Improving yam production in Benin: Variety and quality concerns

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Abstract

Yam (*Dioscorea* sp.) is a staple food and plays a crucial role in food security across West Africa. It is widely consumed in both rural and urban areas. However, significant challenges threaten, such as declining yields, seed rot, soil fertility loss, as well as climate change. In response, various agricultural research institutions and farmers have adopted strategies to ensure year-round availability of high-quality yam and promote good agricultural practices.

This Market Intelligence Brief highlights the innovations and technologies identified through a literature review and field survey conducted among yam producers, traders, and consumers in the following zones in Benin: Dassa, Glazoué, and Tchaourou. The findings revealed major constraints in yam production and processing, especially the seasonal unavailability of preferred varieties such as Laboko, Kodjewe, and Efourou, which are crucial for preparing pounded yam. Other varieties such as Aga and Ofegui are less valued at harvest because of low culinary quality but gain value after a few months of storage.

To overcome these challenges and stabilize income, farmers have adopted strategies such as intercropping and the use of drought-tolerant, multi-cycle, and storable yam varieties that meet consumer preferences.

These changes imply new directions for breeding programs, such as the following:

- Adjusting quality thresholds (e.g., yield) and incorporating new criteria such as storability, ease of seed dissemination, and processability.
- Evaluating *D. alata* hybrids for their potential in pounded yam processing, as some lines show promising agronomic and culinary traits, despite not being initially selected for this use.

Key Points

- The yam market in Benin is characterized by significant variability throughout the year in terms of quality, availability, and price.
- Yam stakeholders face different constraints, such as declining yields, seed rot, soil fertility loss, and quality parameter changes during postharvest storage.

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Key Points (cont'd)

- The yam market is stratified (primary market, secondary/grouping market, and consumption market) and is also marked by wide price fluctuations up to eight times over the year, closely associated with yam quality.
- Breeders have to prioritize new quality trait criteria, such as storability properties of tubers.
- Pounded yam is the most constrained because it requires specific varieties. Thus, breeders must invest in the development of these varieties for this market segment (such as Djiladja harvested in May or Idoro in October cited during the survey).
- Breeders have to promote solutions for a healthy seed supply, such as minisett technique, microsett/microtuber technique, and semi-autotrophic hydroponics technology.

Introduction

Yam is an important tuber in tropical regions for food security, especially in Africa, which provides 95% of the total world production (Dègla and Sourokou 2020). Along with cereals and cassava, it constitutes a staple food for the population in Benin (Mitchikpe et al. 2001), where yam production extends from the center (Djidja District) of the country to the northern areas. The major constraints that characterize yam production in Benin are, among others, lack of water, low soil fertility, drought, insufficient labor, overgrazing, and rodent and insect attacks. Currently, research institutes are using projects such as Africayam and RTB Breeding to develop and popularize resilient varieties that are less demanding in terms of soil fertility and meet the expectations of end consumers in terms of organoleptic quality. This Market Intelligence Brief presents the main findings from a survey, supplemented by a literature review including research articles and gray literature (data from the Ministry of Agriculture, Livestock and Fisheries, and NGOs). The survey was conducted in February (abundance period) and July (scarce period) among key stakeholders in the yam value chain in the center and northern areas (Dassa, Glazoué, and Tchaourou districts) through individual interviews involving 172 stakeholders, with 77 producers, 82 consumers, and 13 traders. It focused on the major constraints of yam cultivation, quality issues of yam derivatives (the products from fresh yam tubers and those from dried yam chips), and possible solutions resulting from recent advances in applicable innovative technologies (such as new varieties and postharvest storage) and scaling of local solutions.

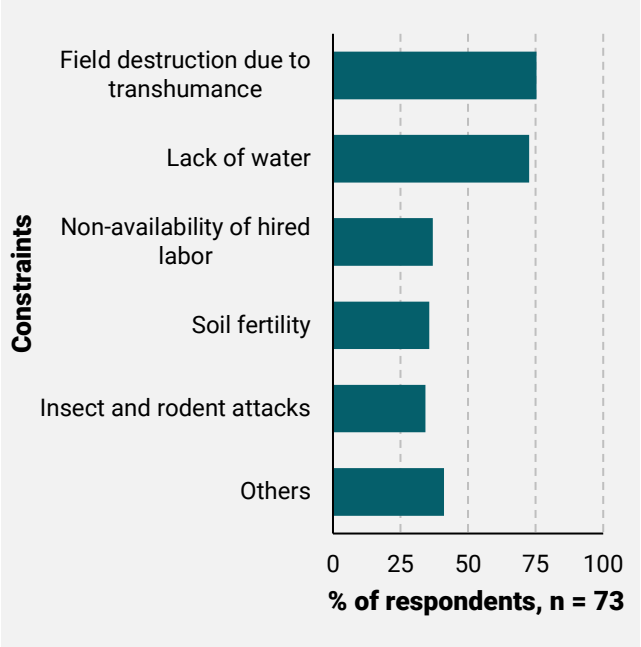
Agricultural practices of yam cultivation

Yam planting in the surveyed regions begins in January/February by either clearing forest land, which is becoming increasingly scarce, or by reusing land for a long period (more than five years). Indeed, in these areas, typical yam production requires fertile soils (Cornet 2005). Thus, when looking for adequate fertile soils for yam culture, farmers tend to abandon old lands and clear new ones, contributing to deforestation. Yam can be grown as a monoculture (1.3% of respondents) or in association (98.7%) with other crops such as cassava, maize, okra, sweet potatoes, or others. When yam is associated with sweet potatoes, the latter act as weed control (Cornet 2005). Moreover, up to six yam varieties can be grown on the same plot of land. This practice facilitates staggered planting and harvesting and thus helps to better manage abiotic (environmental) and biotic (related to pests and diseases) stresses (Cornet 2005). Regarding the yam seed supply, sources are multiple, such as own-saved/personal reserve (89.6% of respondents, n = 77), donations from other farmers (44.3%), and market purchases (9.1%). When planting, most farmers (98.7%) do not use fertilizer; however, 35.2% use phytosanitary products (pesticides, insecticides, herbicides, etc.) that they mainly (80%) purchased in local markets/shops from informal sellers. Financing of yam production is done through own funds (89.6%) or with credit obtained (22.1%) from various micro-credit structures and village savings and loan associations. Finally, respondents mentioned the lack of fertile land (35.6%) and lack of yam seeds (1.6%) as major constraints to the development of yam production, as previously reported (Dansi et al. 2024).

Challenges in the yam value chain for farmers, traders, and consumers

Many challenges were raised in the survey by different stakeholders. The effects of climate change were mentioned, mainly irregular rainfall patterns and ambient temperature around 40 °C. In connection with climate change, farmers are seeing seed rot after planting and the loss of certain varieties of *D. rotundata*. Apart from climate change, the main problems mentioned by producers are field/crop destruction due to movement of livestock, limited availability of hired labor, lack of water, insect and

rodent attacks, and low soil fertility (Figure 1). Other constraints are connected to the unavailability of seeds of other known varieties (Idoro, Djiladja, Alamoura, Kpakara, Ikogan, etc.) of yams that the farmer wishes to cultivate (27.4% of respondents), unsuitable soils/land (17.7%), and lack of financial means (17.7%).



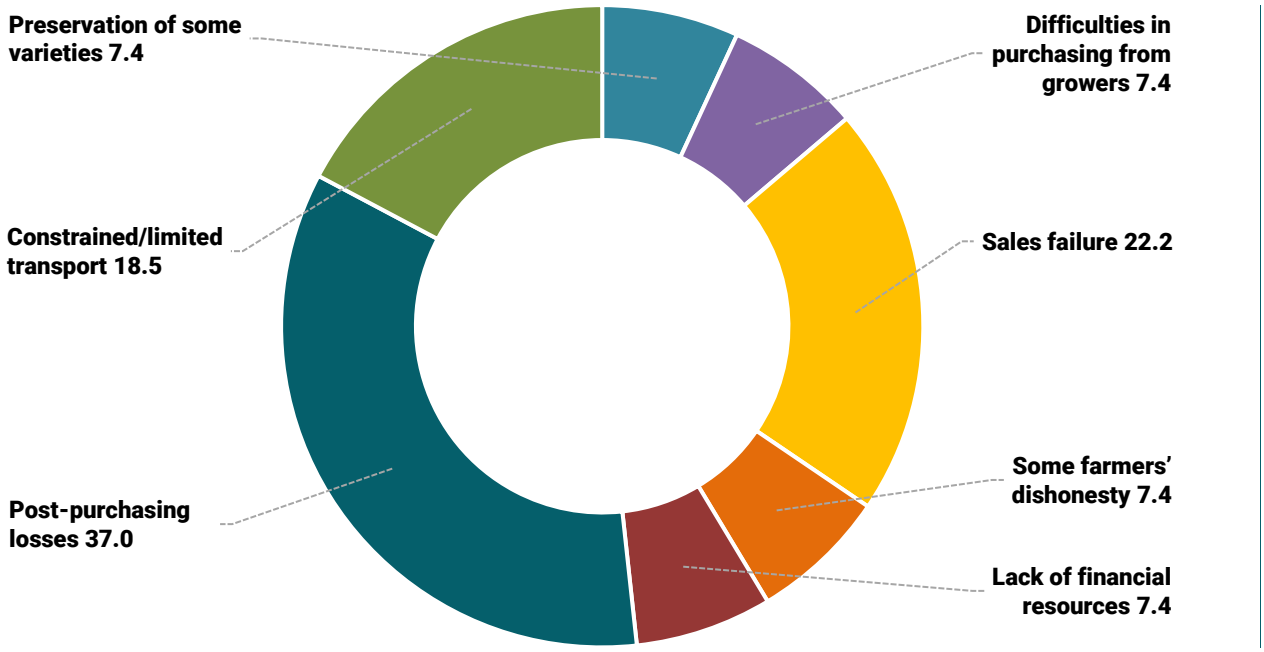
Source: Survey data, 2024.

Figure 1. Main constraints at yam production level.

For yam traders, the major concerns were price fluctuations, the rotting of certain varieties during postharvest, post-purchase losses including losses during transportation but also constrained transportation due to impassable roads for periods of time, the lack of financial resources (working capital for the period between buying and selling), poor sales, and the dishonesty of certain farmers who were initially pre-financed by a trader and who no longer respected the contract and put the trader in financial difficulty (Figure 2). According to surveyed traders, losses during transportation and sales are also due to the use of fertilizer by some producers, which causes the deterioration of yam when the weather is hot. Afolabi et al. (2023) reported that in some genotypes fertilizer application has a positive impact on yield and quality, but in others a yield increase is recorded with some compromise in tuber quality.

Important yam derivatives

In the GloMIP database, four market segments corresponding to two categories of products (fresh and processed) have been delineated on the basis of production area (https://glomip.cgiar.org/market-segments, accessed on 15 September 2025, Table 1). Our study further refines this market segmentation by considering yam-derived products, their associated varietal groups, and the temporal dynamics of their availability throughout the year (Table 2).



Source: Survey data, 2024.

Figure 2. Difficulties of yam traders (% of respondents, n = 27).

Table 1. Yam market segments in Benin as described in the GloMIP database (https://glomip.cgiar.org/market-segments).

Market segment / Basic traits	MS00014	MS01071	MS00012	MS00013
Market segment area (ha)	131,482	4,643	78,861	10,214
Crop	White yam	White yam	White yam	White yam
Color of flesh	White	White	White	White
Period of production	Early	Early-mid	Late/mid	Mid/late
Product type	Fresh tubers	Processed tubers	Fresh tubers	Processed tubers

Table 2. Period of production and availability of some yam varieties.

Varieties	Production period	Period of availability for consumption	Price fluctuation
Laboko Efourou, Gnidou, Monfobou, Moroco, Ikogan, Kodjèwé, Agatou	February/March–August/September	August–April/May	High price at harvest time and dropping thereafter
Kokoro, Alamoura*, Ahimon, Aga**	February/March–December	December–October/November	Price increases 2 months after harvest until 5–6 months of storage
Kpakara*	n.d.	n.d.	
Malanville-Pô, Sakata**	March–December	All year round	Stable price throughout the year
Djiladja (Nigeria)	January–May	May–December	n.d.
Idoro* (Copargo)	February–October	All year round	
Gnarambo, Gangni, Kratchi, Dodo	February/March–October	October–April/May	High price at harvest time and dropping thereafter

* Uncultivated in survey areas but desired/sought-after
** Same variety has different name depending on location.

Source: Survey data, 2024


Dried yam chip flour


Amala dough


Wassa-wassa


Pounded yam

Figure 3. Key yam-based end-products.

In Benin, two market segments are identified: the first concerns fresh products derived from *D. rotundata* and *D. alata* and the second is associated with dried products from *D. rotundata* only. The fresh products include pounded yam, boiled yam, fried yam, roasted yam, and yam stew (Figure 3). Pounded yam remains the most consumed, at least twice a week, followed by fried and boiled yam for 58.8%, 25%, and 20% of the respondents, respectively, during the survey. The second segment includes *amala* (a dough made of dried yam chip flour) and *wassa-wassa* (a couscous-like product).

Quality issues of yam derivative products

The constraints linked to yam processing in Benin are more related to consumer preferences for each yam-based product. For each product, yams with specific characteristics are needed, since no single variety can meet all the various requirements (El Moussaoui 2002). Some varieties undergo enzymatic browning during processing, turning from white to red or brown, resulting in a less appealing related end-product with lower sensory quality

(Honfozo et al. 2021). Regarding pounded yam, quality criteria are more restrictive and only some varieties are suitable for processing into it, particularly a few from *D. rotundata* and *D. alata* species. Tubers must be large (50% of respondents, N = 82), smooth-skinned (38.9%), long (27.8%), with white (16.7%) or yellow flesh (16.7%) for pounded yam. Because of the unavailability of required yam throughout the year, variation exists in quality, with high-quality products found at harvest time (which varies from August to January depending on the variety) and a decline in quality during the period of shortage. One solution is to develop suitable postharvest technology such as wax coating, which has proved efficient for cassava (Atieno et al. 2018).

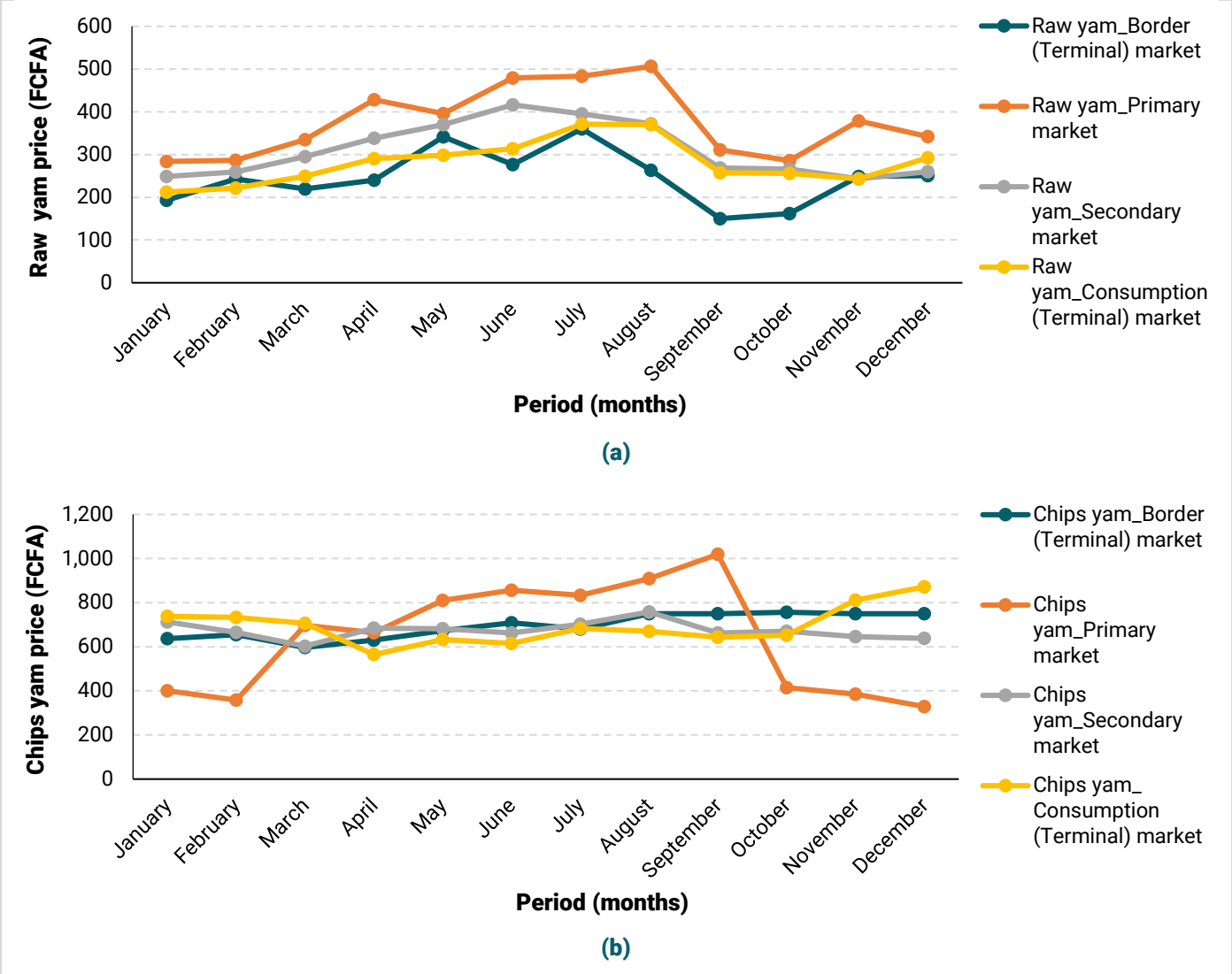
For pounded yam, no good-quality yam exists between April and June in the surveyed areas (Table 2). However, some high-quality varieties identified during the survey from Nigeria (Djiladja harvested in May) or from Copargo, Benin (Idoro harvested in October), are in high demand. However, the production of these varieties is low because of a lack of seed availability and their poor storability, making it difficult to supply the market throughout the year. Accordingly, breeders could invest in developing these varieties (for periods of scarcity) or varieties that can be stored a long time with stable quality, such as Idoro, so that farmers can meet market demand during the lean season.

Yam price variations in markets in response to quality challenges

The yam price varies across time (harvest versus lean periods), location (northern, central, and southern Benin), and by the four types of market: the primary market (producer level), the secondary or collection market (for purchases from producers), and the terminal market (subdivided into border and domestic consumer markets). In all markets, the price of dried yam chips is higher than that of fresh yam (Figure 4). Generally, the fresh yam price (without differentiation for early and late varieties) increases from February to July. Within these general trends, yam varieties can be grouped into three categories based on price seasonality: the first category includes early yam varieties (e.g., Laboko, Efourou, Kodjewe, Dodo), whose price is high at harvest time but then falls. The second category is that of some late varieties (e.g., Kpakara, Aga, Agatou, Ofegui, Kokoro), whose price tends to increase two months after harvest until five to six months of storage. Finally, the third category refers to varieties (e.g., Malanville-Po, Sakata) whose price is constant throughout the year (Figure 5). Specifically for early varieties, the first harvest occurs from the end of July up to September. There is then a large amount of yam on markets, which explains the decrease in price after September. Late-harvested yams, particularly those from the Kokoro group, store better than early-harvested ones. Kokoro is the preferred variety for yam chip production, and its market price typically peaks from June to July.

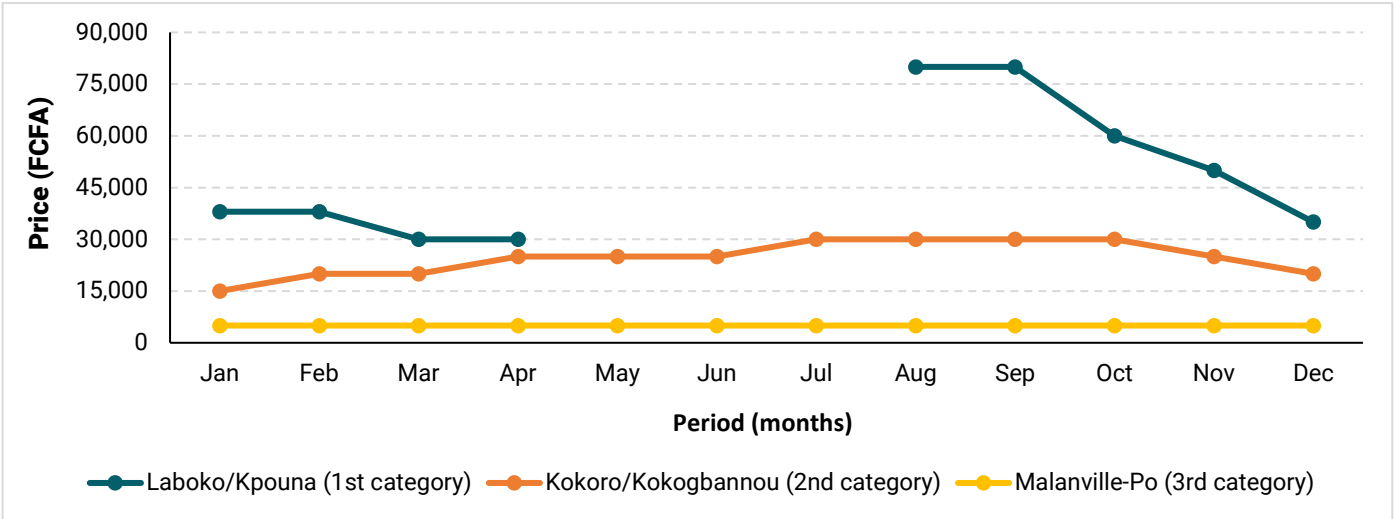
Furthermore, the selling price of certain varieties (e.g., Aga, Kokoro) from the second category as well as culinary quality are low/poor, as revealed by the farmers interviewed. However, most farmers produce them. Indeed, farmers recognize varieties of poor culinary quality but yet produce them. According to the farmers, the logic behind these agricultural practices is a strategy to face price variation, the lean season, and/or climatic risks. Indeed, most farmers plant two groups of yam varieties presenting contrasting price trends and storage behavior. One group consists of early varieties whose price is high at harvest and decreases with storage time; they are poorly storable (Laboko, Efourou, Kodjewe, Dodo). The other group includes late varieties whose price is low at harvest but increases with storage time (Kpakara, Aga, Agatou, Ofegui). No matter how much the price increases over time, the selling price of the first group of varieties always remains higher than that of the second group. To minimize the risk of food and monetary insecurity, some farmers adopt a cultural practice with the two groups of varieties. With the first, the good and most preferred “as good” are sold immediately at harvest time. With the second, the less preferred ones but with high storability are sold later in the year. Thus, depending on the rationale behind the choice of varieties to be produced, we can conclude that all varieties are “good” for farmers for multiple reasons (agronomic, culinary, storability, price, etc.).

As for ordinary fresh yam (Figure 4a), the comparison of trends contrasts with the basic market principles: prices in the primary market are generally higher than in the other markets. A careful reading of the data allows some explanations. Indeed, in most cases, the three types of markets are distant from each other, the primary market being in the rural area (north and center) and the secondary and the terminal markets in the urban centers. The relatively lower price observed in the latter is linked to a bumper harvest and/or the fact that many truck-titans come to dump the yams there at the same time (case of the Dantokpa market), causing prices to fall (DSA 2021). This is supply and demand. Indeed, at the Dantokpa market, when the yam supply is high, the prices are falling as a result, and traders (from the north) are sometimes forced to sell off their products at low prices.



Sources: Direction de la Statistique Agricole, MAEP, Benin, 2023; Survey data, 2024.

Figure 4. Yam price variation in different markets and over a year for raw yam (a) and chips yam (b).



Source: Survey data, 2024.

Figure 5. Price profile by yam category.

Applicable innovative technologies developed for use

New yam technologies developed in Nigeria can be applied for upgrading yam production in Benin (Agre et al. 2022; Aighewi et al. 2015; Aighewi et al. 2014). These technologies cover several areas: the development of seed supply services, new varieties with improved agronomic and culinary traits, and the use of suitable postharvest technologies that enhance fresh yam storability.

Solutions for a healthy seed supply

The development of yam cultivation in Benin must integrate the major constraints identified, including the availability of healthy yam seeds. Thus, the future of this crop depends on the establishment of seed production services using newly developed production techniques, such as the following.

Minisett technique, which is based on the principle that any section (25–30 g) of the tuber can develop buds and sprouting if it has a portion of the periderm (NRCRI 1983; Aighewi et al. 2014).

Microsett/microtuber technique is similar to the minisett technique, with the difference that the sections of the tuber used are smaller (not more than 10 g) than those of the minisett technique (Alvarez and Hahn, 1984; IITA 1985; Otoo 1992).

Semi-autotrophic hydroponics (SAH) technology for producing quantitative and qualitative seed tubers is a new, inexpensive, licensed technology for high-ratio propagation of true-to-type (genetic) virus-free clonal plants (Darkwa et al. 2020).

Solutions for new varieties

The breeding programs initiated many years ago by national and international centers have resulted in the development of new varieties with improved (mainly) agronomic performance. However, some new hybrids have been rejected by producers and consumers because of poor culinary quality. Thus, connections with ongoing yam genetic improvement programs in international research centers and food quality teams should be promoted. The success of these connections was highlighted by the development of some D. alata hybrids (TDa_1510043, TDa_0000194, TDa_1515030, TDa_1520002, and TDa_1520050) intended for pounding by the International Institute of Tropical Agriculture (IITA) (Dansi et al. 2024). Consequently, these varieties are candidates for dissemination to farmers. Furthermore, breeding resilient yam varieties that meet consumers' demand is a current subject that concerns research centers, through which several consortia in Benin must integrate.

Implications for breeders

Yam varieties (early or late) are available year-round, but depend on quality and quantity. However, for pounded yam, which is the most popular consumption form, the varieties used for this purpose have a short shelf life. Breeders are therefore advised to focus their research on yams intended for pounding with better storage capacity. One solution is to cross landraces or hybrids with high pounding potential with those with very high storage capacity.

Implications for key end-products

Major yam end-products are pounded and boiled yam as well as paste (amala) from dried yam chips. Most research aimed at varietal improvement focuses on fresh end-products while varieties intended for yam chips (Kokoro) are neglected. Indeed, among Kokoro varieties/accessions, some have poor processing quality (e.g., browning, yield, dough quality). It is desirable to integrate such landraces (Kokoro) into yam breeding programs.

Conclusions and recommendations

This study highlighted the constraints faced by stakeholders (i.e., farmers, traders, and consumers) related to yam markets in Benin. In short, researchers need to focus on the following:

- Extend the storability of good varieties to at least five months for yam intended for pounding.
- Develop varieties for the scarce period (varieties outside the traditional season).
- Advocate for the adoption of yam varieties specifically developed for low soil fertility, improved storage capability, and superior culinary quality.
- Develop suitable postharvest technologies (i.e., wax coating) that can improve yam shelf life while maintaining quality.
- Establish connections with ongoing yam genetic improvement programs in international research centers, such as IITA.
- Mitigate the risks of food and economic insecurity by promoting the agricultural practice that combines yam varieties with differing qualities in the same plot.

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