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SWEET POTATO PRODUCTION BY PEASANT IN FONDWA, HAITI

PRODUÇÃO DA BATATA-DOCE POR CAMPONESES EM FONDWA, HAITI

PRODUCTION DE LA PATATE DOUCE PAR LES PAYSANS À FONDWA, HAITI

PWODIKSYON PATAT DOUS NAN FONDWA AN AYITI, JAN PEYIZAN YO FÈ SA

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Abstract

Sweet potato (Ipomoea batatas L. (Lam.)) is a staple food crucial for food security in Haiti. This study aimed to characterize the sweet potato production system in the Fondwa region of Haiti, focusing on promoting more sustainable production practices. Data were collected from 39 farmers through semi-structured interviews. They reported the existence of 28 genotypes, although only 12 were identified in the field. The production system is family-based, with occasional hiring of labor. Two key pests, Cylas formicarius and Conoderus vespertus, were identified as significant threats. Productivity ranged from 1.22 to 2.99 Mg ha^{-1}, confirming low expected yields. Farmers earned between HTG 41,000 and 51,000 (approximately USD 410.00 to 510.00) per harvest. Strategies for sustainable development should include the use of adapted genotypes, cover crops, and improvements in soil chemical, physical, and biological fertility, as well as the adoption of agroecological systems.

Keywords: Ipomoea batatas L. (Lam.), peasant agriculture, rural extension, sustainable development.

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Resumo

A batata-doce [*Ipomoea batatas* L. (Lam.)] é um alimento fundamental para segurança alimentar do Haiti. Visando processos de produção mais sustentáveis caracterizou-se o sistema de produção de batata-doce na Região de Fondwa, Haiti. Foram visitados 39 camponeses, onde aplicou-se questionário semi-estruturado. Esses relataram 28 genótipos, porém somente 12 foram identificados no campo. O sistema de produção é familiar, com contratação ocasional de mão de obra. Foram citadas duas pragas de importância, *Cylas formicarius* e o *Conoderus vespertus*. A produtividade apresentou médias variando de 1,22 a 2,99 Mg ha^{-1}, confirmando a expectativa de baixos valores. Os camponeses ganham entre HTG$ 41.000 e 51.000 (entre US$ 410,00 e 510,00) por safra. Estratégias para desenvolvimento sustentável devem ser estudadas, uso de genótipos adaptados, plantas de cobertura, construção da fertilidade química, física e biológica do solo e sistemas agroecológicos são ações que podem ser implementadas.

Palavras-chave: *Ipomoea batatas* L. (Lam.), agricultura camponesa, extensão rural, desenvolvimento sustentável

Résumé

La patate douce [*Ipomoea batatas* L. (Lam.)] est un aliment de base pour la sécurité alimentaire en Haïti. Dans le but de promouvoir des processus de production plus durables, le système de production de la patate douce dans la région de Fondwa, Haïti, a été caractérisé. Trente-neuf agriculteur-paysans ont été visités et un questionnaire semi-structuré a été administré. Ceux-ci ont mentionné 28 génotypes, mais seulement 12 ont été identifiés sur le terrain. Le système de production est familial, avec un recours occasionnel à la main-d'œuvre salariée. Deux ravageurs importants ont été cités, *Cylas formicarius* et *Conoderus vespertus*. La productivité a montré des moyennes variant de 1,22 à 2,99 Mg ha-1, confirmant les faibles rendements attendus. Les agriculteurs gagnent entre 41 000 à 51 000 HTG (soit entre 410 à 510 USD) par récolte. Des stratégies pour un développement durable doivent être étudiées, l'utilisation de génotypes adaptés, des plantes de couverture, l'amélioration de la fertilité chimique, physique et biologique du sol, ainsi que des systèmes agroécologiques sont des actions qui peuvent être mises en ceuvre.

Mots-clés: *Ipomoea batatas* L. (Lam.), agriculture paysanne, extension rurale, développement durable.

Rezime

Patat [*Ipomoea batatas* L. (Lam.)] se yon aliman de baz pou sekirite alimantè an Ayiti. Nan objektif pou ankouraje pwosesis pwodiksyon ki pi dirab, sistèm de pwodiksyon patat nan zòn Fondwa, Ayiti, te karakterize. 39 peyizan agrikiltè te vizite epi yo te reponn yon kesyonè semi-estriktire. Yo te mansyone 28 jenotip, men sèlman 12 te rive idantifye nan jaden yo. Sistèm pwodiksyon yo a se yon sistèm familyal, ak kèk fwa konsa yo anplwaye yon travayè salarye. Yo te site de ensèk nuizib enpòtan, *Cylas formicarius* ak *Conoderus vespertus*. Rannman yo jwenn te an mwayèn ant 1,22 a 2,99 Mg ha-1, sa ki vle di yon pwodiksyon ba. Agrikiltè yo touche ant 41,000 ak 51,000 HTG (ant 410 ak 510 USD) pou chak rekòt. Estrateji pou devlopman dirab dwe etidye; itilizasyon jenotip adapte, plant pou kouvri sòl, amelyorasyon nan fètilite chimik, fizik ak biyolojik sòl la, ansanm ak sistèm agroekolojik yo se aksyon ki pou aplike.

Mo kle: *Ipomoea batatas* L. (Lam.), agrikilti peyizan, ekstansyon riral, devlopman dirab.

Introduction

Sweet potato [*Ipomoea batatas* L. (Lam.)] is a staple food in many developing countries (EMBRAPA, 2021). China leads global production with 70.12%, followed by Africa at 23%, and the Americas contributing 2.7% (FAO, 2021). In addition to being an accessible source of vitamin A, calcium, and ascorbic acid, sweet potato provides more edible energy than other staple foods (OCHIENG, 2019). Cultivated for their underground tuberous roots, they are used for human consumption, animal nutrition, industrial purposes (starch production), and, in some cases, the aerial parts are also consumed (KWAK, 2019).

In the global context of development, food security, and nutrition, sweet potato plays a significant role (LAURIE et al., 2013). Given the economic, social, and environmental challenges faced by food systems, the production of tuberous roots can support the implementation of accessible staple food supply chains, particularly benefiting smallholder farmers and traditional populations (ROESLER et al., 2008).

Arguments for the origin of sweet potato in both the Eastern and Western hemispheres have been presented, including claims of American origin (BARRETT COMPANY, 1918; DE CANDOLLE, 1882; ROULLIER et al., 2013). There are reports that Spanish explorers, after encountering this delicacy on the island of Hispaniola (present-day Haiti and the Dominican Republic), brought sweet potato to Spain, where it became a characteristic dish in some regions (PARDO TOMAS; LOPEZ TERRADA, 1993; KINGSBURY, 1992).

Sweet potato is a primary crop for smallholder farmers in Haiti, despite low yields. In Fondwa, alongside maize and black beans, they form the basis of the peasant economy (JOSEPH et al., 2023). They are cultivated year-round, primarily through the replanting of cuttings obtained from parent plants of the previous harvest (MARNDR, 2016). However, productivity in Haiti is low, averaging 2.23 Mg ha^{-1}, with the Artibonite department being the largest producer, reaching 4.0 Mg ha^{-1} (MARNDR, 2016). In 2016, the sweet potato production area in Haiti covered 49,650 hectares, cultivated in the Northwest, West, Artibonite, and North departments.

The plant is versatile, serving as raw material for food, biofuel, and animal feed. The vines, which contain considerable protein content, are used to feed animal either fresh, dried, or as silage (MONTEIRO et al., 2007; EVANGELISTA et al., 2022). Sweet potato leaves possess antioxidant properties and may aid in the treatment of cardiovascular issues (ISLAM et al., 2002). Orange-fleshed sweet potato, rich in β-carotene, can be used to treat vitamin A deficiency in children (EMBRAPA, 2014). Purple-fleshed tubers offer antioxidant benefits, strengthening immunity and reducing the risk of degenerative and cardiovascular diseases (TERAO, 2023).

The use of tuberous roots deemed commercially unviable by the market (due to shape, size, damage, etc.) can be feasible for starch production or even converted into ethanol (EMYGDIO; CASTRO, 2010; WEIRICH NETO et al., 2023). Sweet potato can yield up to 130 liters of ethanol per ton, compared to 67 liters from sugarcane (EMYGDIO; CASTRO, 2010).

Given the importance of sweet potato as a staple food and its crucial role in the food security and sovereignty of the Haitian people, coupled with its low productivity, there is an urgent need for information to support technical assistance, rural extension, public policies, and international aid initiatives in Haiti.

Methods

This study is part of a teaching and extension project established through an agreement between the Agricultural Mechanization Laboratory of the State University of Ponta Grossa (Lama/UEPG) and the University of Fondwa (UNIF). Over the past five years, Lama/UEPG has been providing distance training to UNIF students, focusing on Rural Extension. This training incorporates discussions on the importance of traditional and ancestral knowledge and employs participatory methodologies to ensure that rural development actions address all pillars of sustainability. Within this context, the current work was proposed and developed, aiming to diagnose the local reality through the application of a semi-structured questionnaire.

Fondwa is a mountainous region with altitudes ranging between 600 and 900 meters, located in the 10th communal district of Léogâne, Haiti, between the coastal cities of Léogâne and Jacmel. Fondwa experiences a Cwb microclimate, characterized as a tropical highland climate with dry winters and hot summers (CLIMATE-DATA, 2021). Temperatures range between 15°C and 27°C, with the lowest recorded temperature being 4°C (PRRNU, 2017). According to the Life Zone Classification, Fondwa is situated in a subtropical highland forest zone (HOLDRIDGE, 1967).

The soils in Fondwa are classified as Ferralitic and Fersialitic according to the Food and Agriculture Organization (FAO) classification, and in the Brazilian classification, they vary from predominantly Neosols and Cambisols, characterized by poor development, to Latossols, exhibiting highly variable chemical properties (BOYER, 1982; BELLANDE, 2009).

Cultivated between 40° North and South latitudes at altitudes of up to 2,700 meters, sweet potato requires temperatures between 15°C and 33°C, with an optimal range of 21°C to 28°C (CIP, 2013; MIRANDA et al., 1995; CIRAD, 2002). High yield rates are associated with a high gradient between daytime and nighttime temperatures (CIRAD, 2002), while temperatures below 10°C adversely affect vegetative growth (CIRAD, 2002). The crop requires 500-600 mm of rainfall during its growth cycle (MIRANDA et al., 1995). In Fondwa, sweet potato is typically cultivated with a planting distance of 20-25 cm between plants and 100 cm between rows, totaling 40,000-50,000 plants per hectare.

This study was conducted from April to November 2022 and comprised three distinct stages. The first stage involved a preliminary informal survey with peasant farmers in Fondwa to identify the sweet potato genotypes being cultivated. This survey was carried out in the main communities of Fondwa, namely Tombe-Gâteau, Piton, Beloc, and Bas-Tonelle.

The second stage focused on determining the productivity of the identified genotypes. In ten agricultural units, five samples of 1 m² were randomly collected. This allowed for the determination of the average yield of the seven identified genotypes. Fresh weight was measured using a KERN scale (Precision balances EG 2200-2 NM, 0.01 g, 2200 g).

The third stage centered on characterizing the predominant production system of the rural units. For this purpose, a semi-structured questionnaire was developed to be administered to local peasants. The questionnaire contained 81 questions covering topics such as: genotypes used, area cultivated, soil preparation and crop management practices, and aspects of sweet potato use and commercialization.

The third stage focused on characterizing the predominant production systems of the rural units. To achieve this, a semi-structured questionnaire comprising 81 questions was designed and administered to local farmers. The questionnaire addressed the following topics: genotypes used, cultivated area, soil preparation and crop management practices, and aspects of sweet potato utilization and commercialization.

The questionnaire was pre-tested with four producers before being administered to 39 sweet potato-producing farmers across the four locations. The selection criteria for participants included accessibility, willingness to take part in the study, and the feasibility of follow-up and data collection during harvest. Data collection was carried out by four agronomists, all recent graduates of the University of Fondwa, who were specifically trained for this task. Notably, two of them were local producers with extensive familiarity with the region and its sweet potato cultivation systems.

Results

Of the total farmers interviewed, 33% were from the Tombe-Gâteau community, the largest region in terms of the number of producers and cultivated area in the region. This was followed by Bas-Tonelle with 25%, Piton with 23%, and Beloc with 19%, the latter being the smallest region with the fewest producers.

The sample of interviewed farmers consisted of 87% men and 13% women. The labor force within the production system is entirely human and family-based. Approximately 26% of family units occasionally hire additional labor. Gender roles define the division of responsibilities in sweet potato cultivation: men undertake physically demanding tasks such as soil preparation, furrowing, transplanting cuttings, weeding, and harvesting, while women contribute by distributing biomass on the soil, assisting in the harvest, and preparing baskets for sale.

Twelve sweet potato genotypes were identified, with the following regional names reported: *Beauregard, Bwadife, Bwafè, Dèyèsenmak, Gwadloupeyen, Gwosavyen, Lawoz, Mòtifye, Sòpa, Sovenouris, Tilikné,* and *Timòpyon*. Additionally, 28 other genotypes were mentioned, which were not cultivated in the interviewed peasants' fields during the year of the study but were recognized as important: *Bisantnè, Tibosan, Toufeleta, Fanmjalou, Tisavyen, Tipoulpoul, Dyòlma, Banboumanyòk, Tikleman, Bouzenkanpe, Tilyann, Podanj, Mòtifye, Chaymilèt, Fanmfouye, Growòch, Tikawòt, Twòppoutè, Banbousalnav, Dyasfora, Tichika, Grennbèf, Tifrany, Grennogisten, Zannoboulin, Kabannbèf, Kayimit,* and *Belanten.*

Peasants mentioned that about 30 years ago, sweet potato was cultivated in a limited manner in the region, predominantly for family consumption, and many local genotypes have since disappeared. In a botanical collection program conducted in Camp Perrin, 180 km from Fondwa, peasants reported 52 local names of sweet potato genotypes; however, during field collection, technicians identified only 30 genotypes (MARNDR, 2016). Germplasm collection from rural properties presents challenges, as two different cultivars in a gene bank may correspond to the same genotype (MOULIN et al., 2012; NEIVA et al., 2011).

Of the 12 genotypes identified, local farmers emphasized five as ancient varieties: *Bwadife, Timòpyon, Sòpa, Bwafè*, and *Laroz*, which have been cultivated for over 25 years. These genotypes are highly valued for their productivity, adaptability to climatic conditions, pest resistance, and ease of obtaining cuttings. In Brazil, the conservation of most sweet potato genotypes is predominantly managed by smallholder farmers and indigenous communities (MOULIN et al., 2012; AUGUSTIN et al., 2000; WEIRICH NETO et al., 2023).

Sufficient productivity data for statistical analysis could not be collected for all genotypes. Productivity data were collected for seven of the twelve reported genotypes: *Bwadife, Dèyèsenmak, Gwadloupeyen, Gwosavyen, Sòpa, Sovenouris,* and *Timòpyon*. For the remaining genotypes, sufficient fields for representative sampling were not found during the harvest period.

When categorizing the cultivated area, three groups were identified: peasants with 0.08 to 0.78 ha (41%), peasants with 0.79 to 1.95 ha (46.2%), and peasants with larger areas, cultivating 1.96 to 5.07 ha (12.8%). Peasants mentioned that most of their neighbors are also involved in sweet potato cultivation, totaling, according to them, 431 peasants in the Fondwa region. On average, peasant agriculturists in Fondwa cultivate up to three sweet potato fields per season, covering an average area of 0.57 ha each, totaling 1.7 ha per year.

The use of mulch is a common practice, with vetiver grass (*Vetiveria zizanioides*) often employed prior to sweet potato cultivation. Sowing typically occurs approximately 60 days before planting. This technique offers considerable benefits, as even within a short timeframe, it enhances soil fertility by improving chemical, physical, and biological properties. Future research should focus on determining the optimal quantity, types, and timing for sowing and managing mulch to maximize its effectiveness.

Regarding the acquisition of cuttings for sweet potato cultivation, it was found that most farmers (85%) obtain this input through purchase, while 12% rely on donations, and only one out of the 39 interviewed producers used self-produced cuttings. Cuttings are predominantly purchased in the Léogâne region, with donations typically made by farmers from Léogâne to those in Fondwa. Notably, the cuttings purchased in Fondwa originate from the previous agricultural season in Léogâne.

Selection criteria, which encompass agronomic, economic, and culinary aspects, play a significant role in the choice of genotypes. Eight agronomic factors were identified as potentially critical in this selection process: growth cycle or precocity, tolerance to water stress at the start of harvest, pest resistance, tolerance to weed competition and intercropping systems, edaphoclimatic adaptability, effective post-harvest conservation, and the morphology of tuberous roots.

The selection of early-maturing genotypes is crucial for peasants, as those with shorter cycles can be harvested before the period of more intense rainfall, resulting in lower loss rates and reduced exposure to pests. Additionally, obtaining more favorable prices at the beginning of the harvest is an additional incentive cited.

The most cultivated genotypes in Fondwa, empirically validated by local farmers, include *Gwosavyen*, *Gwadloupeyen*, *Dèyèsenmak*, *Tiliknè*, and *Sovenouris*. Introduced approximately six years ago, these genotypes are favored for their early maturity, large tuberous roots, and high productivity. Prior to planting, farmers in Fondwa follow specific practices to prepare the cuttings. The cuttings are left to dry (wilt) in shaded areas, a process believed to reduce deterioration after planting. On the planting day, the cuttings are defoliated and trimmed to lengths of about 25 cm, containing three to five nodes each. Farmers typically adopt a planting density ranging from 40,000 to 50,000 plants per hectare.

Regarding soil chemical fertility, over 95% of peasants use crop residues. There are no specific criteria for this use, necessitating studies on characterization, combination, and recommendation as part of the production system management. This practice, along with the use of agroecological systems, can enhance soil fertility, not only chemical but also physical and biological, and improve production (MAZER et al., 2022).

The occurrence of drought periods at the onset of planting represents a significant challenge. In Fondwa, the sweet potato planting season, spanning from February to April, often coincides with water shortages. To mitigate this issue, farmers adopt a soil management system involving tillage and ridge construction. According to the farmers, this practice reduces the risk of tuberous root rot later in the cycle, as the region experiences heavy rainfall and flooding during the harvest period.

Given the absence of infrastructure for water supplementation, sweet potato cultivation is highly reliant on natural climatic conditions. In this context, local farmers play a pivotal role in genotype selection, as there is no official research institution dedicated to this effort. It is essential to identify sweet potato genotypes that are well-adapted to the specific climatic variations of Fondwa and Haiti. Notably, Cuba, which experiences similar climatic conditions, has successfully identified the genotype INIVIT B-50, adapted to regional water stress and achieving productivity levels exceeding 4.5 Mg ha^{-1} under such conditions—a result deemed very favorable by researchers (RODRIGUEZ et al., 2017). Considering the geographical proximity, this genotype presents a promising candidate for testing in Fondwa.

Given Fondwa's mountainous topography, it is essential to implement conservation-oriented management practices. These include the use of soil cover plants (both living and dead), crop rotation, fire prevention, and reduced soil tillage. High-biomass crops, such as *Mucuna aterrima* and *Canavalia gladiata*, could play a vital role in this approach. Additionally, agroforestry practices—such as seeding and transplanting trees and shrubs and preserving native species—offer promising strategies for enhancing water and soil conservation in Fondwa (BLAISE et al., 2024; ROLO et al., 2024).

It was observed that approximately 90% of Fondwa peasants cultivate sweet potatoes either in monoculture or in association with congo beans *(Cajanus cajan)*, maize, or black beans. The most common practice involves using maize and black beans as preceding crops and cabbage (*Brassica oleracea var. capitata*) as a succeeding crop. Cabbage cultivation is strategically employed to capitalize on the residual soil fertility following sweet potato production and serves as a cash crop for the peasants. However, it is crucial to consider that cabbage, being a water and input-demanding crop, requires careful management practices to prevent exacerbating soil degradation.

Given the common practice of cultivating sweet potatoes in association with congo beans, maize, and black beans, it is essential to consider the ability of sweet potato genotypes to interact positively in such arrangements. Approximately 10% of peasants who do not adopt sweet potato cultivation are mostly elderly individuals unable to perform the physical activities required by the crop.

Although two sweet potato seasons are cultivated per year, the second season is practiced by only 10% of the peasants, typically between August and September, with harvesting occurring in February. Sweet potato has emerged as the dominant cash crop in recent years, especially after the January 2010 earthquake. Prior to 2010, coffee was the predominant commercial crop in Fondwa, which was considered a reference area in the country. However, following the earthquake and the destruction of the existing processing unit, peasants in Fondwa abandoned coffee production, eliminating their coffee plantations and intensifying sweet potato cultivation. Sweet potato is now the primary crop for income generation among peasants.

During the crop cycle, 80% of the peasants reported problems with insects. They identified two main insect pests affecting sweet potato, locally called *tiyogann* and *denden*. The first was identified as *Cylas formicarius*. The second resembles like *Agrypnus spp* in the larval stage but resembles *Conoderus vespertinus* in the adult stage. It is possible that both exist in Fondwa. Currently, there are no reports confirming the presence of *Conoderus vespertinus* in Haiti, but since it is present in the United States, it may have been introduced to Haiti in recent years (WILLIS, 2010).

In the larval stage, *Conoderus vespertinus* bores into tuberous roots to feed (WILLIS; ABNEY; KENNEDY, 2010). The damage, which can range from small holes to deep and extensive tunnels, directly affects the final price of the tuber (WILLIS; ABNEY; KENNEDY, 2010). Other insects and

rodents attack sweet potato production in Fondwa but at low intensity, such as the locally called *marocas* (*Phyllophaga spp*, Coleoptera: *Scarabaeidae*). Peasants estimate a 10% loss in production due to these insects.

Pests and insects, such as *Cylas formicarius* and *Euscepes postfasciatus*, represent a global challenge in sweet potato production (CIRAD, 2002). Strategies such as pheromone traps have been effective in controlling *Cylas formicarius* populations, reducing damage by about 25% and increasing production (CHALFANT et al., 1990). These traps can be made from perforated used containers (gallons), with a pheromone suspended inside and liquid soap at the bottom (LAWRENCE et al., 1990; MANRDR, 2016).

The fungus *Beauvaria bassiana* is an effective option for reducing damage caused by *Cylas formicarius* (HLEREMA et al., 2017). The use of larval baits is an alternative for controlling *Conoderus vespertinus* (WILLIS; ABNEY; KENNEDY, 2010).

In Cuba, a study identified the fungus *Metarhizium* as a promising candidate for the biocontrol of Cylas formicarius in sweet potato (BARÓ et al., 2022). In Côte d'Ivoire, the repellent effect of four concentrations of neem (*Azadirachta indica*) extracts on *Cylas formicarius* was tested. The application of 20 cL L^{-1} of leaf extract resulted in 85% repellency (DOUAN et al., 2022). Chemical treatments with insecticides, specifically those containing the active ingredient lambda-cyhalothrin, are also available; when applied to cuttings, they effectively eliminate eggs (MANRDR, 2016). However, only 5% of the interviewed peasants are knowledgeable about these control methods.

Another interesting report concerns the susceptibility of different sweet potato genotypes to insect damage. According to the peasants, genotypes such as *Gwosavyen*, *Gwadloupeyen*, and *Sòpa* tend to have "more holes," indicating higher susceptibility to insect damage. In contrast, genotypes like *Bwadife* and *Mòtifye* exhibit "fewer holes," suggesting a certain level of resistance to insects.

Production is planned to meet both market and family consumption needs. By cultivating various genotypes, peasants demonstrate a preference for certain varieties for commercialization and others for personal consumption. For example, *Bwadife* is a genotype preferred by 84% of peasants for personal consumption due to its favorable taste profile. Peasants describe it using expressions such as "very flavorful," "sweet," "dry," and "firm." In contrast, genotypes like *Gwosavyen and Bisantnè* are less appreciated, often described as "too soft" and "lacking flavor."

Resistance to diseases and pests is an extremely important criterion for sweet potato cultivation. Introducing genotypes from other countries without prior adaptation testing to local conditions risks compromising sweet potato production in the region. An evaluation of pest susceptibility in 55 sweet potato genotypes, accessions, and clones, conducted in 17 field experiments in the United States, revealed that 43 genotypes exhibited significantly less insect damage compared to the *Beauregard* genotype, which was recently introduced in Fondwa (JACKSON et al., 2012).

In South Carolina (USA), researchers observed the interference of spontaneous plants in two sweet potato genotypes, with the Carolina Bunch genotype outperforming *Beauregard* (HARRISON; JACKSON, 2011). This finding underscores the need for testing genotypes cultivated in Haiti. The complexity of sweet potato association with other crops highlights the importance of considering this characteristic in genotype selection (SHEN et al., 2022).

According to this study, the average productivity in Fondwa was 2.06 Mg ha^{-1}. Statistically, the regional productivity was 3.5 Mg ha^{-1}, resulting in an estimated regional production of approximately 1,509 Mg (FAOSTAT, 2021). The unit of sale for sweet potatoes is the basket, with an approximate

weight of 40 kg. At the time of sale, tuberous roots are categorized into large, medium, and small, each with differentiated prices. In 2022, peasants reported that when sold directly on the property, a basket of large tuberous roots was sold for HTG 1,750 (Haitian Gourdes), or USD 17.50, while small roots were sold for HTG 1,000 or USD 10.00. Roots damaged by rodents or insects are not purchased.

During the research season, a peasant sold an average of 29 baskets of sweet potatoes, earning between HTG 41,000 and 51,000, or approximately USD 410.00 to 510.00. Most peasants (64%) stated that the selling price of the basket is higher at the beginning of the season. This explains their preference for early-maturing genotypes, even if these genotypes do not produce the highest yields.

Sweet potato production in Fondwa represents 2.7% of Haiti's total production (FAO, 2021). With a production of 42,002 Mg in 2019, Haiti was the second-largest producer in the Caribbean region, after Jamaica (FAO, 2021). However, comparing Haiti's production with that of the Dominican Republic in 2021, it is notable that despite Haiti's production area being four times larger, the Dominican Republic's production was similar to Haiti's (FAO, 2021).

It was found that 30% of peasants choose to deliver their production to local market points, while 70% prefer to sell to buyers who collect directly from the property. Of the 30% of peasants who sell off the property, 69% deliver to local markets, such as Tombe-Gâteau, the main market in the 10th district of Léogâne, from where sweet potato is redistributed, mainly to the capital, Port-au-Prince. Additionally, 14% of the production is sold in the Duffort market, while the remaining 17% is sold in the cities of Gressier and Jacmel.

Peasants reported that the selling prices in Duffort and Port-au-Prince are the highest. However, despite being aware of this price disparity, the main limitation lies in transportation, which forces peasants to sell predominantly in the local market. Establishing an association or cooperative, which could begin with the acquisition of a transport vehicle, could be a viable public policy option.

After harvest, the aerial parts of sweet potatoes are used as animal feed, which helps reduce pest populations affecting the crop. It is worth noting that, although the use of sweet potato aerial parts for human consumption is practiced in some countries, it is not common in Haiti. Strategies such as adopting good cultural practices, including proper soil management, plant spacing, weed control, correct harvest timing, and the selection of less susceptible genotypes, are effective alternatives for reducing insect damage (CHALFANT et al., 1990).

Post-harvest conservation is considered important, although 70% of peasants report that commercialization occurs on the same day as harvest. Part of the harvest is designated for personal consumption, staggered over a period of up to ten months. According to the peasants, the *Bwadife* genotype can remain in the soil for this duration without deterioration or insect attacks. This characteristic explains why 90% of the peasants choose it for personal consumption.

Another important characteristic is the market value a genotype can achieve. The visual characteristics of tuberous roots, including shape and absence of surface defects, are crucial. Additionally, the attractiveness of a genotype can be influenced by the mass of the tuberous roots, considering not just size but also dry matter content. Aspects such as taste, shape, and flesh color also play significant roles in determining commercial value. For example, the *Sòpa* genotype, with its light orange flesh, is one of the most widely produced genotypes by peasants. More scientific research should be conducted for characterization, as orange flesh indicates the presence of β-carotene, which is beneficial for human nutrition.

When asked about sweet potato processing, the peasants reported the existence of products

such as bread, juice, and flour. However, these processes are uncommon, with a preference for direct field sales on the day of harvest. In this context, it is imperative to promote discussions addressing processing options. For example, a study in Kenya analyzed consumers' willingness to pay for orange-fleshed sweet potato juice and found that rural consumers were willing to pay premiums of up to USD 2.22 L^{-1}(OWUOR et al., 2023).

These results highlight the opportunity for peasants to increase their income through the transformation of their production. Generating value-added products through agro-industries, combined with agroecological production systems, can be key to achieving agricultural sustainability (MAZER et al., 2022). In the case of sweet potatoes, numerous processing options can be explored due to their high starch content (WEIRICH NETO et al., 2023).

Peasants report that, culturally, sweet potato plays a significant role in mystical practices in Hait. Some *loás* (spirits in the Vodou religion) are known to appreciate roasted sweet potato (*patat boukannen*), with *Kouzen Zaka* being particularly highlighted. *Kouzen Zaka* is considered the protector of Haitian agriculture and is revered in a special way by peasants who adhere to Vodou. In the Catholic religion, he is syncretized as Saint Isidore the Laborer.

Kouzen Zaka is venerated as the *loá* of agriculture and harvest, and is also recognized as a hardworking *loá*. His responsibilities include protecting fields, promoting bountiful harvests, and ensuring agricultural prosperity. In gestures of gratitude, peasants prepare offerings composed of roasted sweet potato, roasted corns, roasted peanuts, coconut tablets, dried coconuts, cassavas, and *doukounou* (a traditional Haitian dish made from corn).

Sweet potato also composes typical dishes, the most famous being "*tom-tom*," which can be made with breadfruit or sweet potato. In the sweet potato version, the tubers are boiled in salted water and then mashed in a mortar. In daily life, peasants reported that the most common preparation is frying (43%), followed by mixing with rice and legumes (29%), roasting directly over fire (12%), use in broths (3%), and about 13% reported using sweet potato in bread and cakes (DESSALINES, 2008). This diversity highlights the versatility of sweet potato in Haitian cuisine, attesting to their cultural and food security importance.

Finals Considerations

Sweet potato is the primary cash crop in Fondwa. The production chain faces several issues, which are evident in the productivity, ranging from 1.22 to 2.99 Mg ha^{-1}. Compared to other Caribbean countries, productivity in Haiti is considerably low. Simple research and rural extension actions could support discussions and present parsimonious solutions.

It is urgently recommended to establish nurseries for cuttings production. Studies and practices of soil and biodiversity conservation management, such as soil cover, crop rotation, no-till farming, and agroecological production systems, should be encouraged for research and adoption by peasants. In Brazil, studies have demonstrated yields of 38 Mg ha^{-1} using "creole" genotypes and agroecological systems, suggesting the possibility of knowledge exchange (SILVA, 2023).

Considering that over 95% of peasants use manure, it would be prudent to study this fertilizer, including optimal doses and combinations. Improving the genetic enhancement and edaphoclimatic adaptation of local genotypes, rather than importing varieties from other regions or countries, is a valuable alternative that must be considered. The local genotype *Sòpa*, with its light orange flesh and

high productivity as reported by peasants, deserves special attention as it could play a crucial role in combating food insecurity in Haiti.

Regarding insect attacks, a varietal effect was observed in the infestation by *Cylas formicarius*, with the *Bwadife* genotype being the least affected. This genotype is highly valued by peasant producers, indicating that it warrants further study. Practices such as using pest-free plant material, crop rotation, incorporating plant residues into the field after harvest, and identifying less susceptible genotypes could contribute to increase productivity. The use of pheromone traps to mitigate pest populations has already been reported as effective (CHALFANT et al., 1990). It is suggested that peasants consider transforming their production by focusing on water and soil conservation, agroecological production systems, and more sustainable agriculture.

It is crucial for the University of Fondwa to establish a research and rural extension program dedicated to sweet potato cultivation. This program should allocate time and land for experiments and train technicians to provide technical assistance focusing on this crop.

Conclusions

The primary method of obtaining sweet potato cuttings is through purchase (85%), followed by donation (12%) and self-production (3%). The labour force in the production system is entirely human.

Haitian peasant producers consider eight criteria for selecting the genotype to be used: precocity, tolerance to water stress at the beginning of harvest, pest resistance, resistance to weed competition and intercropping, soil adaptability, good post-harvest conservation, and the morphology of tuberous roots.

During the agricultural season from April to November 2022 in Fondwa, Léogâne-Haiti, 12 sweet potato genotypes were identified and locally recognized as: *Beauregard, Bwadife, Bwafè, Dèyèsenmak, Gwadloupeyen, Gwosavyen, Lawoz, Mòtifye, Sòpa, Sovenouris, Tilikné,* and *Timòpyon*. Another 28 genotypes were mentioned by the peasants but were not cultivated in the fields during this season.

The productivity characterization of seven genotypes (*Gwosavyen, Gwadloupeyen, Sòpa, Bwadife, Dèyèsenmak, Timòpyon,* and *Sovenouris*) revealed that sweet potato productivity in Fondwa is notably low, with an average yield of 2.06 Mg ha^{-1}, ranging from 1.22 to 2.99 Mg ha^{-1}.

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