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Farmers Knowledge and perception of yam new Rapid Multiplication Techniques in Northern Benin

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A B S T R A C T

Yam is an important tuber crop that highly contributes to food security in West Africa. Unfortunately, its varieties rarely combine all the desired agronomic and food quality characteristics hence indicating the necessity of crossing interesting genotypes. In the breeding programs, both vegetative and sexual reproduction are used by breeders. In order to assess farmers' knowledge of, and perceptions on, various methods used, 12 villages randomly selected in the district of Bassila in northern Benin, were surveyed using participatory research appraisal tools and techniques among which focus group discussion, individual questionnaire, field visits. Knowledge on yam diversity, sexual reproduction, and recognition of male and female flowers, selection criteria and propositions for varieties crossings were recorded. Village Akaradè has the highest rate of varieties loss (48.28%). 20 farmers' preference criteria were recorded; among them commercial value, yield, taste, productivity, are the most important. Cultivars Ouroutani (male) and Katala (female) were identified as good parents for crossing. The great majority (96%) of producers were unaware of the existence of sexual reproduction in yams, and expressed a desire for training. Seven diagrams of crossings were proposed by the producers based on sex and the characteristics of desired varieties. Breeders must train the producers on Rapid Technics of Multiplication and mainly on the use of the seeds resulting from opened pollination that generally occurs but burned in their fields.

Introduction

Many considerable progresses has been made in reducing hunger and poverty worldwide, but progress in Africa has so far been very limited. The most affected are rural households whose livelihoods depend heavily on rain-fed agriculture. Rainfall plays a major role in determining agricultural production and the economic and social well-being of rural communities. Rainfall patterns in sub-Saharan Africa are influenced by large-scale intra-

seasonal and inter-annual climate variability, leading to frequent extreme weather events such as droughts and floods that reduce agricultural production, with serious consequences in terms of food shortages.

Households and communities facing severe food shortages are forced to adopt coping strategies to meet the immediate food needs of their families. Roots and tubers, including cassava, sweet potato, potato and yam, are among the main food crops for human consumption in Africa (Nteranya *et al.,* 2015).

Among different yam species produced in West Africa, *Dioscorea rotundata* Poir. - *Dioscorea cayenensis* Lam. complex remains the most important, widely cultivated and consumed (Mignouna et Dansi, 2003). Yam tubers from this complex are good sources of carbohydrates, vitamins and minerals (Olajumoke *et al.,* 2012). Increasing the productivity of these yams will therefore help to improve livelihoods of rural and urban populations and guarantee food security in West Africa (Hgaza *et al.,* 2010).

In Benin, yam is the second most important food crop after maize, with production of over 2,500,000 tonnes, and remains the staple food for a large proportion of the population (Baco, 2014). Of the yam species grown in Benin, *D. rotundata-cayenensis* complex accounts for more than 95% of total production (Dansi *et al.,* 2003). A survey by Loko *et al.,* (2013) revealed an uneven distribution of yam varietal diversity in this complex in Benin. Of the four diversity zones, the Donga Department nevertheless appears to be an area of average diversity, but with a diversity loss rate of 35.82% (Loko *et al.,* 2013).

This calls for a policy of maintaining varietal diversity and creating new yam varieties that best meet current soil and climate conditions. It is therefore important to know beforehand the yam variety potential existing in this region, to establish clearly their distribution and extent, and to identify different possibilities of crossing for better crossings. Farmers' knowledge of floral biology and the possibilities of creating yam varieties from seed is still unknown.

The aim of this study is to inform farmers about yam new Rapid Technique of Multiplication (RTM) and have their perception of sexual reproduction by seeds in order to increase yam diversity among identification of crossing that could naturally give rise to new yam varieties adapted to current needs, soil and climate conditions. Specifically, this study aims to assess the current state of yam varietal diversity according to flowering (intensity and sexe), record desirable or undesirable characteristics to be maintain or not by farmers; document farmers' knowledge of yam sexual reproduction and identify, taking into account sex and agronomic characteristics, the different crosses of interest in order to lead to new, high-performance varieties.

Materials and Methods

Survey and data collection

Twelve villages were selected for data collection to ensure of the representativeness of the study area (Figure 1). The data were collected using participatory research techniques such as group discussions, individual interviews and visits for direct observations in the field (Kombo *et al.,* 2012; Dansi *et al.,* 2013). To facilitate the work, the discussions were conducted with the help of local translators (one of the farmers or an educated young person) from each village. The village chiefs were involved in organizing the surveys and facilitating contacts with the farmers.

In each village, group surveys were carried out with at least 20 yam farmers of both sexes and of different ages, brought together with the help of village head chief. After a clear presentation of the objectives of the study, there was an open-ended discussion. In each village, farmers were asked in groups to list the different varieties they grow by category (late varieties with one harvest; early varieties with two harvests).

The distribution and extent of these were documented using the Four Square analysis method (Dossou-Aminon *et al.,* 2015; Loko *et al.,* 2022). The varieties recorded at the village level are classified into four classes: varieties grown by many households over large areas (+ +), varieties grown by many households over small areas (+ -), varieties grown by few households over large areas (- +) and varieties grown by few households over small areas (- -).

To document farmers' criteria for varietal preference and farmers' knowledge of sexual reproduction in yams**,** farmers were firstly informed and trained on how to recognize male and female flowers. Then, we asked them to indicate the sex of pre varieties they want to improve desirable and undesirable agronomic traits. This method

provided reliable information as it enables exchange of ideas between the respondents. The sex of the different varieties was confirmed by direct observations in the field. A total of twenty households were interviewed per village, representing 240 people. This method was used to measure farmers knowledge of sexual reproduction of yams. For cross proposals, group work was done by village prospected.

Statistical data analysis

The assessment of the current state of yam variety diversity in the Commune of Bassila was conducted by using data collected at village and household level which were analyzed using descriptive statistics (frequencies, percentages, averages, etc.) to generate tables and figures.

The rate of loss of varietal diversity (TPDV) was calculated per surveyed village according to the formula described by Kombo *et al.,* (2012) and used by Dansi *et al.,* (2013a); Orobiyi *et al.,* (2013) and Gbaguidi *et al.,* (2013): TPDV = [(n-k) / N] x 100

Where n = number of cultivars at risk of extinction, k = number of newly introduced cultivars in quadrant 4 (cultivated by few households and on small areas) and N = total number of cultivars recorded in the village.

Results and Discussion

Sociodemographic of surveyers

Twelve villages were visited and two hundred and forty (240) producers with at least one field and belonging to six ethnic groups (Ani 43.2%; Nago 23.2%; Kotocoli 12%; Lopa 10.4%; Peulh 8.8%; Koura 2.4%) were individually interviewed. The age range varied from 26 to 76, with an average of 51. The largest age group was 55 to 65, with a rate of 30%, and the smallest was 75 to 85, with a rate of 3%. Of the 240 growers surveyed, 75.2% were illiterate, 13.6% had attended secondary school and 11.2% had not progressed beyond primary school. These growers own between 1 and 12 varieties, with an average of 4.12 varieties per individual.

For 48.8% of respondents, the household size varied between 10 and 20 people, with 43.2% having 10 people. In terms of years of experience, 26.4% of respondents had an average of 20 years' experience, and 2.4% had 60 years' experience. Across the villages, 82.4% of farmers surveyed sow between 0.25ha and 1.25ha. Only 1.6% of growers produce on areas of 2.25 to 2.75 ha.

State of yam varieties evolution in the Commune of Bassila

In the study area, the average number of varieties per village is 16 local varieties. The village of Akaradè has the greatest variety diversity, with 29 local varieties, while the lowest diversity is 13 in six villages (Table 1).

Among the 29 local varieties in Akaradè, 17 are grown by few households over small areas, with a rate of varieties disappearing of 48.28% (Table 1). The average rate of loss recorded in the Commune of Bassila is 22.18%. In the villages of Kaoutè and M'bayakou, of the 16 and 17 local varieties surveyed, only one is grown by many households over large areas, and 12 and 15 local varieties respectively are grown by many households over small areas (Table 1). In the villages of M'bayakou, Biguina, Pénélan and Igbomakro, 11 to 12 of the local yam varieties previously recorded in 2007 have disappeared.

The number of varieties grown per household varied across villages from 1 to 12, with an average of 4.14 varieties per household. In the older age groups, the old varieties are maintained and the diversity per household is high.

For proper analysis of the crosses that will be proposed by the growers, the sex and the undesirable traits to be improved for each variety are documented and presented for some varieties proposed by farmers themselves (Table 3). Varieties such as Aliba, Labôkô, Wouroutani flower intensely male while Gnidou flowers intensely female (table 3).

Farmers' criteria for choosing yam cultivars by ethnic group in the study area

Ten criteria are used by producers to choose their yam cultivars in the Commune of Bassila. The most important criteria are market value (76.8% of respondents), taste (64.8% of respondents), productivity (62.4% of respondents), pound quality (34.4% of respondents), earliness (32% of respondents) and post-harvest conservation for 15% of respondents. Cultivar selection criteria varies from one ethnic group to another. High

market value, good taste, high productivity, good quality of mashed potatoes and earliness are important selection criteria for all ethnic groups. For the Ani, the cultivar's resistance to drought is not an important criterion, unlike for the Lokpa and Nago for whom it is (Table 4). However, cultivar tolerance to weeds was only reported by the Ani. Smoothness tubers are a criterion of interest for Ani, Kotokoli and Koura.

Among the cultivars identified in the study area, some meet at least 67% of the most important criteria. Wouroutani and katala cultivars are highly sought on the market, have a good taste, high productivity and good mash quality, as is the case with Labôkô. Wouroutani meets several preference criteria and is therefore a good parent in yam breeding programmes.

Knowledge of the reproductive biology of yam and suggestions for crosses of interest by farmers

Majority of yam farmers knew that yams flower (96% of responses) and bear fruit (87.2% of responses), unlike 96.8% who could not tell the difference between male and female flowers (table 6). More than 95% of farmers were unaware that yams can reproduce by seed and that the seeds could even germinate in their fields. 92.8% of farmers expressed a desire to be trained so that they could use the seeds to select new varieties (table 6).

Once the yam growers were aware of the possibilities of pollination (crosses) in yam in order to develop new varieties, they made proposals for crosses (Table 7) between the different local varieties that they have, taking into account the sexes.

The aim of these crosses is essentially to produce new varieties of yam with good agronomic and culinary characteristics, but with greater resistance to diseases (viros, anthracnose) and pests (nematodes and termites).

To enable farmers to participate in the cross-breeding stage or to make their own crosses, we have designed cross-breeding systems (Figure 2) with one (monocross) or several (polycross) male parents against one female parent. In these systems, which are installed in fields slightly isolated from yam plantations, pollination is open but tightly controlled. The farmer will harvest a hybrid population or a mixed hybrid population from which he will select the best genotypes. Bassila is a humid forest area where yam is a major crop and the staple food of the local population. Most of the yam producers surveyed were aged between 55 and 65, with at least 20 years' experience in yam production. This can be justified by the fact that most young people in this region prefer to go to urban centers such as Djougou, Parakou, Natitingou, Cotonou and Nigeria in search of work, rather than stay in the village and work their own fields (Biaou, 2006).

Farming is the main staple activity in the Commune of Bassila, and the older people surveyed inherited it from their parents. As a result, the rate of illiterate farmers is high. The small cultivated areas may be linked to the age of the producers, who no longer have enough energy, and also to the high cassava production noted in recent years in the Commune of Bassila (Agré *et al.,* 2015).

Across the villages surveyed in the Commune of Bassila, the average number of local varieties is 16. The highest diversity (29 local varieties) recorded in the village of Akaradè can be justified by its proximity to Togo, which facilitates varietal introductions across migration (Egah *et al.,* 2023). Similar results were obtained by Loko *et al.,* (2013) for yam (*Dioscorea rotundata* - *Dioscorea cayenensis*) and Dossou-Aminon *et al.,* (2015) on sorghum in Atacora between Benin and Burkina.

Per farmer, the number of varieties varied from one to twelve, which is similar to the results found in Congo for cassava by Kombo *et al.,* (2012), while for cassava, Amerindian farmers may have more than fifty varieties each Elias *et al.,* (2001a). It could be said that the low diversity of varieties in Benin is due to the fact that the sources of yam seed are not very diversified, and that seed from the previous harvest is often used. It is important to consider the movement of rural exodus that can negatively impact varietal wealth (Lin, 2019; Baird, 2021).

In the twelve villages, some forty varieties are cited by growers as having disappeared. These include Tôtônan, Tahounan, Radoudou, Itchèrèhoundji and Guiyélignin. The average rate of disappearing varieties (22.18%) observed is lower than that reported in the Donga department (35.82%) by Loko *et al.,* (2013), but is still significant. It will therefore be necessary to work with producers to set up an in situ conservation system to maintain existing diversity. Rare or endangered varieties should be quickly collected and conserved ex situ for breeding purposes, because each variety has desirable traits that can be capitalised on.

Table.1 State of varieties evolution

Village	NTC	NVD	M+S+	M+S	M-S+	M-S	NVNI	NVVD	TVD (%)
Akaradè	29	0	8	2	2	17	3	14	48,28
Biguina	13	11	1	5	5	2	0	2	15,38
Bodi	23	7	8	3	6	6	0	6	26,09
Guiguisso	13	5	1	9	0	3	0	3	23,08
Igbomakro	13	12	7	6	0	0	0	0	
Kaoutè	16	3	1	12	0	3	0	3	18,75
Kikélé	14	7	7	3	1	3	0	3	21,43
M'bayakou	17	11	1	15	1	0	1	0	
Nagayilé	13	7	8	3	1	1	0	1	7,69
Pénélan	13	12	4	3	6	0	0	0	
Saramanga	13	9	4	7	0	2	0	2	15,38
Igbèrè	17	0	9	3	1	4	0	4	23,53
Moyenne	**16,17**	**7,00**	**4,92**	**5,92**	**1,92**	**3,42**	**0,33**	**3,17**	**22,18**

NTC: Total number of cultivars; NVD: Number of varieties disappearing; NVNI: Newly introduced varieties; NVVD: Varieties in danger of disappearing; TVD: Rate of disappearing varieties.

Table.2 Variation of varietal diversity at household level across villages and age

Variation across village			
	Minimum	**Maximum**	**Mean**
Akaradè	4	12	6,7
Biguina	1	4	2,8
Bodi	2	7	3,91
Guiguisso	2	4	2,9
Igbèrè	2	6	4
Igbomakro	2	10	6,1
Kaoutè	2	9	5
Kikélé	2	7	4
M'bayakou	2	5	3,25
Nagayilé	2	6	3,3
Pénélan	1	7	4,25
Saramanga	3	6	3,7
Variation across age groups			
25 - 45	1	9	4,12
45 - 60	1	10	3,81
60 - 85	2	12	4,56

Table.3 Sexual characters, desirable and undesirable characteristics of some varieties recorded in the Commune of Bassila

N°	Vernacular name	Cycle	Sex, Intensity of flowering	Desirable characteristics	Undesirable characteristics to be improve
1	**Ouroutani/ Wouroutani** Akaradè (M+S+) ; Biguina (M+S-) ; Bodi (M+S+); Kaoutè (M+S+); M'bayakou (M+S-) ; Pénélan (M+S+) ; Saramanga (M+S+); Guiguisso (M+S-); Nagayilé (M+S+); Igbomakro (M+S+); Kikélé (M+S+)	Early	Male +++	- High productivity and big size of tubers - Resistance to wet soil and to rain late - Possibility to produce seeds by mini setts techniques - Easy to pound and high culinary qualities	- Susceptible to poor soil, nematodes and weeds - Poor post-harvest and post-maturity storage in mounds - Seed tubers rot quickly if not sown on time.
2	**Bakpanantini** Kaoutè (M+S-), Bodi (M-S-); Nagayilé (M-S-); Akaradè (M+S+); Guiguisso (M+S-) M'bayakou (M+S-); Igbomakro (M+S-); Kikélé (M+S-); Saramanga (M+S-)	Late	Female ++	- High productivity with large, medium-length tubers - Good post-harvest conservation (3 à 4 mois) - Stainless tuber after peeling - Resistance to poor soil - Very high culinaries qualities	- Very difficult to crush as it is very hard - Requires a lot of stakes and is susceptible to weeds, excess soil moisture and nematodes - Not suitable for mini-fragmentation,
3	**Amoula** Bodi (M-S+) ; M'bayakou (M+S-) ; Nagayilé (M+S-)		Female ++	- Very high productivity with big and long tubers - Very high culinaries qualities	- Very sensitive to poor soil and excess soil moisture - Bad post-harvest storage
4	**Katala boboyi** Kaoutè (M+S-) ; Akaradè (M+S+), Biguina (M+S-) ; Guiguisso (M+S+) ; M'bayakou (M+S) ; Nagayilé (M+S+)	Early	Female +++	- High productivity, long, large tubers - Good post-maturity storage in mounds (5 months) - Good adaptation to lowlands - Good culinary qualities	- Très sensible au sol pauvre - Très sensible aux nématodes
5	**Aliba/ Alihounba** Akaradè (M-S-) ; Biguina (disappear)		Male +++	- High precocity - High productivity with long, large tubers - Suitable for sandy soils - Too high sprouting and multiplication rates, - Tuber too sweet and very easy to crush - Very good post-harvest storage, away	- High sensitive to sun and heat

				from sun and heat; tuber wounds heal very quickly.	
6	**Gnidou** Akaradè (M-S+) ; Biguina (M+S-) ; Guiguisso (M+S-) ;Igbomakro (M+S-) ; Kaoutè (M+S-) ; Nagayilé (M+S+) ; M'bayakou (M+S-)	Early	Female +++	- High productivity with long, large tubers - Very tolerant to weeds	- Sensitive to poor soils - Poor culinary qualities - Oxidises after peeling
7	**Labôkô** Akaradè (M-S-); Biguina (M-S+); Igbomakro (M+S-) ;Kaoutè (M-S-); Igbèrè (M+S+) ; Kikélé (M+S-)	Early	Male +++	- Excellent culinary qualities: a very mild, very sweet tuber and very good quality pounded yam	- Only likes damp areas - Very susceptible to disease and pests.
8	**Ataa/ Atèguè** Guiguisso (M+S-) ;Nagayilé (M+S+) ; Bodi (M-S+) ; Pénélan (M-S+) ; Saramanga (M+S-) Akaradè (M+S+); Kaoutè (M+S-), Biguina (MS+) Biguina (M-S+)	Tardive	Male +++	- Rounded tuber suitable for mechanized harvesting and exporting - Good quality pounded yam - Produces very good quality pods -Very good post-maturity storage in mounds (5 months)	- Low productivity - Very susceptible to mealybugs - Slight oxidation after peeling - Requires gravelly soil
9	**Kpagnina** Akaradè (M+S+) ; Bodi (M+S+) ; Kaoutè (M+S) ; Nagayilé (M+S+); Biguina (M-S+) ; Pénélan (M-S+) ; Saramanga (M-S-)	Late	Male +++	- Very high productivity with numerous tubers (6-8) of average length and size per mound - Good culinary qualities - Very good post-harvest shelf-life (8 to 9 months). - Produces very good yam chips that are rarely attacked by storage insects.	- Sensitive to excess soil humidity and heat
10	**Tchachabim** Akaradè (M-S-); Kaoutè (M+S-), Biguina (M-S+)	Late	Male +++	- High productivity with 4-5 tubers per mound - Good culinary qualities; very good pods - Suitable for rich clay soils	-Very short shelf life in beds - Very sensitive to nematodes

Table.4 Importance of preference criteria

Preference criteria	Study area (%)	Percentage of farmer by ethnie (%)					
		Anni	Kotocoli	Nago	Lokpa	Peulh	Koura
High market value	76,8	20,49	23,33	20,59	31,43	35,29	11,11
Good taste	64,8	19,67	21,67	19,12	14,29	23,53	33,33
High productivity	62,4	19,67	25	17,65	20	11,76	11,11
High quality of pounded yam	34,4	13,93	5	32,35	11,43	11,76	-
Precocity	32	13,93	15	4,41	20	17,65	11,11
Long post-harvest conservtion	15,2	5,74	8,33	1,47	-	-	22,22
Tuber white color	4	2,46	-	1,47	-	-	-
Tolerance of weeds	3,2	3,28	-	-	-	-	-
Resistance of drought	3,2	-	-	2,94	2,86	-	-
Yam skin smoothness	2,4	0,82	1,67	-	-	-	11.11

Table.5 Examples of cultivars by preference criteria

Main criteria of preference	Example of cultivars
High market value	Katala, Wouroutani, Mankpanatini, Amoula
Good taste	Wouroutani, katala, Lassiri, Odjouyawo
High productivity	Katala, Wouroutani, Môrôkô, Kpadjibakôkpô
High pounded yam quality	Wouroutani, Katala, Labôkô, Mankpanatini, Amoula, Kpadjibakokpô, Aroukpè, Kroukpanan
Early maturing	Wouroutani, Aliba
Long shelf-life	Evala, Agbadawou, Sintèrè, Abouda

Table.6 Farmers' perceptions of sexual reproduction of yams

Parameter	Percentage of producers aware of	Percentage of producers who don't know
Flowers knowledge	96	4
Identification of sex	3,2	96,8
Fruits knowledge	87,2	12,8
Seeds knowledge	26,4	73,6
Knowledge of reproduction by seed	4,8	95,2
Seed germination in the field	5,6	94,4

Table.7 Cross-breeding proposals from producers

Male variety	Female variety	Expected results
Ouroutani	Katala	Nematode-tolerant varieties with large, long tubers. Good for pounded yam, sweet.
Amoula	Katala	Varieties with Amoula's size and high resistance to termites
Ataa	Mankpanatini	Varieties resistant to disease (virosis, anthracnose)
Kroukpana	Gnidou	High-productivity varieties of Gnidou with the organoleptic and culinary qualities of kroukpanan
Aroukpê	Mangbanantini	New variety with Mangbanantini shape. Good crushed and highly productive.
Ouroutani	Koukouma	Disease-resistant variety, long and large tubers, good for pounding
Ouroutani	Gnidou	White yam, very good quality mash, soft, no oxidation after peeling.

Figure.1 Surveyed villages

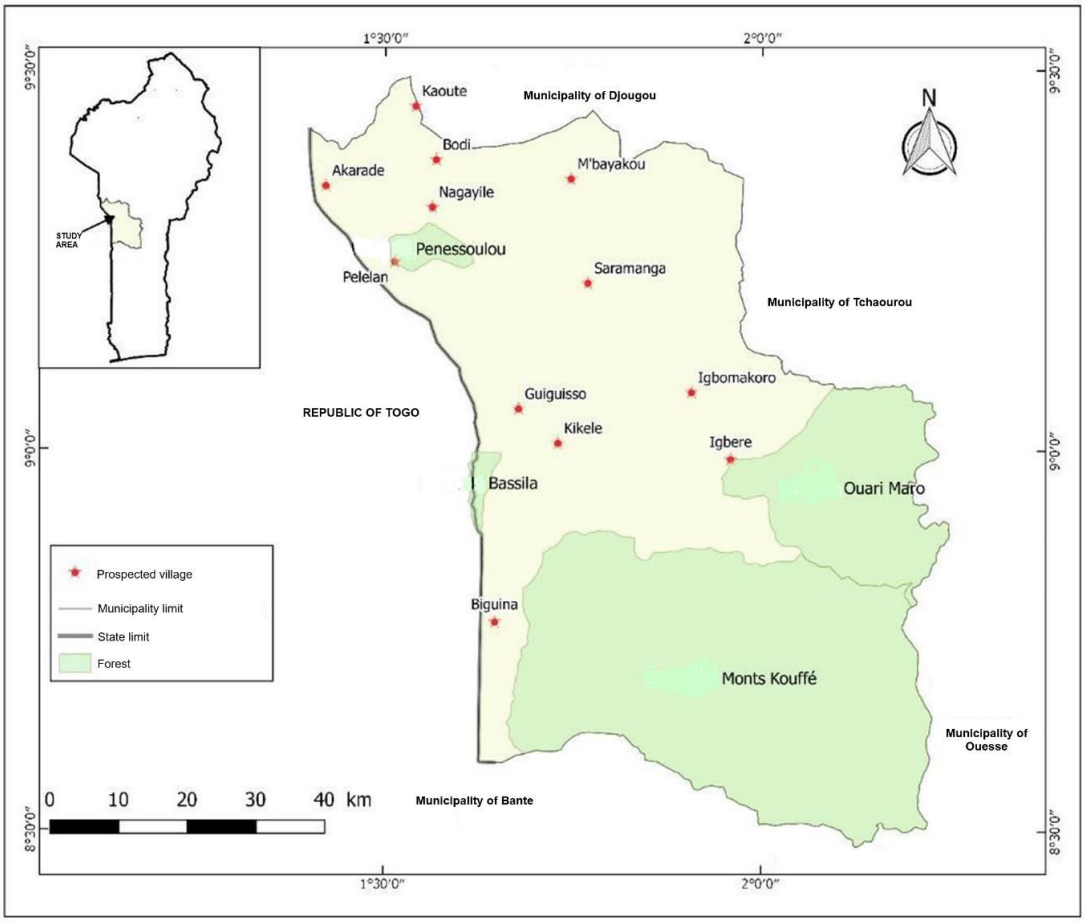
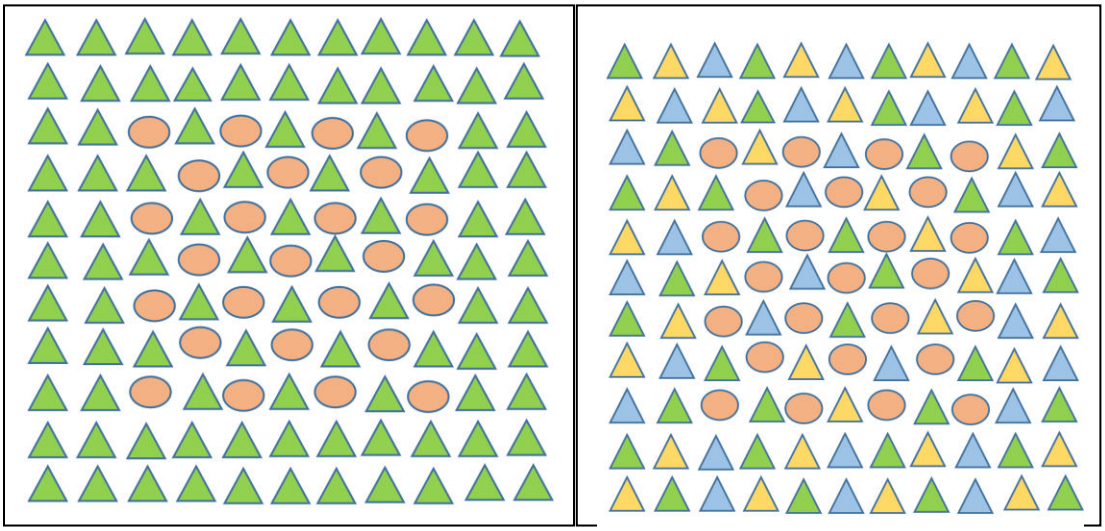


Figure.2 Open pollinisation plan proposed



In Bassila area, twenty preference criteria are used to choose yam varieties. The first place of 'Market value' as the first criterion can be justified by the fact that production is mainly market-oriented. The high importance of 'taste and quality of pounded yam' is due to the fact that yam is one of the staple foods of these communities. 'Productivity' is the primary objective for any producer. Similar results have been reported for yam by Dansi *et al.,* (2013) and Loko *et al.,* (2013), for cassava by Agré *et al.,* (2015), for sorghum by Dossou-Aminon *et al.,* (2015) and for rice by Odjo *et al.,* (2017).

Post-harvest preservation is important for high-cost storage and sale during the lean season or yam shortage. For all ethnic groups, high market value, good taste, high productivity, good quality of the pounded yam and earliness are the most important selection criteria.

Cultivars such as Wouroutani and Katala, which perform well on several preference criteria, are good candidates for use as elite parents in the various yam breeding programs.

Despite the fact that every year farmers see yam seeds in their fields that become dehiscent after drying and then burn the vines, they have never paid attention to any young yam seedlings that might be growing in the field. Ninety-six point eight (96.8%) of respondents did not know that yam could reproduce sexually while 87.2% has known that it produces fruits. In most of villages, it is the plant that produces the fruit that is considered male. They make the comparison with a man who has a visible genital apparatus, unfortunately for yam, it the female that bears fruit.

It was strange for farmers to learn that from the seed you can obtain a tuber that constitutes a potential new variety. These results are similar to those of Yolou *et al.,* (2015). The growers themselves followed the sexes and performance of the proposed varieties, which led to seven crossing proposals with precise performance targets. The most important varieties that producers have listed and have characteristics they would like to improve are those that are produced in many households by many producers. Loko *et al.,* (2022), show that in a breeding program for early maturity yam landraces, two groups of landraces can be used as parents: the first is category of good parents for early maturity yam varieties and the second the ideals parents for late-maturing.

Parents proposed by producers for crossing are among these two groups above mentioned cited. Varieties like Katala boboyi, Makpanatini and Koukouman are female parents suggested and can be used in different breeding programs in Benin.

Cross-breeding yams is difficult and cannot be carried out manually by farmers for seed production. Even in cutting-edge research stations such as IITA (International Institute of Tropical Agriculture) and with experienced technicians, success rates are still in the region of 10 to 30% (Mondo, *et al.,* 2022).

In plant breeding and seed production, participatory selection is nowadays highly recommended (Bonneuil *et al.,* 2007). Thousands of seeds are produced every year in farmers' fields by open or free pollination, with probably some very high-performance genotypes being overlooked. Breeders need to encourage farmers to harvest them regularly, and by participative works, germination can be done for many trials in order to select the best ones.

We can only improve what we have. Thus, the various crosses defined with the growers are expected to be used by scientific researchers (breeders) and also by research NGOs through the training of growers in the use of yam seeds from open pollination (according to the proposed schemes) and controlled pollination if possible.

In the Municipality of Bassila with the greatest diversity recorded in the Akaradè village. Early and late cultivars are equitably distributed across the study area. A large number of cultivars have disappeared and call for a strategy to strengthen and conserve existing diversity.

Bassila growers prefer cultivars that are in high demand on the market, taste good, highly productive and make good crushed yam. The cultivars Ouroutani and Katala are good parents to involve in yam breeding programs. Organize training for supervisors and producers on the valorization of yam seeds from free or controlled pollination in Benin.

This involves seedling and seedling management techniques, field transfers, vine cutting techniques (multiplication by lianas), and minisetts, setting up oriented but free crossing blocks.

Author Contributions

Myriame Dansi: Investigation, formal analysis, writing—original draft. Yêyinou Laura Estelle Loko: Validation, methodology, writing—reviewing. Espérance Codjia:—Formal analysis, writing—review and editing. Abel Amegan: Investigation, writing—reviewing. Nonfodji Attikleme: Resources, investigation writing—reviewing. Sylvana Adohou: Validation, formal analysis, writing—reviewing. Agre Paterne: Conceptualization, methodology, data curation, supervision, writing—reviewing the final version of the manuscript. Alexandre A. Dansi: Investigation, formal analysis, writing—original draft.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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