RESEARCH ARTICLE Agricultural Science Digest, Volume 45 Special Issue: 169-178 (November 2025)

# Indigenous Knowledge, Farming Practices and Production Challenges for Cocoassié (*Dioscorea praehensilis* Benth.): Semi-cultivated Yam Intercropped with Cocoa

Brou Claude Kouame[1], Chia Michelle Valérie Angui[1], Any Olivier Komenan[2], Raoul Sylvère Sie[1]

10.18805/ag.DF-692

## ABSTRACT

**Background:** A semi-wild yam, *Dioscorea praehensilis* locally called 'cocoassié 'in Côte d'Ivoire significantly alle*via*tes poverty and enhances household nutrition in several West and Central African countries. Despite its economic and social importance and potential to improve food security, it remains scientifically overlooked and underutilized.

**Methods:** Using participatory rural appraisal (PRA) tools and techniques, 31 villages in eastern, midwestern and southwestern Côte d'Ivoire, selected according to the importance of *D. praehensilis* production, were surveyed. Information on using and managing *D. praehensilis* diversity and related folk taxonomy, agricultural practices and production constraints was collected and analyzed. The diversity of *D. praehensilis* was assessed using the Shannon Weiner diversity index (H'), Pielou's evenness index (E) and Margalef species richness index (d).

**Result:** By synonymy, 18 landraces of *D. praehensilis* were identified. They were divided into four groups. Stem spine density, tuber root spine density and tuber flesh color are the main morphological characteristics used by farmers to describe the four groups of *D. praehensilis*. The Shannon diversity index (H'=1.30), equitability (0.72) and Margalef species richness (0.65) showed moderate diversity and distribution in the study areas. Farmers reported a decline in *D. praehensilis* production due to several factors, mainly limited rainfall (30.73%), high tuber flesh oxidation (18.7%) and short post-harvest self-life (15.46%). The most common storage method is pit storage (92.76%). In all study areas, *D. praehensilis* has a high food value and is important to food security.

**Key words:** *Dioscorea praehensilis,* Indigenous knowledge, Participatory rural appraisal survey, Production challenges.

## INTRODUCTION

*Dioscorea praehensilis* Benth. is a diploid species (2n = 40) and the most widely grown wild and semi-cultivated yam, playing a crucial role in enhancing food security and alle*via*ting poverty in many rural areas of West and Central Africa (Dansi *et al.,* 2013; Ngelinkoto *et al.,* 2021). When other cultivated yams and crops are unavailable, *D. praehensilis* tubers reach physiological maturity, offering farmers essential sources of starch, protein, minerals and vitamins (Songuimondenin *et al.,* 2018; Ngelinkoto *et al.,* 2021). It also enhances the diversity of cultivated yams, specifically *D. rotundata* and *D. cayenensis*, through ennoblement (Scarcelli, 2015). Wild *D. praehensilis* is used in traditional medicine to treat male sterility, colic, malaria and mystical practices (Tostain *et al.,* 2003).

In Côte d'Ivoire, semi-cultivated *D. praehensilis* is commonly known as "cocoassié".

This yam is grown in a traditional agroforestry system and is often intercropped with cocoa and coffee. *D. praehensilis* production, consumption and marketing are restricted to the cocoa and coffee belt, largely because of its short postharvest shelf life. Knowledge and information on *D. praehensilis* in Côte d'Ivoire are scant. There is limited information regarding farmers' views on diversity, local classifications, production constraints, post-harvest conservation techniques and farm management practices related to *D. praehensilis*. We do not know any studies focusing on indigenous knowledge regarding *D. praehensilis.* However, farmers' knowledge is crucial for sustainable agriculture amid climate change. Small farmers have kept traditional knowledge of *D. praehensilis* yam which is essential to managing this vital resource. This study aimed to improve the use of *D. praehensilis* in Côte d'Ivoire. It did so by compiling scientific data. It had four goals: (i) to examine the diversity of *D. praehensilis*;

[1]Department of Natural Sciences, Nangui Abrogoua University, Unit of Phytotechny and Genetic Improvement, 02 BP 801 Abidjan 02 (Côte d'Ivoire).
[2]Department of Agroforestry, Jean Lorougnon Guédé University, BP 150 Daloa (Côte d'Ivoire).

**Corresponding Author:** Brou Claude Kouame, Department of Natural Sciences, Nangui Abrogoua University, Unit of Phytotechny and Genetic Improvement, 02 BP 801 Abidjan 02 (Côte d'Ivoire). Email: kbrouclaude@gmail.com

**How to cite this article:** Kouame, B.C., Angui, C.M.V., Komenan, A.O. and Sie, R.S. (2025). Indigenous Knowledge, Farming Practices and Production Challenges for Cocoassié (*Dioscorea praehensilis* Benth.): Semi-cultivated Yam Intercropped with Cocoa. *Agricultural Science Digest*. **45 (Special Issue):** 169-178. doi: 10.18805/ag.DF-692.

**Submitted:** 05-11-2024 **Accepted:** 25-02-2025 **Online:** 22-04-2025

(ii) to find out how farmers identify its varieties; (iii) to pinpoint production challenges and (iv) to record farmers' methods for storing tubers. To achieve these goals, several ethnobotanical surveys were conducted through the cultivation areas in Côte d'Ivoire. The findings reported here will further guide genetic diversity studies on this crop and help formulate sustainable promotion and management strategies.

## MATERIALS AND METHODS

This study was carried out from August 2022 to November 2023 in the three main *D. praehensilis* production zones identified by Digbeu *et al*. (2009) : The eastern, central-western, and south-western regions. These regions are characterized by high production volume and diversity (Fig 1). The east zone includes Adzopé and Abengourou, with a climate featuring semi-deciduous forest and preforest savannah, highly leached ferrallitic soils, annual rainfall of 875-1,910 mm and an average temperature of 26.7°C. The central-western zone, comprising Daloa and Vavoua, experiences yearly rain between 800 and 1,400 mm in its semi-deciduous forests and moderately leached soils. The southwestern zone encompasses Soubré and Méagui, characterized by temperatures ranging from 25°C to 28°C and rainfall of 1,200 to 1,400 mm and features highly leached soils and dense forests. Table 1 lists surveyed localities and their administrative locations (subprefecture, department, region).

Data were gathered using participatory rural appraisal methods such as interviews and field visits, based on Assogba *et al*. (2015). The focus was on producers socioeconomic traits, landrace diversity, farming methods, production challenges and post-harvest practices. Local leaders aided the process by organizing farmer meetings and providing translators. Snowball sampling was used to select the respondents (N' Danikou *et al.,* 2015). All analyses were performed using XLSTAT 2016.

## RESULTS AND DISCUSSION

### Socio-demographic characteristics of *D. praehensilis* farmers

Of the 560 D. *praehensilis* producers surveyed, 98.74% were men with 1 to 3 wives. Their households had 4 to 22 members. They belong to five ethnic groups: Abron, Agni, Abbey, Attié, and Baoulé. The Agni are the most common, at 57.80%. The *D. praehensilis* farmers interviewed have a shallow level of education. Most (76.34%) have never been to school. Only 2.6% attended secondary school. The rest (21.06%) attended primary school (Fig 2A). They had no training or support in cultivating *D. praehensilis*. The main activity of these respondents in all study areas was farming (97%). Some farmers had off-farm income-generating activities such as trade and civil service. The age data show that 6.07% of respondents were young (age<35). 53.26% were adults (35<age<50). 40.67% were old (age>50). The mean age was 48 years (Fig 2B). The farmers' experience in *D. praehensilis* cultivation ranged from 7 to 60 years, with a mean of 19 years.

*D. praehensilis* yam is mainly grown by men because they own the cocoa and coffee plantations where *D. praehensilis* is intercropped. This observation confirms the results of studies in Togo and Ghana (Gnamkoulamba *et al.,* 2002). Sixty years of experience cultivating *D. praehensilis* has confirmed the idea of recent traditional selection methods proposed by Zoundjihekpon (1993) and Hamon (1988). On the other hand, the cultivation of *D. praehensilis* in Côte d'Ivoire seems to be more recent than in Ghana, from where it is believed to have been introduced.

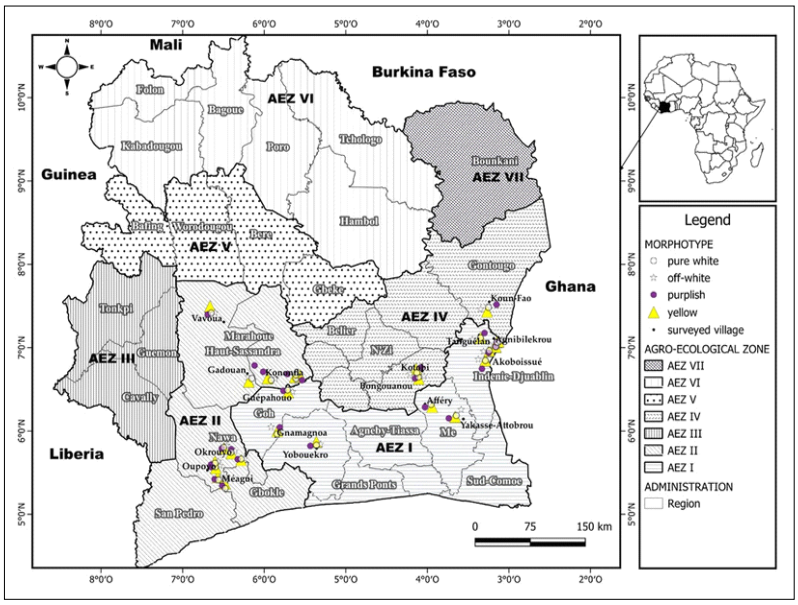



**Fig 1:** Survey sites and distribution of D. *praehensilis* morphotypes.

**Table 1:** Surveyed villages and their administrative location.

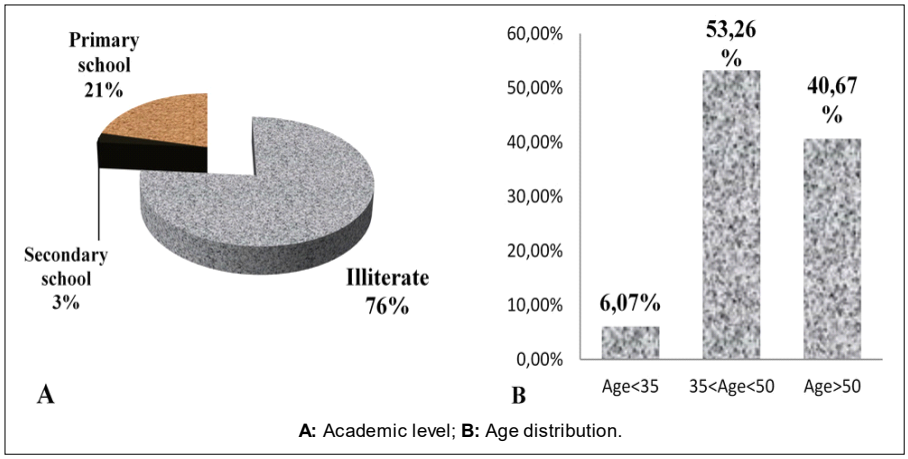
| Villages | Subprefecture | Departement | Region |
|---|---|---|---|
| Kotokoso | Damé | Agnibilékro | Indénié-Djuablin |
| Massakro | Damé | Agnibilékro | Indénié-Djuablin |
| Brahimakro | Damé | Agnibilékro | Indénié-Djuablin |
| Sirikikro | Damé | Agnibilékro | Indénié-Djuablin |
| Manzanoua | Akoboissué | Agnibilékro | Indénié-Djuablin |
| Siakakro | Akoboissué | Agnibilékro | Indénié-Djuablin |
| N'guessankro | Tanguelan | Agnibilékro | Indénié-Djuablin |
| Kouamékro | Tanguelan | Agnibilékro | Indénié-Djuablin |
| Anokikro | Koun-Fao | Koun-Fao | Gontougou |
| Assindi | Koun-Fao | Koun-Fao | Gontougou |
| Robert-Porte | Oupoyo | Méagui | Nawa |
| PetitBondoukou | Oupoyo | Méagui | Nawa |
| Krohon | Méagui | Méagui | Nawa |
| Touagui | Méagui | Méagui | Nawa |
| Gnititouagui | Méagui | Méagui | Nawa |
| Tekessi | Nafana | Prikro | Iffou |
| Kouassikro | Nafana | Prikro | Iffou |
| Louah | Diégonéfla | Oumé | Goh |
| Kouaméfla | Diégonéfla | Oumé | Goh |
| Kononfla 1 | Kononfla | Sinfra | Marahoué |
| Konanbokro | Bazré | Sinfra | Marahoué |
| Krofoinsou | Krofoinsou | Botro | Gkékè |
| Affery | Affery | Adzopé | Mé |
| Abongoua | Yakassé-Attobrou | Adzopé | Mé |
| Yakassé-Attobrou | Yakassé-Attobrou | Adzopé | Mé |
| Grand-Yapo | Grand-Yapo | Agboville | Agnéby-Tiassa |
| Batékro | Gueyébly | Duekoué | Guemon |
| Kohondoukro | Gadouan | Daloa | Haut Sassandra |
| Vaafla | Seitifla | Vavoua | Haut Sassandra |
| Gnamanouan | Gagnoa | Gagnoa | Loh-Djiboua |
| Yobouékro | Divo | Divo | Loh- Djiboua |

### *D. praehensilis* folk taxonomy and classification

Farmers in the study know *D. praehensilis* by different names depending on their sociolinguistic group. Within each sociolinguistic group, there are several indigenous names. As a result, 18 cultivars were recorded in all the study sites. The local and generic names of *D. praehensilis* cultivars and the farmers' criteria for categorizing and naming cultivars by ethnic group surveyed in Côte d'Ivoire are presented in Table 2. Globally, by combining correspondence analysis between cultivar names with their main characteristics described by farmers, the 18 inventoried cultivars could be broadly classified into four main morphotypes. Table 3 summarizes the *Dioscorea* genus descriptors used by farmers to name a cultivar. In all the villages studied, farmers frequently used phenotypic characteristics related to tubers (48.60%) and stem (40.90%) and less frequently the descriptors related to inflorescences (9.42%) and leaves (1.08%) to recognize, identify and classify or describe *D. praehensilis* landraces. Identification of landraces based on these characters varied among sociolinguistic groups. Furthermore, there was a significant difference in the phenotypic markers used to characterize these cultivars within each sociolinguistic group. This suggests that individuals within the same sociolinguistic group may differ in the criteria they use to characterize landraces ($\chi^2$=149.482; p<0.05). A factorial correspondence analysis (Fig 3) showed that Agni and Baoulé farmers named their *D. praehensilis* landrace by referring to the density of spines on the stem, the color of the tuber flesh and the presence of spines on the tuber roots. *D. praehensilis* landraces are defined by the Abron ethnic group in terms of stem spine density and tuber flesh color. The Abbey ethnic group distinguishes cultivars based on flowering type and tuber shape. The Attiés rarely use phenotypic characters to identify *D. praehensilis* landraces. They refer to them under the generic name "cocoassié". 18 recorded *D. praehensilis* morphotypes were grouped into four classes based on tuber flesh color: pure white, yellow,

spotted white and purple (Fig 4). The white morphotype includes cultivars with irregularly shaped tubers that develop an irregular shape and pure white flesh color. The stem is densely spined and colored at the base. The off-white morphotype usually has cylindrical tubers that are smooth on the rootlets and have either mottled purple or yellow flesh. The purple morphotype consists of elongated or rounded tubers with many rootlets and purple flesh. The yellow-fleshed morphotypes can be either completely yellow or have a mottled red appearance. All four morphotypes have very similar characteristics in their aerial parts, including leaves and stems and in their reproductive structures, such as inflorescences. Because of this similarity, it is difficult to distinguish them by these characteristics.

Farmers classified *D. praehensilis* landraces into four categories based on the color of the tuber flesh pure white, spotted white, yellow and purple. Farmers also use phenotypic traits such as stem spine density, stem color and spine presence on tuberous roots to name and classify *D. praehensilis* landraces. Farmers in the study area, particularly from the Agni, Abron and Baoulé ethnic



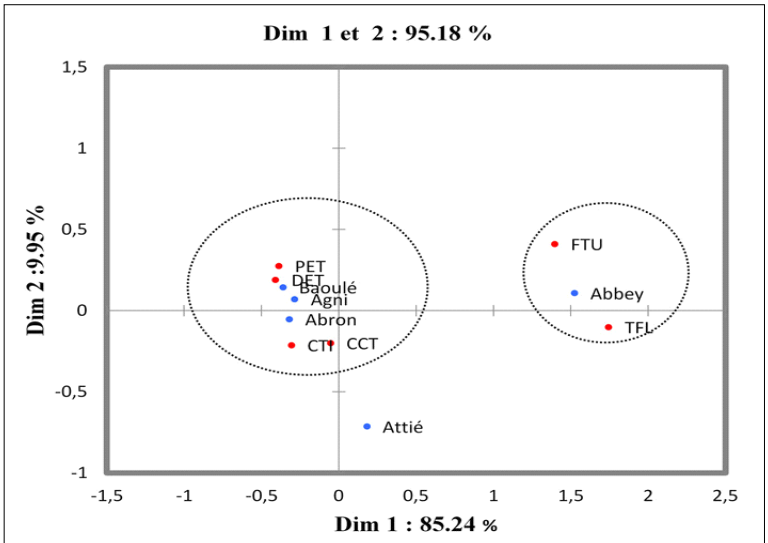

**A:** Academic level; **B:** Age distribution.

**Fig 2:** Respondents' socio-demographic profile.

**Table 2:** *D. praehensilis* cultivars found in the study area, folk taxonomy and Characteristics.

| Morphotypes | Folk taxonomy | Ethnic group | Signification | Description |
|---|---|---|---|---|
| Pure white | cocoassié assôbayrê | Agni | As the king of yams | The stem is densely spined and coloured at the base, with spines also present on irregularly shaped tubers that have pure white flesh. |
| | cocoassié oufoué gnêin | Baoulé | Tubers with pure white flesh | |
| | cocoassié foufoué | Agni | Tuber with flesh | |
| | cocoassié fiman | Abbey | Tuber with white flesh | |
| Spotted white | cocoassié bolué | Agni | Similar to wild yam | Cylindrical tubers that have smooth rootlets without any spines. The flesh of the tubers is either mottled purple or yellow. |
| | cocoassié wondon | Abron, Agni | Yam is in an intermediate state. | |
| | cocoassié Tê | Agni | Subpar yam | |
| | Cocoassié biman | Abbey | Tubers with blacked flesh or skin | |
| | cocoassié kpa | Baoulé | High-quality yam | |
| | cocoassié démé | Agni | Sustaining yam | |
| | cocoassié lokpa | Baoulé | Precocious Yam | |
| | cocoassié koffi-kan | Baoulé | Yam Introduiced by Koffi-kan | |
| | cocoassié kôcoumlô | Abron | Famine yam | |
| | Cocoassié blé | Baoulé | Colored flesh yam | |
| Purplish | cocassié affouênouan | Baoulé | Yams harvested annually | Tubers are elongated or rounded, covered with dense rootlets and have purple flesh. |
| | cocoassé blé | Agni, Baoulé | Colored flesh yam | |
| Yellow | cocoassé cocomiséné | Agni | Yams are grown under cocoa plantations. | Tubers can have either yellow flesh or flesh with red specks. |
| | cocoassié kongbé | | Yam similar to Koungbé | |
| | cocoassié ôklê | Agni, Baoulé | Yam with colored flesh | |

groups, have developed a good knowledge of *D. praehensilis*. Tuber flesh color, spine development on tuber roots and spine density on the stem are stable traits that better characterize *D. praehensilis* landraces. Farmers indicated that stem color and tuber shape, are less useful for distinguishing landraces because these traits are affected by environmental factors. The linguistic polymorphism observed in this study could lead to confusion about the diversity of *D. praehensilis*. This is because different landraces may have the same local name and one may be known by several local names (Adoukonou-Sagbadja *et al.,* 2006). Therefore different landraces can share the same name and other names can know a single landrace among the 18 local landraces identified by farmers. Otabo *et al.* (2016); Agre *et al.* (2015) and Kombo *et al.* (2012) have highlighted that homonyms and synonyms are also found in other tuber crops, including cassava. In addition, *D. praehensilis* diversity is significantly lower than that of *D. cayenensis* and *D. rotundata* in Côte d'Ivoire (Zoundjihekpon, 1993; Hamon, 1988). This difference may be due to more recent traditional selection practices.




CCT: Tuber flesh color; PET: Spines on rootless; TFL: Types of flowering; DET: Spines density on stem; CTI: Stem color; FTU: Tube shape.

**Fig 3:** Factorial correspondence analysis linking ethnic groups and *dioscorea* characters used to describe *D. praehensilis*.

**Table 3:** Number of respondents using *Dioscorea* gender terms by sociolinguistic group.

| Ehtnic group | Abron | Abbey | Agni | Attié | Baoulé | Total |
|---|---|---|---|---|---|---|
| **Stem-related descriptor** | | | | | | |
| Stem color | 30 | 3 | 28 | 1 | 22 | 84 |
| Spines on stem | 30 | 8 | 28 | 7 | 22 | 75 |
| Stem spines density | 8 | 2 | 10 | 0 | 8 | 28 |
| Spines forms | 0 | 0 | 0 | 0 | 0 | 0 |
| Spines color | 2 | 0 | 2 | 0 | 0 | 4 |
| **Tuber-related descriptor** | | | | | | |
| Tubers shape | 0 | 10 | 10 | 0 | 6 | 26 |
| Tubers aspect | 5 | 3 | 0 | 0 | 8 | 16 |
| Rootlets on tuber | 5 | 6 | 0 | 0 | 15 | 26 |
| Spiny tubers rootlets | 10 | 0 | 20 | 0 | 18 | 48 |
| Tuber flesh color | 30 | 5 | 30 | 16 | 30 | 111 |
| **Flowers related descriptor** | | | | | | |
| Male flowers | 0 | 15 | 5 | 0 | 2 | 22 |
| Female flowers | 0 | 15 | 5 | 0 | 2 | 22 |
| **Leaves related descriptor** | | | | | | |
| Leaf forms | 0 | 0 | 0 | 0 | 5 | 5 |
| Leaf color | 0 | 0 | 0 | 0 | 0 | 0 |

**Diversity of *D. praehensilis* across surveyed regions in Côte d'Ivoire**

A summary of the diversity indices and the number of cultivars in the surveyed villages is presented in Table 4. The results show that *D. praehensilis* diversity distribution in the study area is uneven. Shannon's diversity index ranges from 0.84 to 1.15 at the regional level, while Pielou's evenness ranges from 0.77 to 0.88. Diversity is highest in the East region (H'=1.15), closely followed by the Midwest (H'=1.11). The Southwest region has slightly lower diversity (0.84) than the other regions. All seven cultivars identified were found in the eastern part of Côte d'Ivoire. Dédia, Abongoua, Assindi, Kotosso and Massakro are the five villages with the highest diversity. The Shannon diversity indices range from 2.034 to 2.389. The villages have a moderately equitable distribution of cultivars, with all equitability index values above 0.85. Ottawa has the lowest varietal diversity (H'=0.503).

Shannon's diversity index, equitability and Margalef species richness indices revealed moderate genetic diversity among *D. praehensilis* morphotypes in the regions studied. *D. praehensilis* diversity recorded in our study is significantly lower than that reported by Adewum *et al.* (2021) in Ghana. This suggests that farmers in Côte d'Ivoire made less intensive traditional selections during the domestication of *D. praehensilis.* Eastern Côte d'Ivoire has the greatest diversity. This region plays a crucial role in the production, consumption and market of *D. praehensilis.* The east region is likely where *D. praehensilis* was domesticated, as noted by Hamon (1988). The limited diversity of *D. praehensilis* in the Southwest and Midwest may be due to its recent arrival as a result of population movements. The heterogeneity of *D. praehensilis* diversity

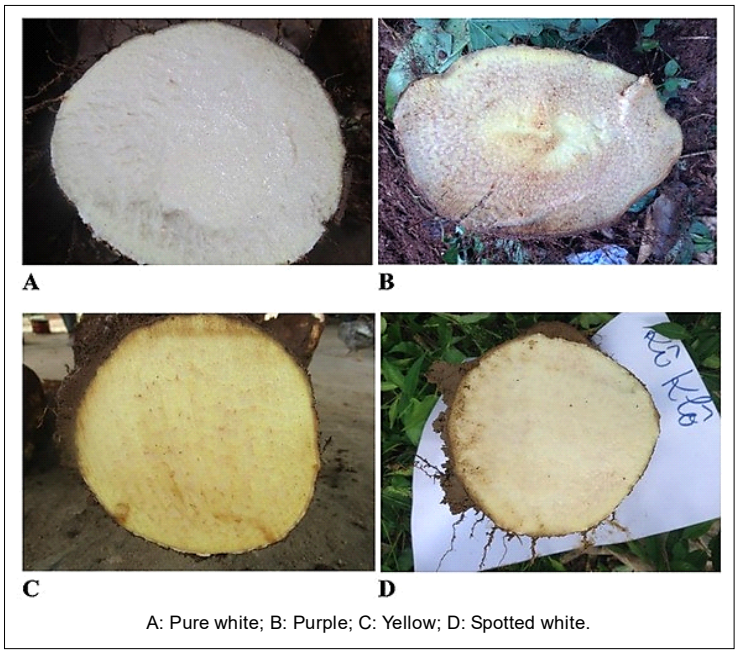
**Table 4:** Diversity of *D. praehensilis* in the regions covered by the study.

| Regions | Villages | Number of cultivars | Shannon-Weiner diversity index (H') | Pielou's equitability index (E) | Margalef's diversity index (D) |
|---|---|---|---|---|---|
| East | Assindi | 7 | 2,214 | 0,856 | 1,872 |
| | Massakro | 6 | 2,116 | 0,818 | 1,764 |
| | Ladjikro | 2 | 0,971 | 0,97 | 0,921 |
| | Kotokosso | 5 | 2,118 | 0,912 | 1,482 |
| | Abongoua | 6 | 2,389 | 0,924 | 1,74 |
| | Yakassé-Attobrou | 3 | 1,534 | 0,968 | 1,13 |
| | N'guessankro | 4 | 1,716 | 0,858 | 1,514 |
| | Siakakro | 2 | 1 | 1 | 0,957 |
| | Manzanouan | 4 | 1,561 | 0,78 | 1,395 |
| | N'zanfouenou | 4 | 1,635 | 0,817 | 1,322 |
| | Damé | 6 | 1,168 | 0,452 | 1,306 |
| | Affery | 3 | 1,502 | 0,947 | 1,048 |
| | Mean | | 1,15 | 0,88 | 0,935 |
| Midwest | Gnamagnoa | 3 | 1,411 | 0,89 | 0,85 |
| | Louha | 5 | 1,932 | 0,83 | 1,34 |
| | Yobuekro | 4 | 1,803 | 0,9 | 1,3 |
| | Dédia | 5 | 2,034 | 0,87 | 1,34 |
| | Konanbokro | 3 | 1,515 | 0,95 | 0,94 |
| | Yassouakro | 4 | 1,676 | 0,83 | 1,3 |
| | N'guessankro | 5 | 1,805 | 0,78 | 1,4 |
| | N'golankro | 2 | 0,977 | 0,97 | 0,7 |
| | Kouaméfla | 3 | 1,272 | 0,8 | 0,91 |
| | Vaafla | 4 | 1,528 | 0,76 | 1,33 |
| | Mean | | 1,10 | 0,85 | 0,727 |
| South-west | Robert-Porte | 5 | 1,8 | 0,775 | 1,89 |
| | Petit-bondoukou | 2 | 0,845 | 0,845 | 0,957 |
| | Okrouyo | 4 | 1,305 | 0,652 | 1,429 |
| | Méagui | 3 | 1,459 | 0,92 | 1,16 |
| | Gnititouagui | 3 | 1,049 | 0,662 | 1,17 |
| | Nobert-Carrefour | 4 | 1,886 | 0,943 | 1,633 |
| | Ottawa | 2 | 0,503 | 0,503 | 1,018 |
| | Kpada | 2 | 0,918 | 0,918 | 1,079 |
| | Mean | | 0,84 | 0,77 | 0,56 |

can be attributed to two main factors. The first is human influence. Farmers select *D. praehensilis* landrace based on agronomic traits such as high yield, early maturity, good production and organoleptic traits such as taste and ease of cooking. The second factor is favorable agroecological conditions, including consistent and abundant rainfall and moderate humidity, which promote the growth and development of various yam species, including *D. praehensilis.*

**Constraints related to *D. praehensilis* production**

*D. praehensilis* production faced biotic and abiotic constraints based on farmers' responses and perceptions. Table 5 shows the main constraints associated with reducing




A: Pure white; B: Purple; C: Yellow; D: Spotted white.

**Fig 4:** Some morphotypes of *D. praehensilis.* based on tuber flesh color.

**Table 5:** Constraints limiting production and utilization of *D. praehensilis* yam.

| Constraints categories | | Factors | % of responses across surveyed area | | | Chi² | P-value |
|---|---|---|---|---|---|---|---|
| | | | East | Midwest | Southwest | | |
| | | High tuber flesh oxidation | 18.7 | 10.34 | 12.47 | | |
| | Culinary and quality traits | Short post-harvest shelf-life | 15.46 | 18.21 | 10.64 | 86.193 | 0.000*** |
| Abiotic | | High fibrous tuber texture | 4.26 | 3.47 | 3.22 | | |
| | | Poor taste | 1.62 | 1.06 | 1.4 | | |
| | | Subtotal | 40.04 | 33.08 | 27.73 | | |
| | Agronomic traits | Prolonged dormancy | 8.76 | 4.32 | 5.64 | | |
| | | Difficulty in harvesting | 2.62 | 1.54 | 2.04 | | |
| | | Inadaptation to low soil fertility | 2.76 | 4.67 | 3.87 | | |
| | | Affected by erratic rain | 35.55 | 27.31 | 31.20 | | |
| | | Low productivity | 1.84 | 0.67 | 1.32 | | |
| | | Subtotal | 51.53 | 38.51 | 44.07 | | |
| | Others | Affected by the loss of coffee and cocoa plantations | 5.67 | 22.87 | 23.8 | | |
| | | Low market value | 0.24 | 1.21 | 1.36 | | |
| | | subtotal | 5.91 | 24.08 | 25.16 | | |
| | | Insect pest | 2.16 | 3.32 | 2.10 | | |
| Biotic | | Diseases | 0.36 | 1.01 | 0.7 | | |
| | | Subtotal | 2.52 | 4.33 | 2.8 | | |

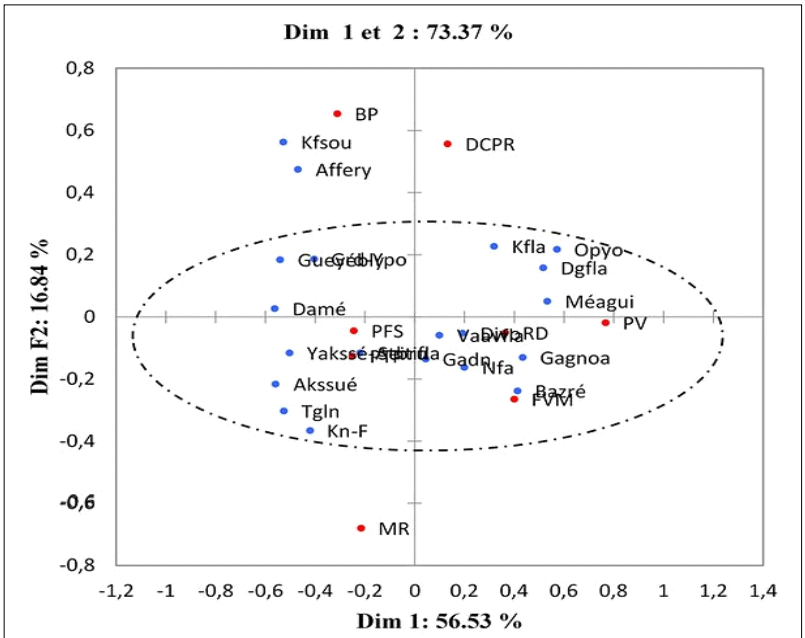
the production and utilization of *D. praehensilis* morphotypes in Côte d'Ivoire. The identified abiotic factors contributing to 97.54% of the issues include agricultural practices, market conditions and the characteristics of the tubers. The specific tuber characteristics are rapid oxidation of the flesh (18.7%), short shelf life after harvest (15.46%), a fibrous texture (4.26%) and poor taste (1.62%). Agronomic factors also significantly impact production and utilization, accounting for 57.05% of the challenges reported by farmers. Major agronomic problems include long dormancy (8.76%), low productivity (1.84%), difficulty in harvesting (2.62%), being affected by erratic rainfall (30.73%) and challenges in growing in poor soils (2.76%). In addition, challenges related to abiotic factors, such as the loss of coffee and cocoa plantations (7.55%) and low market value, account for 3.24% of the problems. Biotic factors such as pests and diseases represent 2.91%. The challenges varied significantly among the different villages studied ($\chi^2$ = 86.1934, p = 0.000***), indicating clear differences in ranking these problems among the villages. A factorial correspondence analysis revealed a relationship between the constraints related to *D. praehensilis* and the specific villages studied (Fig 5).

The three main factors that affect the crop of *D. praehensilis* are a short shelf-life after harvest, quick oxidation of the flesh and erratic rain. Erratic rain is the most important abiotic constraint that seems to spare no region of Côte d'Ivoire (Dekoula *et al.,* 2018). However, these constraints can be overcome by electing and using local varieties that are more efficient in terms of drought tolerance and good post-harvest conservation, as with some crops, such as cassava, to circumvent these various constraints (Agre *et al.,* 2015). In addition, *in vitro* culture techniques through micropropagation can be used to multiply these selected varieties, as was the case for cassava, a greatly appreciated tuber in Côte d'Ivoire (Cacaï *et al.,* 2012).

**Economic and social importance of *D. praehensilis***

Most farmers (81.63%) reported growing *D. praehensilis* for their consumption. They prepare it by pounding, boiling, or stewing. In August and September, over 70% of meals included it. Farmers do not have rituals for eating *D. praehensilis* yam. But they do for *D. cayenensis* and *D. rotundata* yams. Only 18.37% of the farmers surveyed sold some of their produce at local markets, in the fields, or at home (Fig 6). The tuber's price depends on its size, shape, color, texture, moisture, flesh and skin. The relationship between seller and buyer, as well as the season, also matters. Prices drop with stronger seller-buyer ties. They rise in lean seasons. Women primarily sell *D. praehensilis* yams. They make between 30 and 60 USD a year. Most of this money goes to food. From August to September, women lead the marketing of *D. praehensilis* yams.

Yam (*Dioscorea spp.)* is a food security crop of great economic and sociocultural importance for millions of people in sub-Saharan Africa (Wembou *et al.,* 2017). This important role was confirmed by the current study conducted on *D. praehensilis*. This yam is mainly used for food in the study area. This shows that producers are aware




BP: Low productivity; DCPR: Short shelf life after harvest; PV: Loss of coffee and cocoa plantations; PFS: Growing in poor soils; MR: Pest and diseases; FVM: Low market value: PTP: Erratic rain; RD: Difficulty in harvesting.

**Fig 5:** Relationship between constraints on *D. praehensilis* production and surveyed areas.

**Table 6:** *D. praehensilis* indigenous conservation techniques.

| Postharvest storage techniques | Percentage of practicing person (%) | Description | Advantages | Disadvantages |
|---|---|---|---|---|
| Store in a humid place | 5.63 | The tubers are first piled in a shaded area and then covered with wet grass. | Easy to implement, inexpensive, prevents tuber dieback. | Long-term risks include decay and damage from rodents and insects. |
| Conservation in holes | 92.6% | The tubers are buried in holes that are dug close to the houses and then they are covered with soil. | Simple to prepare, cost-effective, helps prevent tuber rot and shields against rodents and insects. | Long-term storage increases the risk of tubers sprouting. |
| Storage in packing | 0.12 | Tubers are placed in containers and kept moist. | Economical and easy to implement. | Risk of rot. |
| Conservation in sheds or trees | 1.49% | Tubers are collected and hung in sheds or trees in the field. | Facilitates better tuber ventilation. | Heavy tubers are not suitable for this type of storage, as they are exposed to rodents. |



**Fig 6:** *D. praehensilis.* marketing.

of the product's high nutritional value and how its value can contribute to the community's food security. Studies conducted in Togo and Ghana confirmed that *D. praehensilis* is consumed directly as foutou, boiled, or stewed. Its use helps to regulate the use of other foodstuffs of more commercial interest (Gnamkoulamba *et al.,* 2002). *D. praehensilis* tubers are a major source of income for farmers, particularly in eastern Côte d'Ivoire. Despite its status as a neglected plant, local populations attach great importance to this yam.

**Indigenous post-harvest storage techniques**

Post-harvest storage of *D. praehensilis* tubers has three main purposes. Consumption accounts for 98.42% of cases, sales (1.46%) and use as seed (0.12%). Farmers have developed various techniques to optimize post-harvest tuber storage conditions to achieve these aims. These techniques protect against heat and pests, particularly termites and rodents. We identified and described four advantages and disadvantages of postharvest storage techniques (Table 6). The most common technique is pit storage, used by 92.76% of farmers, followed by storage in damp places (5.63%), in packaging (0.12%) and in sheds or trees (1.49%). Regardless of the technique, fresh tubers generally last between 7 and 20 days after harvest. These post-harvest storage techniques are different from those used for *D. alata, D. cayenensis* and *D. rotundata* yams, as described by Digbeu *et al.* (2009).

## CONCLUSION

This study has revealed that *D. praehensilis* is of ethnobotanical importance in Côte d'Ivoire. Across the agroecological production zones, varietal diversity is distributed unevenly. The off-white morphotype is the most common. *D. praehensilis* is affected by erratic rainfall. High tuber flesh oxidation characteristics, post-harvest, were the main cause that hindered the ability to maintain *D. praehensilis'* diversity. Indigenous knowledge contributed to the

sustainability of the *D. praehensilis* farming system. However, by improving current farming practices, this species could better support and enhance local communities' livelihoods, well-being and health. *D. praehensilis* is used mainly for household consumption and trade in production areas. Moreover, local farmers have also acquired the knowledge to use the genetic resources of *D. praehensilis.* Despite its neglected status, this yam is well appreciated, suggesting that its market and nutritional potential can be exploited to meet the needs of food and nutritional security in Côte d'Ivoire. This could be effective if integrated strategies for conserving and using *D. praehensilis* genetic resources are defined. These strategies may include intensive research and essential development action.

**Conflict of interest**

All authors declared that there is no conflict of interest.

## REFERENCES


Adoukonou-Sagbadja, H., Dansi, A. and Akpagana, K. (2006). Indigenous knowledge and traditional conservation of fonio millet (*Digitaria exilis, Digitaria iburua*) in Togo. *Biodiversity and Conservation.* **15:** 2379-2395.

Agre, A.P., Kouchade, S., Odjo, T., Dansi, M., Nzobadila, B., Assogba, P., Dansi ; A., Akoegninou, A. and Sanni, A. (2015). Diversité et évaluation participative des cultivars du manioc (*Manihot esculenta* Crantz) au Centre Bénin. *International Journal of Biological and Chemical Sciences*. **9(1):** 388-408.

Assogba, P., Dansi, A., Dansi, M., Ewedje, E.E.B.K., Loko, Y.L., Sanni, A. and Adjatin, A. (2015). Indigenous knowledge and agro-morphological evaluation of the minor crop Kersting's groundnut [*Macrotyloma geocarpum* (Harms) Marechal et Baudet] cultivars of Benin. *Genetic Resources Crop Evolution*. **63:** 513-529.

Adewumi, A.S., Asare, P.A., Adu, M.O., Taah, K.J., Akaba, S., Mondo, J.M. and Agre, P.A. (2021). Farmers' perceptions on varietal diversity, trait preferences and diversity management of bush yam (*Dioscorea praehensilis* Benth.) in Ghana. *Scientific African*. **12:** e00808: 1-14.

Cacai, G.H.T., Ahanhanzo, C., Dangou, J.S., Houedjissin, S.S. and Agbangla, C. (2012). Effets de différentes combinaisons hormonales sur l'organogenèse *in vitro* de quelques cultivars locaux et variétés améliorées de *Manihot esculenta* Crantz (manioc-Euphorbiaceae) cultivées au Bénin. *International Journal of Biological and Chemical Sciences*. **6(4):** 1593-1607.

Dansi, A., Orobiyi, A., Dansi, M., Assogba, P., Sanni, A. and Akpagana, K. (2013). Sélection de sites pour la conservation in situ des ignames sauvages apparentées aux ignames cultivées: cas de *Dioscorea praehensilis* au Bénin. *International Journal of Biological and Chemical Sciences*. **7(1):** 60-74.

Dekoula, C.S.D., Kouamé, B., N'goran, K.E., Ehounou, J-N., Yao, G.F., Kassin, K.E.,Kouakou, J.B., N'guessan, A.E.B. and Soro, N. (2018). Variabilité des descripteurs pluviométriques intrasaisonniers à impact agricole dans le bassin cotonnier de Côte d'Ivoire : cas des zones de Boundiali, Korhogo et Ouangolodougou. *Journal of Applied Biosciences*. **130:** 13199-13212.

Digbeu, D.Y., Due, A.E., Brou, K., Kouakou, A.M., Nemlin, G.J. and Dago, G. (2009). Characterization of yam landraces in Côte d'Ivoire with respect to food quality and end uses. *Journal of Applied Biosciences*. **20:** 1203-1214.

Gnamkoulamba, A., Tchala, W., Tostain, S. and Soumana, I. (2002). Le bayere, une forme domestiquée de *Dioscorea praehensilis* Benth. dans la préfecture de Wawa (Togo). *Annales des Sciences Agronomiques du Bénin*. **2(3):** 45-53.

Hamon, P. (1988). Structure, origine génétique des ignames cultivées du complexe Dioscorea cayenensis-rotundata et domestication des ignames en Afrique de l'Ouest. Thèse de doctorat université de Paris XI Centre d'Orsay, 230 pages.

Kombo, G., Dans,i A., Loko, L., Orkwor, G., Vodouhe, R., Assogba, P. and Magena, J. (2012). Diversity of cassava (*Manihot esculenta* Crantz) cultivars and its management in the department of Bouenza in the Republic of Congo. *Genetic Resources Crop Evolution*. **59:** 1789-1803.

N'Danikou, S., Achigan-Dako, E.G., Tchokponhoue, D.A., Agossou, C.O.A., Houdegbe, C.A., Vodouhe, R.S. and Ahanchede, A. (2015). Modelling socioeconomic determinants for cultivation and *in-situ* conservation of Vitex doniana Sweet (*Black plum*), a wild harvested economic plant in Benin. *Journal of Ethnobiology and Ethnomedicine.* **11:** 28.

Ngelinkoto, P.M., Lokassa, A-M.K., Bulumuka, B., Maliani, J.K., Ngondo, M.M., Mbuli, R.L., Mukoko, J.B. and Mukeba, F.B. (2021). Phytochemical study and Anti-nutritional Factors in Stems of *Dioscorea praehensilis* Benth (Dioscoreaceae). *Journal of Botanical Research.* **3(4):** 1-10.

Otabo, F.R., Labeyrie, V., Duval, M.F., Mabanza, J. and Mialoundama, F. (2016). Diversité variétale de manioc sur la base des nominations vernaculaire des agriculteurs dans 4 bassins de production (Hinda, Loudima, Odziba et Oyo) en République du Congo. *Journal of Applied Biosciences*. **104:** 9932-9941.

Scarcelli, N. (2015). Structure et dynamique de la diversité d'une plante cultivée à multiplication végétative: le cas des ignames au Bénin (*Dioscorea sp.)* Université Montpellier II Sciences et Techniques du Languedoc, 230 pages.

Songuimondenin, S., Kouadio, T.M., Binaté Siaka, Kouassi, K.A., Konan, K.H. and Kouadio, E.J.P. (2018). Functional properties of flours from fresh and boiled wild yam *dioscorea praehensilis* tubers. *Advances in Research.* **17(3):** 1-13.

Tostain, S., Allomasso, T. and Sokpon, N. (2003). Conservation de l'igname sauvage *Dioscorea praehnesilis* dans les forêts sacrées du département de l'atlantique (Sud du Bénin) et dans les jardins de cases. *Annales des Sciences Agronomiques du Bénin*. **1(4):** 55-72.

Wembou, E.P., Dourma, M., Wala, K., Woegan, Y., Gbogbo, A., Batawila, K., Dansi, A., Tozo, K. and Akpagana, K. (2017). Agrodiversité, Gestion paysanne et importance de *Dioscorea praehensilis* Benth. dans la zone subhumide du Togo. *African Journal of Food Agriculture Nutrition Development.* **17(3):** 12455-12475.

XLSTAT. (2016). Logiciel. https://www.xlstat.com.

Zoundjihekpon, J. (1993). Biologie de la reproduction et génétique des ignames cultivées de l'Afrique de l'Ouest, *Dioscorea cayenensis rotundata*. Thèse de doctorat à l'université de Côte d'Ivoire. 362 pages.