers lacking other sources of the essential micronutrient in their diets. As such, the crop represents a compelling entry point to enhance food security in the country.

Yet despite the importance of cassava to Nigeria's entire food system, the physiological and physical quality of cassava seed—irrespective of genetic improvement—rarely garners attention in the formulation and implementation of seed policy and regulatory reform efforts (Spielman *et al.*, 2021; Wossen *et al.*, 2020). For

instance, while about 39% of the cassava area in Nigeria is under improved cassava varieties, almost all farmers rely on the informal system to obtain planting material for improved varieties (Wossen *et al.* 2020). Because they often transmit soil- and seed-borne pests and diseases from one generation to the next, low quality stems can significantly affect both the yield and quality of the tuberous cassava roots that are ultimately produced, consumed, and sold. Not surprisingly, Nigeria's cassava yields are at most half of the yields achieved in other major cassava-producing countries such as Thailand and Vietnam (Spielman *et al.*, 2021; Wossen *et al.*, 2020).

This low productivity is partly attributable to market imperfections that constrain farmers' access to high-quality seeds of improved cassava varieties. Cassava stems are typically exchanged in informal markets that embody many of the classic failures observed in other seed markets: asymmetric information between seller (who may know the genetic and physical potential of the seed) and farmer (who cannot assess quality prior to cultivation). For instance, while more than 50 improved cassava varieties have been officially released and disseminated to farmers in Nigeria, farmer-to-farmer exchanges are the single most important means of obtaining stems of these varieties (Wossen *et al.*, 2020). In these informal markets, the trade in cassava stems generally precludes any form of quality assurance, apart from the transmission of information about the reputation of a particular seller who might have quality stems of existing or new cassava varieties. Stem exchanges in these unregulated informal markets are often difficult to quantify or characterize, resulting in insufficient information on the type of variety or quality of stems exchanged. Hence, farmers often acquire stems that may not be what they expect or need either because sellers have lost track of the variety type being exchanged, or because of willful deception on the seller's part. The magnitude of the problem is not small: using DNA-fingerprinting to identify improved cassava varieties in Nigeria, Wossen *et al.* (2022) find that 25% of farmers often misperceive improved varieties as local varieties, while 10% misperceive in the other direction.

To improve our understanding of how information market frictions (i.e., asymmetric information about quality seed) distort farmers' valuation of high-quality seeds, we conducted an information provision auction experiment with a total of 421 cassava farmers across 22 villages in Benue and Oyo States of Nigeria, the heart of Nigeria's cassava production system. In the auction experiments, farmers bid on a bundle of cassava stems, the most common unit used to buy/sell cassava stems in the local market, for three types of cassava stems in two rounds. The stem types included in the auctions were (i) certified stems of an improved variety (Tropical Manihot esculenta (TME) 419), (ii) non-certified stems of an improved variety (recycled TME 419), and (iii) recycled stems of multiple and typically unknown local varieties (referred hereafter to as "*local stems*"). It is important to note the following differences in the quality of the three stem types included in our auction: (i) certified TME 419 is equivalent to recycled TME 419 in terms of genetic quality, and both are genetically superior to local varieties; (ii) certified TME 419 is superior to both recycled TME 419 and the local varieties, with the latter two

types being indistinguishable in terms of physical quality (according to which certified TME 419 is superior to recycled TME 419), and (iii) the combination of genetic and physical quality are consistently ordered (from best to worst) as certified TME 419, recycled TME 419, and recycled stems of local varieties.

In each round farmers were asked to submit their maximum bid. The first round was a pre-quality information auction in which farmers were asked to state their maximum bids based on their own subjective stem quality assessment based on the physical appearance and other observable stem characteristics. The second round was a post-information auction in which participants were asked to state their maximum bid for each seed type based on objective seed quality information. We advised participants to submit their maximum bids for each stem type simultaneously, having disclosed to them that only one of the rounds and stem types would be selected randomly as the binding outcome of the auction.

**Results**

For each seed type, Figure 1 shows the pre- and post-quality information demand curves generated from the bids of all the auction participants. For each round and stem type, auction price points ($p$) are reported along the x-axis, and the share of participants whose bid was equal or greater than $p$ is reported on the y-axis. Pre-quality information, we see that the demand curves for certified and recycled improved stems track closely, indicating that participants were able to discriminate between improved and local seeds but not between certified and non-certified improved seed. Figure 1 (right panel) shows that the provision of quality information shifts the full distribution of participants' bids for certified improved stems in the intended direction. The average bid for certified improved stems increased by 46% to NGN 417/bundle (from NGN 285/bundle pre-reveal), while the average bid for recycled improved stems declined by 13% to NGN 256/bundle (from NGN 294/bundle pre-reveal). More importantly, at the current median price of certified improved seed (i.e., NGN 500/bundle), the share of participants willing to pay a premium for certified improved seed increased by 85 percent from 21 percent pre-quality information to 39 percent post-quality information. Taking the post-quality-information bids as proxies for farmers' true valuations of the three stem types, we see that local stems are about correctly valued, as are improved non-certified stems (medium quality). However, improved certified stems (high quality) are massively under-valued. This suggests that under-provision of high-quality stems would be ubiquitous in largely unregulated and informal stem markets, where farmers' ability to infer quality is severely limited and hence stem quality is unobservable at the point of exchange.

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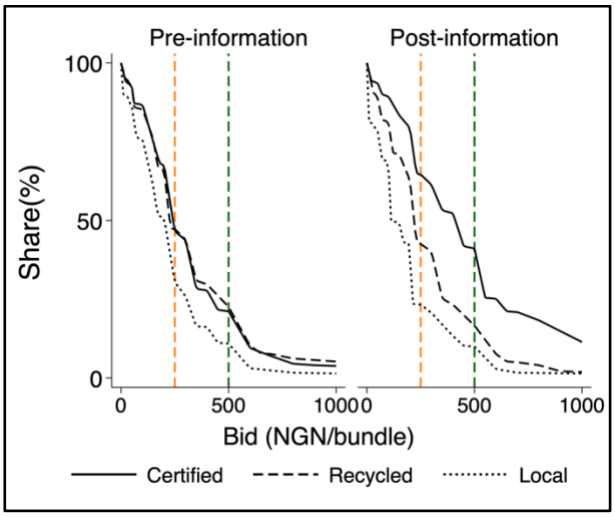


**Figure 1: Pre and post quality information demand for quality seed**

With our experimental evidence showing that farmers are prone to quality misperception and that the provision of quality information significantly shifts demand for certified improved seed, we suggest the need for greater investment in the design of quality assurance systems that deliver seed which is simultaneously superior in genetic, physical, and physiological characteristics. This is a potentially important entry point for efforts to increase productivity—yields, output, and returns—among smallholders. However, even when market frictions are addressed, adoption of certified seed might not occur due to considerable variation in productivity, profitability, or other factors that shape farmers' choices, including behavioral factors. Based on the above results and the insights generated from the findings explicated in Wossen *et al*. (2020), Spielman *et al*. (2021), and Wossen *et al*. (2024), we recommend the following set of public policy, investment, and regulatory reforms.

**Policy recommendations**

- **Introduce a "*light-touch certification*" system by allowing and recognizing multiple seed quality grades:** Introduce multiple seed quality grades (e.g., quality-declared seed or similar categories), along with related standards and protocols to reduce entry barriers in the market. This is crucial since a strict certification system may break down in the presence of poor/weak quality control-where regulators have limited capacity to implement, monitor, or enforce quality standards effectively. Without credible quality signaling mechanisms, our experimental finding suggest that the seed system should be viewed almost exclusively as a distribution channel for stems of existing (and new) improved varieties at any quality that can provide farmers with a wider choice of agronomic, stress-resistance, nutritional, and processing traits, thereby reducing the share of farmers relying on local varieties and ultimately improving adoption and cassava yields in the country. That said, at upper levels in the seed system—where breeder and foundation seed are produced and distributed—the quality of planting material needs to be managed carefully to avoid potentially catastrophic introduction of new pests and diseases. Hence, we recommend a light-touch regulation system that combines **mandatory** certification of early generation seed with capacity development and strict adherence to starter stem replacement schedules

at the lower grade level (e.g., clean seed producer level). Compared to the existing strict certification system, this light-touch system-based on multiple seed quality grades-is likely to be more effective in improving the supply of improved varieties, irrespective of its physical quality. The success of the light-touch system is, however, contingent on (a) a continuous flow of improved varieties that provide farmers with a menu of desirable traits: biotic stress resistance, abiotic stress tolerance, nutritional qualities, and processing qualities, and (b) public investment in both breeding and technical and enterprise capacity development of seed producers who are the primary interface with farmers.

- **Prioritize public investment in breeding for host resistance and early generation seed production:** In the presence of strong breeding capabilities for host resistance, quality cassava seed and improved cassava varieties are functionally synonymous. As such, in the current context of Nigeria, we recommend public investment on the production and distribution of high-quality early generation seed, primarily as a mechanism to disseminate improved varieties that confer biotic stress resistance, abiotic stress tolerance, and nutritional and processing traits.

- **Develop the capacity of local seed entrepreneurs:** The unique biological and economic characteristics of vegetative propagation constrain the time and space over which seed can be exchanged, as well as the feasible sizes of the exchanges. Because cassava stems are bulky, perishable, and difficult to preserve for long periods of time or transport over long distances, some degree of localization—village-based or otherwise—is necessary. As such we recommend, re-organizing and supporting local seed entrepreneurs and farmer-based organizations to produce, brand, and distribute seed in "*localized markets*" using high-quality early generation seed. Necessarily, this requires the strategic use of producer and consumer subsidies**.** Such support can take the form of technical advice and training on quality seed production, internal inspection practices, business planning and marketing; or may take the form of subsidized credit or preferential, low-cost access to early generation materials from research centers, equipment for seed production (e.g. access to mass propagation technologies). Considering the low adoption and slow varietal turnover rate of improved cassava varieties in Nigeria, efforts to increase access to improved varieties through strategic investment and support to local seed entrepreneurs could play an important role in accelerating both adoption and varietal turnover (i.e., switching from local to improved varieties) in the country.

- **Accelerate national efforts for cassava value chain transformation and governance:** An institutional arrangement should be put in place to coordinate various efforts to accelerate and facilitate the cassava value chain transformation. Transforming the cassava seed system in Nigeria requires efforts from multiple actors and strong policy support along the whole cassava value chain with a focus in the following areas:

    - Rapid multiplication of high-quality planting material

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- Processing for High Quality Cassava Flour (HQCF)
- Manufacturing of high-value cassava products
- Innovative distribution and marketing strategies

**Further reading**

Spielman, D. J., Gatto, M., Wossen, T., McEwan, M., Abdoulaye, T., Maredia, M. K., & Hareau, G. (2021). Regulatory options to improve seed systems for vegetatively propagated crops in developing countries. IFPRI Discussion Paper 02029. International Food Policy Research Institute (IFPRI). Washington, DC. https://doi.org/10.2499/p15738coll2.134441

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