

Characterization of the production systems and local initiatives for the conservation of traditional seeds of neglected crops: The case of roselle (*Hibiscus sabdariffa*) in Boulkiemde Province

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ABSTRACT

Sorrel is an important leaf vegetable in Burkina Faso thanks to its nutritional, medicinal and economic benefits. Despite its nutritional and economic potential, sorrel remains marginalised in national agricultural policies, and traditional seeds are tending to disappear. The present study aimed to enhance knowledge of local production systems and seed conservation practices for sorrel, with a view to supporting the sustainable development and valorisation of this species. Individual surveys were conducted among producers, and interviews were held with decentralised agricultural services. The results show that sorrel cultivation is not widespread in the study site. It is mainly grown in vegetable farming systems on small-scale plots, typically covering less than 400 m². Cultivation techniques are rudimentary, with no specific technical guidelines, which limit yields. Despite its economic potential, sorrel production remains limited and is mainly oriented toward household consumption and local marketing. Seed conservation relies mainly on traditional storage practices. Producers use various containers such as ash-filled cans, 100 kg bags, paint tins and jerry cans to protect seeds from insects and moisture. While these traditional methods demonstrate local ingenuity, they are generally inadequate for ensuring effective long-term seed conservation. To improve production, it is necessary to strengthen producers' capacities through training on technical itineraries and to provide them with improved, high-performance seeds.

Key words: Sorrel, Production system, Seed conservation, Traditional storage practices, Sustainable agriculture

INTRODUCTION

Agriculture in Burkina Faso plays a key role in ensuring food and nutritional security and accounts for approximately 45% of farm household income (PNDES-II, 2021). It is largely dominated by subsistence farming systems, with a focus on cereal production, including millet, sorghum, rice, and maize. However, agricultural productivity remains constrained by multiple factors, including low yields, climatic conditions, inherently poor soils, and inadequate soil fertility management practices (Bado, 2002). Despite sustained efforts by public authorities and development partners to improve agricultural productivity, food self-sufficiency remains a challenge. This situation is partly due to the long-standing emphasis of agricultural research and extension services on a narrow range of staple crops (Bambara, 2009). Consequently, several neglected crops such as Bambara groundnut (*Vigna subterranea*), roselle (*Hibiscus sabdariffa*), fabirama (*Solenostemon rotundifolius*), macabo (*Xanthosoma sagittifolium*), taro (*Colocasia esculenta*), African yam bean (*Sphenostylis stenocarpa*), spider plant (*Cleome gynandra*), kenaf (*Hibiscus cannabinus*), and pumpkin (*Cucurbita pepo*) are generally cultivated on small plots (NEPAD, 2020). Among these neglected plants, Guinea sorrel (*Hibiscus sabdariffa*) holds a prominent position. Locally, it is known as Bito in Mooré, Dah in Dioula, Brê in Dagara, and Vôh in Gurunsi (Ouangraoua *et al.*, 2021). Sorrel leaves are widely consumed and are often combined with other leafy vegetables in the preparation of traditional sauces such as bagbenda and kanzaga. Sorrel-based dishes also have cultural significance in Burkina Faso, particularly among Mossi and Gurunsi communities, where they are commonly served during wedding and child baptism ceremonies (Tarnagda *et al.*, 2019). The calyces represent the most valued part of the plant due to their high content of organic acids, vitamin C, and especially anthocyanins (Cissé *et al.*, 2009). According to Kellou *et al.* (2024) sorrel calyces are primarily used to prepare herbal teas and traditional beverages, while the leaves are commonly eaten as vegetables or incorporated into soups and sauces, particularly across West Africa. Beyond its culinary applications, *H. sabdariffa* is also widely used in traditional medicine and as a food seasoning. Pharmacological studies have documented

multiple health benefits, including diuretic and antihypertensive effects, antioxidant activity, regulation of blood lipids and glucose levels, as well as anti-inflammatory, antifibrotic, and cardioprotective properties (Da-Costa-Rocha *et al.*, 2014; Sopian *et al.*, 2023). In the context of seed conservation, some farmers play a crucial role by actively committing to maintaining and preserving varietal diversity. They also play a crucial role in preserving intergenerational and indigenous knowledge related to the production and conservation of neglected species (Bâ, 2023). Sorrel cultivation is becoming increasingly important because of its significant contribution to farmers' incomes, poverty alleviation, and nutritional security, largely due to its high nutritional value (MAHRH, 2008; Soro *et al.*, 2012). Despite its recognized nutritional and economic potential, sorrel remains largely overlooked in national agricultural policies, and many traditional seed varieties are progressively disappearing. In Burkina Faso, only a limited number of studies have specifically examined sorrel production systems or local seed conservation practices. Existing research has mainly focused on biochemical composition and biological properties (Sanou *et al.*, 2022), storage pests affecting seeds (Koussoubé *et al.*, 2018), seed production techniques (Hien, 2012), ethnobotanical characterization of Guinea sorrel (Ouangraoua *et al.*, 2021) and the role of producers in conserving traditional seeds (Bâ, 2023). Given the ongoing erosion of biodiversity among underutilized crop species, documenting cultivation practices and indigenous seed conservation methods has become increasingly important for the conservation and sustainable utilization of sorrel (*Hibiscus sabdariffa* L.). Therefore, this study aimed to characterize local production systems and traditional seed conservation strategies in order to generate knowledge that supports the promotion and sustainable cultivation of this valuable crop.

MATERIALS AND METHODS

Study area

The study was carried out from May to July 2025 in Boulkiemdé Province. The selection of localities was based on information provided by the agricultural office. In addition, only provinces engaged in vegetable crops were included (Fig. 1).

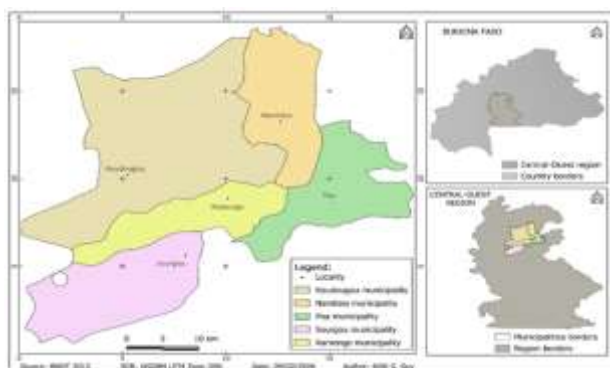


Fig. 1. Study areas

Identification of production sites and sample selection

A prospective survey was carried out according to the methods described by Gerville-Réache and Couallier, (2011) to identify sorrel producers and seed keepers. Five municipalities were selected using simple random sampling without replacement from a predefined sampling frame that included all 15 municipalities. Within these selected municipalities, 181 producers were identified, from whom a representative sample of 97 individuals was drawn (Table 1).

Table 1. Distribution of respondents by commune and village

Province	Surveyed municipalities	Study area	Number	Sampling	Frequency (%)
Boulkiemdé	Koudougou	Nayalgue	25	13	13.54
		Godin Oualagtenga	30	16	16.67
		Gninga	20	11	10.41
	Ramongo	Kolokando Ipendo	42	22	22.92
	Poa	Yaoghin	15	8	8.33
	Sourgou	Kougsin	20	11	11.46
		Lâ	20	11	11.46
	Nandiala	Baoghin	9	5	5.21
Total	5	8	181	97	100

Administration of the questionnaire

The questionnaire was initially pre-tested with two producers. This pilot phase enabled the refinement of the questionnaire content before the main survey. Each sorrel seed producer, seed keeper, and management staff member was interviewed individually. Interviews took place either in the field or at the interviewees' homes, depending on their availability.

Data analysis

Data collected were entered, processed, and analysed using Sphinx Plus2-V5 software. Data entry required the prior design of a data entry form using Sphinx Plus2-V5 software. The prepared data were used to calculate frequencies and produce tables and figures.

RESULTS

Socio-demographic characteristics of respondents

The socio-demographic characteristics of the respondents are presented in Table 2. The majority of sorrel producers surveyed are adults, mainly aged between 30 and 50 years, while young people under 30 are significantly under represented, accounting for only 13.4% of respondents. Regarding marital status, the majority of respondents are married (82.47%), with the remainder being widowed. Educational attainment is generally low: 85.6% of respondents have received no formal education. Only a minority have completed primary, secondary, or technical education, and notably, none of the respondents have attended university.

Table 2. Distribution of respondents according to marital status and educational level

Characteristic	Category	N	Frequency
Age of respondents	< 30 ans	13	13.4%
	30 – 40 ans	43	44.3%
	40 – 50 ans	30	30.9%
	> 50 ans	11	11.4%
Marital status	Married	80	82.47%
	Widowed	17	17.53%
Educational level	No formal education	83	85.6%
	primary education	5	5.2%
	High school	3	3.1%
	Alphabetized	5	5.2%
	Professional training	1	1.0%

Characterisation of sorrel production practices

Surface occupied by respondents

Fig. 2 shows the distribution of areas used by the respondents. It appears that the majority of respondents (73.3%) cultivate small plots ranging from 0 to 50 m². Among the respondents, 14.4% cultivated sorrel on plots ranging from 50 to 100 m², 6.2% used areas between 100 and 150 m², while only 1.0% cultivated plots ranging from 150 to 200 m². The largest areas, between 300 and 350 m², are used by only 2% of respondents.

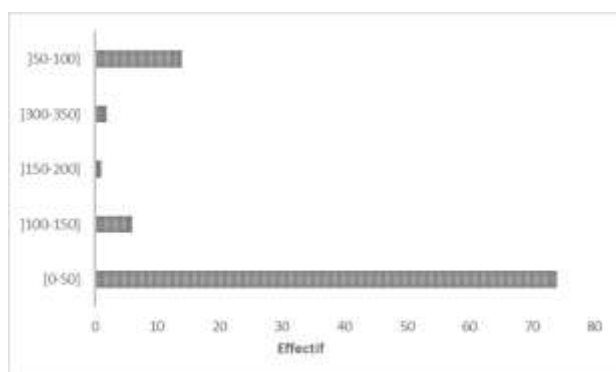


Fig. 2. Distribution of areas used

Traditional varieties of sorrel used and the sorrel production season

Proportion of sorrel varieties cultivated in the dry and rainy seasons are presented in Table 3. During the rainy season, the most widely cultivated variety is Wegde Pelga, grown by 72.2% of respondents. It is followed by Bite Zalé, cultivated by 21.6% of producers.

Table 3. Proportion of sorrel varieties cultivated in the dry and rainy seasons

seasons	Varieties	Number of respondents	Utilization rate (%)
Rainy	Wegde pelga	70	72.2
	Bite zalé	21	21.6
	Wegde miougou	6	6.2
Dry	Wegde pelga	23	25.77
	Bite zalé	72	74.23
	Wegde miougou	2	2.06

In contrast, Wegde Miougou (commonly known as bissap) is rarely produced, representing only 6.2% of respondents. During the dry season, all the women producers interviewed continue to grow sorrel, primarily in irrigated market gardens managed by cooperatives or in individual household plots. The varietal distribution

shifts during this period, with Bite Zalé becoming the dominant variety (74.23% of respondents), followed by Wegde Pelga (25.77%). Wegde Miougou remains marginal during this season as well, accounting for only 2.06% of respondents.

Production sites

The survey revealed that sorrel grown is more widespread in the village of Sourgou-Kougsin, which accounts for 32.29% of the area under cultivation (1,485 m²) in the study area, with 11 respondents. It is followed by the municipalities of Ramongo and Koudougou with 15.57% and 14.48% of the area under cultivation, respectively (Table 4).

Table 4. Production area

Area of production	No. of respondents	Cultivated area (m ²)	Utilization rate (%)
Koudougou Nayalgue	11	408	9.03%
Koudougou-Godin	16	411	9.10%
Oualagtenga			
Koudougou-Gninga	13	654	14.48%
Ramongo-Kolokando	22	703	15.57%
Ipendo			
Poa-Yaoghin	8	260	5.76%
Nandiala-Baoghin	5	181	4.01%
Sourgou-Kougsin	11	1458	32.29%
Sourgou-Lâ	11	441	9.77%
Total	97	4516	100.00%

Types of soil preparation

The results of the study show that the most commonly used type of soil preparation is the creation of beds, which is used 100% of the time during the dry season.

Types of organic fertilisers used

The study shows that 90.7% of respondents use compost to fertilise their fields and only 9.3% do not use it (Fig 3).



Fig 3. Distribution of respondents according to organic fertilisers

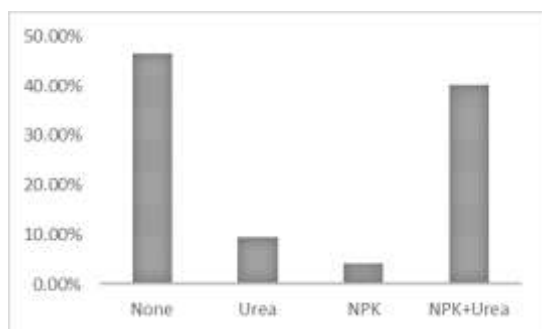


Fig. 4. Fertilizer used by farmers

Type of inorganic fertilizer used

The proportion of respondents who do not use any inorganic fertilizer is 46.4%, compared to 40% who use both NPK and urea (Fig 4). A small proportion of respondents use only urea (9.3%) or NPK (4.1%).

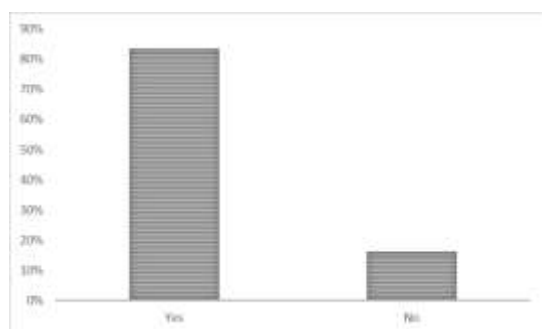


Fig. 5. Phytosanitary treatments

Phytosanitary treatments

A large majority of sorrel producers (83.5%) reported the use of phytosanitary treatment for pest management, while 15.5% indicated that they did not employ any such measures (Fig. 5). Among respondents, 47.4% reported using chemical insecticides, 36.1% used biological insecticides (biopesticides), and 16.5% indicated that they did not apply any pest control treatments (Fig. 6).

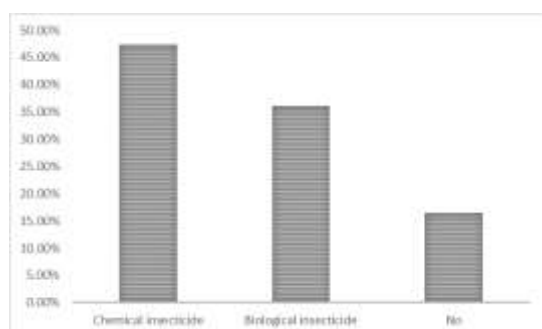


Fig 6: products used

Relationship between respondent-level education and agricultural practice

Table 5 shows the ordinal logistic regression analysis. Among the agricultural practices examined, only the use of organic fertilizers demonstrates a statistically significant association with the educational level of the producers. Specifically, producers who utilize organic fertilizers have significantly lower odds of attaining a higher educational level compared to their counterparts who do not (OR = 0.17; 95% CI [0.04 – 0.82]; $p = 0.027$). This finding suggests that the use of organic fertilizers is associated with a nearly 83% reduction in the odds of being in a higher education category. No other agricultural practice included in the model was found to be significantly associated with educational level.

Table 5. Distribution of agricultural practices according to respondents' educational level

Variables	Odds Ratio	Confident limit (95%)	p-value
Organic_fertilisers (Yes)	0.17	[0.04;0.82]	0.027
Fertilizer_used (NPK)	3.81	[0.31;47.51]	0.298
Fertilizer_used (NPK+Urea)	1.36	[0.31;6.05]	0.685
Fertilizer_used (Urea)	0.78	[0.06;9.56]	0.849
Phytosanitary_treatments (Yes)	0.08	[0.01;1.7]	0.106
Product_used (Chemical insecticide)	0.63	[0.11;3.57]	0.600
Product_used (No)	0.12	[0.01;2.68]	0.181

Constraints on sorrel production

The Fig. 7 shows the main constraints identified in sorrel production. Diseases (88.7%) and water shortages (83.5%) were identified as the most significant constraints, followed by low soil fertility (27.8%). Other constraints, including limited knowledge of cultivation techniques (13.4%), drought (4.1%), and the lack of high-yielding varieties (3.1%), were reported much less frequently.

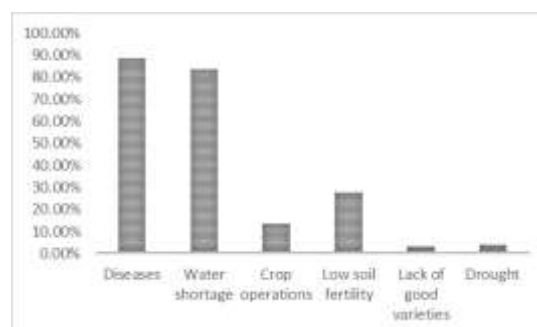


Fig. 7. Distribution of respondents by type of inorganic fertilizer

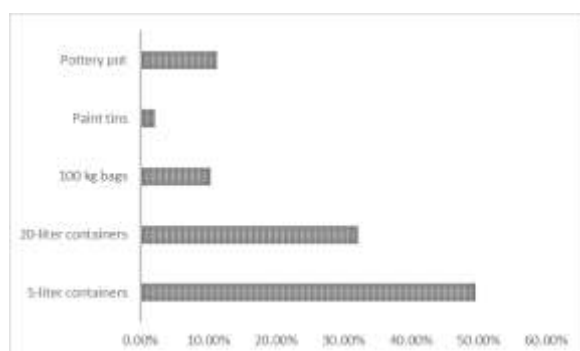


Fig. 8. Distribution of respondents by type of container used

Type of storage container

Survey shows that five-litre containers are the most commonly used for seed storage, accounting for 49.5% of cases, followed by twenty-litre containers with 32.2%. 11.3% of respondents use pottery pot, 10.3% use 100 kg bags and 2.1% of respondents use paint tins (Fig. 8).

Storage constraints

Fig. 9 shows the main constraints affecting sorrel seed storage. Insects' infestation emerged as the predominant challenge, being reported by 97.9% of respondents. While, only 2.1% of them identified other types of storage constraints.



Fig. 9. Distribution of respondents by seed conservation constraints

DISCUSSION

Surveys conducted in the Centre-West region of Burkina Faso, show that sorrel (*Hibiscus sabdariffa* L.) cultivation plays a significant role in the livelihoods of local populations, despite being practiced on small landholdings. The survey indicates that sorrel production is primarily carried out by women. Survey data collected from growers further indicate that sorrel cultivation in

the study area is almost exclusively managed by women, highlighting the strongly gendered nature of this agricultural activity. This situation may be explained by the central role of adult women within households, which reinforces their involvement in income-generating activities such as leafy vegetable production. These results are supported by those of (Ouangaoua *et al.*, 2022) who reported that sorrel is an undemanding crop and is socially perceived as feminine. Diouf *et al.* (2007) also underline that women possess specific knowledge and a strong interest in traditional leafy vegetables. Moreover, Doka *et al.* (2014) demonstrated that women are regarded as essential pillars of the household, playing a key role in both community survival and the conservation of local resources.

However, these finding contrast with those of Zongo (2022) who reports a man predominance among leafy vegetable producers in the Sanguié province. The analysis of educational level shows that the majority of respondents are illiterate. This is mainly due to the historical exclusion of rural women from educational opportunities, which remains a major obstacle to their socioeconomic independence. The low educational attainment observed among respondents reflects broader gender disparities in access to education in Burkina Faso. National statistics indicate that women remain disadvantaged in literacy and educational attainment compared with men (INSD, 2009). Data from the 2006 General Population and Housing Census (RGPH) similarly show that educational attainment was consistently higher among men than women, with women more frequently represented among those with no formal education (INSD, 2008). This limited access to education restricts women's ability to adopt modern agricultural techniques and access relevant information a point also supported by (Ntsama and Kamgnia, 2008), who identify education as a key determinant in the adoption of agricultural innovations.

In the Centre-West region, sorrel is mainly cultivated in vegetable growing areas, with Sourgou, Ramongo and Koudougou as key production zone. However, no precise data on sorrel cultivation areas are available for the region. In Boulkiemdé province, plots rarely exceed 400

m², reflecting its marginal status despite widespread consumption. Because it is considered a neglected crop, farmers are reluctant to allocate dedicated plots to it outside of vegetable growing areas. These observations are consistent with those of Ouangraoua *et al.* (2021), who also found that sorrel is mainly grown on small plots and is often cultivated along field edges or intercropped with peanuts, cowpeas, millet, sorghum, or maize.

However, in market gardening systems, raised beds are preferred for monoculture production. This finding aligns with previous reports on the cultivation practices of underutilised crops McClintock (2004) and Ouangraoua *et al.* (2021).

The results show that the local naming of sorrel varieties in the Mooré language are consistent, based on morphological criteria such as calyx colour, plant size, and calyx size. These findings align with those reported by Bâ (2023) and Ouangraoua *et al.* (2021). The varieties bii (short calyx) and wegda (long calyx) are the most frequently mentioned. Two other varieties are distinguished by color: bit-pelga (green sorrel) and bit-miougou (red sorrel), the latter further divided into two subtypes based on calyx coloration (Bâ, 2023).

Among the varieties cultivated, bite zalé is the most popular among consumers due to its smaller leaves, which are suitable for preparing sauces, and their lower acidity compared to the Wegda variety. These results are consistent with those of Diouf *et al.* (2007), who note that women's selection criteria relate to leaf morphology and taste after cooking.

The study highlights difficulties in accessing mineral fertilizers, whose use remains limited and often fails to comply with technical recommendations due to high costs and low levels of training among female producers. The majority of respondents rely on unregistered chemical pesticides, commonly referred to as "Marie gloves," due to a lack of biological alternatives and limited awareness of the associated health risks. These practices can lead to pesticide residues and other contaminants in the produce (Agre *et al.*, 2016).

However, some producers trained in agroecological methods use neem extracts for effective pest control. The main production constraints identified are fungal diseases and water scarcity, which have also been reported by Ouangraoua *et al.* (2021) and Diouf *et al.* (2007). Seeds are generally stored in airtight containers at home such as jars, jerrycans, or bags with ash which helps limit infestations. Nevertheless, insects, particularly *Spermophagus niger* (Coleoptera: Chrysomelidae), remain the primary constraint on sorrel seed storage. Several studies confirm that this species is the main pest affecting stored seeds in West Africa (Kaboré *et al.*, 2025; Koussoubé *et al.*, 2016; Sanon *et al.*, 2017).

CONCLUSION

Hibiscus sabdariffa remains an underutilized crop in Burkina Faso despite its nutritional, economic, and sociocultural importance. Its marginalization in agricultural policies and research programs contributes to the inefficient use of its production systems and the gradual loss of local seed stocks. This study underscores the critical role of traditional cultivation practices and indigenous seed conservation methods in preserving agrobiodiversity.

Integrating these practices into agricultural development strategies could promote the sustainable cultivation of roselle and enhance food and nutritional security.

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