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Ethno-Botanic Study and Characterization of the Farming System of Dry Season Sorghum's Accessions in South of Chad

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ABSTRACT

As part of the genetic resources conservation regarding to the accessions of sorghum out season and for a better understanding traditional management systems and conservation local accessions grown in the Sudanian area of Chad, prospecting and collection was conducted in six cantons. Two hundred and ninety eight farmers were involved in group interviews during investigations with the rate of 20.68% women. The study has allowed collecting 55 accessions, with an average of 9.17 per village accessions which indicates the presence of significant genetic diversity. The survey reveals a significant availability of arable land for flood-recession sorghum which is one of main staple food crop in the prospected areas. The peasant taxonomy has crucial importance in the diversity and culture system's management. Thus *Badourou* accession which means "against the snap" in Soumraï (local language) is sown around the fields to fight against grain eating birds. Also, the accessions of Naming characters seed color, the development cycle, use and origin of accessions. Outlook assessment morphological diversity, physiological and molecular values and are planned to preserve the genetic resources of this type of sorghum for genetic improvement.

KEYWORDS: Sorghum, out season, dry season, diversity, Chad.

1. INTRODUCTION

Sorghum [Sorghum bicolor (L) Moench] was domesticated more than 5,000 years, likely in areas that today correspond to southern Sudan and Ethiopia [1]. It is among the main crop cultivated in Chad with an annual production around 360,000 tons [2]. An original agricultural innovation of rural populations of Chad basin is the utilization in out season of flooded clay soils to bed sorghum and contributes to 10% of cereal production in Chad [3]; [4]. The flood-recession sorghum often allows providing essential production to populations living in marginal agricultural areas where the possibility to cultivate other crops is limited [5]. Generally, the accessions of this type of sorghum can grow in harsh climatic environments. The potential land area for this crop, in Central and West Africa is around 4 million hectares and 1 million hectares of this potential is located in Chad [6]. Chad is therefore a great potential growing area of the plant. Studies in different countries such as Senegal, Cameroon, Mali and Niger on flood-recession sorghum agree on existence to diversity of production and cultivation system of the plant and a significant genetic variability [7]; [5]; [8]. A study by [4] locates the great flood-recession sorghum growing areas in Chad, grouped into 4 main areas. The areas flooded by the Logone, the floodplain Ba-Illi of 2 000 km^2; Plain Massenya flooded by the river Chari of 15 000 km^2; Plain Salamat covering 180 000 km^2 meadows [4]. Despite the significant decline in flood-recession sorghum growing areas in Chad, very few studies have been undertaken to know its genetic diversity and use it to improve and to create varieties. It is partly to ameliorate this problem and improve the production of flood-recession sorghum to Chad that this study is conducted. It will be through a survey, a collection of accessions and through the history of flood-recession sorghum and then have information on farmers' cultivation practices.

2. MATERIALS AND METHODS

2.1. Study area

Prospecting was conducted in the Sudanian area of Chad extending between the 8th and 12th North parallel with an area of 193,050 km² and located between isohyets 800 to 1200 mm and sample collection is made in three regions, Tandjilé, Mayo Kebbi Est and Mayo Kebbi Ouest. The climate is tropical with alternating seasons, a wet season characterized by rainfall runs from May to November and a dry season from November to May. Annual rainfall recorded during the study, the Bébédjia station was 1297.4 mm, distributed as shown in Figure 1. The

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vegetation is characterized by savanna Sudano-Sahelian, slightly wooded north but more trees in the center, south savanna becomes Sudano-Guinean characterized by gallery forests.

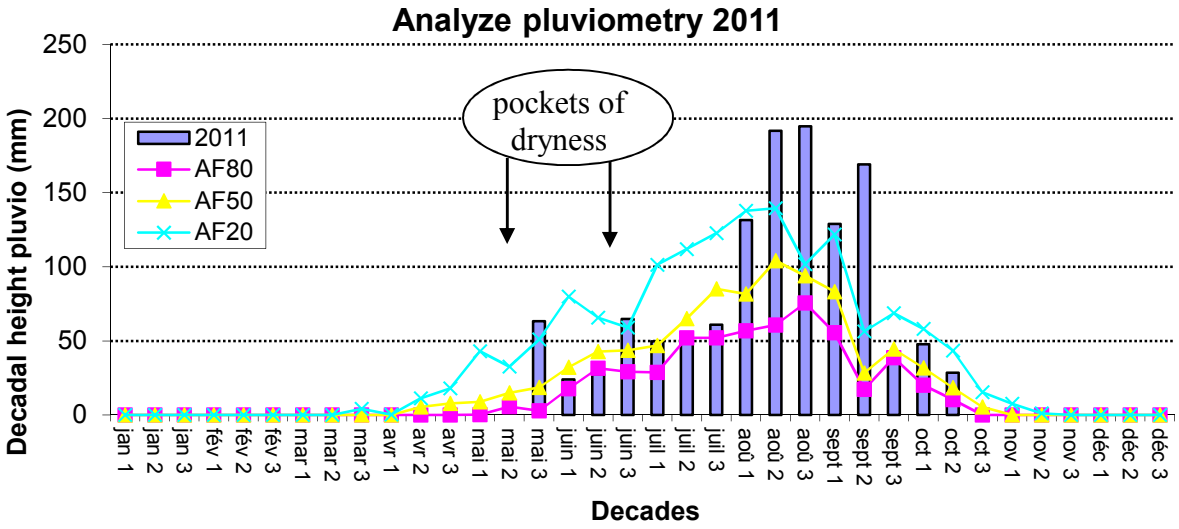

Figure 1 : Rainfall analysis of 2012

2.2. Site selection, data collection and analysis

The flood-recession sorghum crop in Chad is cultivated in dry season, within seasonal of flooded vertisols [4] specific to certain geographic areas. To determine producing regions of this type of sorghum, agricultural data were collected near the heads of regions of the National Rural Development Office (ONDR) in 7 regions of the Sudanian area. The presence of this culture was identified, only in the regions of Tandjilé and Mayo Kebbi Est and Mayo Kebbi Ouest. Six cantons were selected on the basis of flood-recession sorghum production, representing two per region and each village has been prospected. Data for this study were collected in January 2012 with a participatory technique based on observations and collecting panicles in the field, collective and individual interviews. After the presentation sessions to administrative and traditional authorities, field are visited and organized to have a clearer idea of growing sites and varieties used. Then the group discussion of work has been done with all producers of berbéré present in the village with the help of a translator and following a questionnaire guide. The general information (name of the canton, village and ethnic group) are collected. After a presentation of the research program objectives to producers, they are asked to list all the local varieties (common names) even those were not cultivated now in the village. Samples collected in the field are reviewed to ensure the effective presence of different local varieties. Through group discussions, detailed information about morphological descriptions, agronomic and culinary (as farmer perception) is documented. Information's on the origin of raw seeds, local names, their meaning, technology selection and seed saving, the uses of each accession are collected. To reduce intra-accessions heterogeneity, preference was given to collecting panicles rather than those of threshed grain. All the collected data were analyzed in Excel 2007 software.

3. RESULTS

3.1. People surveyed

The study was conducted in 6 village and 295 farmers were surveyed (Figure 2) with the largest workforce in Goulmourévé (67) followed by Margalao (62), Doumougou (61), Tchaguine (58), Biparé (19) and Youé (19). In Doumougou, Youé and Biparé, women did not participate in group discussions during the investigation, whereas to Tchaguine, there are more women (56.9%) than men (43.1%).

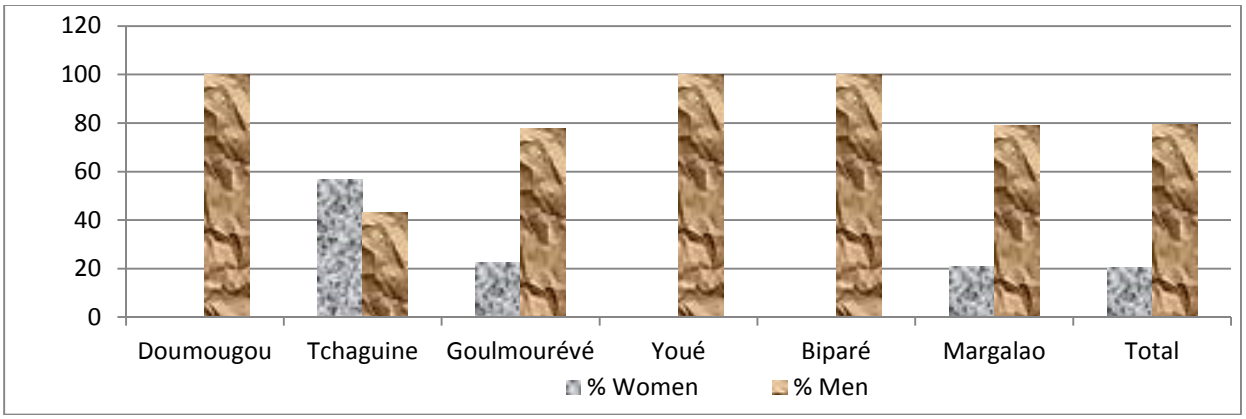

Figure 2 : people surveyed

3.2. Accession's diversity, cultivation and farming areas

Eight to 14 accessions were collected in 6 cantons with an average of 9.17 per canton accessions. Tchaguine (25.45%) is the canton which has provided most of the accessions (Table 1) and followed by the Goulmourévé (18.18%). A total of 46 accessions were collected. The investigation revealed the existence of a large availability of arable land for sorghum recession in the region of Tandjilé (Doumougou, Tchaguine), Mayo-Kebbi Est (Goulmorévé, Youé) and Mayo Kebbi Ouest (Margalao, Biparé). In the region of Logone Occidental there were not notified suitable areas for cultivation. Regions of Logone Oriental, Mandoul and Moyen Chari are full of significant potential in arable land. The Tandjilé Ouest department in Tandjilé region also has an availability of arable land that is not exploited because of threat animals. The flood-recession sorghum takes the main square of food crops in all cantons surveyed except Margalao where it takes the second place after the rained sorghum. Its culture is mainly practiced by the field manager (60%), but it can also be practiced by children (30%) for the preparation of school years and women (10%) for their own needs. Crop products are kept as panicle (54.55%) or grain (45.45%) in attics (38.46%), in sacks (38.46%) or on trays (23.08%).

Table 1: Characteristics of flood-recession sorghum's accessions

Modalities	Variants	Frequency (%)
Accessions collected per canton	*Doumougou*	14,54
	Tchaguine	25,45
	Goulmourévé	18,18
	Youé	14,55
	Biparé	12,73
	Margalao	14,55
Owners fields	*Manager of the holding*	60
	Child	30
	Woman	10
Seed conservation form	*Panicle*	54,55
	Grains	45,45
Place of harvest conservation	*Attic*	38,46
	bag	38,46
	hurdle	23,08

Crop residues, mainly stems (Figure 3) are left in the field (36.36%) or used as producers' animal feeds (45.45%) or sold to farmers (9.1%) or used in the preparation of the traditional salt by women (9.1%) for seasoning dishes.

Figure 3 : Using rods of recession sorghum accessions

3.3. Peasant taxonomy of accessions

The Table 2 can raise 6 ethnic groups and a various nomenclature accessions between these groups and within each group. The main criteria are the colors of the seeds, the use reserved for each accession, origin and some characters related to the panicle. In Soumraï, there is an accession called "*Badourou*" meaning against the snap millet because it produces bitter seeds milky grain stage and loses this character at maturity stage. This feature is used to push the seed-eating birds. There is an accession "*Farine*" that produces a lot of flour encountered both in Soumraï and Gabri. The accession "*Ndjamena*" encountered in Massah and Tupuri would come to Ndjamena. The accession "Toumon" encountered in Gabri, means sorghum round head. It is encountered in Lamé "Vounging" and in Moundang "Zabili" two accessions that have the same meaning, pig's mouth because the tip of the panicle which resembles the pig's mouth. There are names that evoke the particular type of sorghum, including «*Sécheresse*» in Gabri and "*Donglon*" among Tupuri meaning sorghum respectively dry seasons and sorghum that does not like the rain.

Table 2: Summary of common names and meanings of some accessions

Ethnic group	Number of accessions	local name	Meaning
Soumraï	1	*Maïdekomi*	Red sorghum grain
	2	*Farine*	Sorghum flour
	1	*Badourou*	Against birds eat-mil
Gabri	3	*Farine gournagourna*	Sorghum flour
	2	*Bagouwayeélété*	Bagouwayered
	2	*Secheresse*	Sorghum dry seasons
	1	*Toumon (Toukom)*	Sorghum round head
	1	*Gogoumi*	White sorghum flour
	1	*Heda dallatcho*	Young lady
	1	*Dormi*	white sorghum
Massah	1	*Tchokowawana*	As rained sorghum
	1	*Ndjamena*	Sorghum came to Ndjamena
Tupuri	1	*Ndjamena*	Sorghum came to Ndjamena
	1	*Mindeurie*	Sorghum flour
	1	*Tchorolalé*	Appreciates sandy
	2	*Donglon*	Who does not love the rain
	1	*Manbalam*	Sorghum Mambalam
Lamé	2	*Vounging*	Mouth's pig
	1	*DongloBando*	yellow sorghum
	2	*Bambou mbou*	Red sorghum
Mundan	1	*Zabili*	Mouth's pig

3.4. Original selection and seed management

In most cantons surveyed the flood-recession sorghum is an old crop. However, the culture is introduced in Goulmourévé and Biparé by colonizers in the 1950s for feeding aid during the years of famine. The criteria for choosing different accessions by producers are primarily the color of the grains (30.77%), secondly the precocity (23.08%) and the yield of the panicle (15.38%). Other minor characters, such as soil type, resistance to bird and plant height are also used in the selection of accessions. Producers distinguish accessions on the basis of the characteristics of the leaves, stalks, panicles, seeds and lengths and thicknesses of the stems. The selection of seed is

done in the field on healthy panicles, large and compact, but a few times, it also did in the attic. The flood-recession sorghum crop is made primarily by transplanting in all cantons. In Doumougou, it can be done by direct seeding in year of poor rainfall. However in Margalao, an accession *Bambou* is grown both in direct seeding and transplanting.

4. DISCUSSION

The study was conducted in 6 cantons and 295 farmers were surveyed and 20.68% are women. In Doumougou, in canton Youé and Biparé, women do not attend the group discussion, however in Tchaguine there were more women than men. The absence of women in some cantons in group discussions goes back to cultural origin because for certain ethnic groups, women must not take part in public debate, involving men.

The study collected 8 to 14 accessions per village, which corresponds to an average of 9.17 accessions per village. In total 55 accessions were collected and Tchaguine has provided most of accessions (14). This average value of 9.17 is lower than that of [9], which obtained 12.4 average varieties of sorghum in Burkina Faso but much higher above those of [10] on sorghum of Benin, [11] on the sweet grain sorghum in Burkina Faso and [12] on the sweet grain sorghum in Chad who found 5.54, 1.24 and 2.84 respectively. This determines existence of great diversity which is an important asset for the genetic improvement of sorghum cultivation programs in Chad.

The investigation revealed the existence of a large availability of arable land for flood-recession sorghum in the Sudanian area of Chad. According to [4], the largest transplanted sorghum expansion areas are between the latitudes 9˚5 'and 13˚0' N, in Nigeria, in Northern Cameroon and in Chad [4]. In the regions of Eastern Logon, Mandoul and Moyen Chari, it is noted significant potential of arable land, which is not exploited because of the threat animals. In the region of Mayo-Kebbi East, the culture occupies an estimated area of 56,311.5 ha for an estimated area of 57,936.17 ha for rained sorghum and in the Mayo-Kebbi West region; it occupies an estimated area 11,040 ha for an estimated area of 63,574.33 ha for rained sorghum. According to [6] the potential area in flood-recession sorghum in Chad is situated around 1 million ha.

The study revealed the existence of six ethnic groups with widely varying of local taxonomy between and within these groups. Peasant denominations do not only change from one locality to another but also from one ethnic group to another [11]; [13]. The main criteria used are the colors of the seeds, the use reserved for each accession, origin and some characters related to the panicle. According to [14], [15] and [16] common names of sorghum are related to the type of panicle, color of husks of grains as well as the development cycle. In Soumraï, there is one accession called "Badourou" meaning against the snap millet because it produces bitter in the stage of milky grain and lost this character at maturity stage. This feature is used to pushout the seed-eating birds. Indeed, the farmers sow this accession around their field, thus at the time the birds attack the field, they are to push back by the bitter taste of this accession and leave the field. That makes it possible to protect the other accessions from the attack of the birds.

It is encountered in both the Soumraï and Gabrian accession "*Farine"* that produces a lot of flour. The presence of the same name in several ethnic groups could be attributed to seed exchanges that take place freely between farmers [11] and [10]. There are names that evoke the particular type of this sorghum, particularly "*Sécheresse"* in Gabri and "*Donglon"* in Tupuri which respectively mean sorghum dry seasons and sorghum that does not like the rain. The recognition of the names give to varieties a perfect knowledge of the traditional classification system which is important because the local name is the basic unit used by producers in the management and selection of these genetic resources [10].

The flood-recession sorghum is produced in monoculture, in the surveyed area, because there is no other crop could be cultivated in dry season. In most cantons surveyed the flood-recession sorghum is an old crop. However, the culture is introduced in Goulmourévé by colonizers and Mambaye in the 1950s, for food or food aid during the years of famine. According to [4] all local residents' plains or flood basins in Chad have largely turned to the production since the drought of 1970-1980.

The criteria for choosing different accessions revealed by producers are primarily grain color, precocity and yield of the panicle. According to [11] the method of country selection is based primarily on visible phenotypic characters and easy to observe. Other minor characters, such as soil type, resistance to bird and plant height are also used in the selection of accessions. Producer distinguished the accessions on the basis of the characteristics of the leaves, stalks, panicles, seeds and lengths and thicknesses of the stems. The selection of the seed is done in the field on healthy panicles, large and compact, but a few times, it also did in the attic.

The flood-recession sorghum crop is made primarily by transplanting in all cantons. At Doumougou it can be done by direct seeding in year of poor rainfall and in Margalao, *Bambou* accession is grown both in direct seeding and transplanting. In the valley of the Senegal River, the flood-recession sorghum is distinguished by the absence of transplanting [17].

5. Conclusion

This study has allowed to collect 55 flood-recession sorghum accessions and to highlight significant genetic diversity recessions sorghum managed by producers. The essential accession's is done by transplanting, however in Doumougou it is done by direct seeding till year of poor rainfall and in Margalao, an accession *Bambou* is grown both in direct seeding and transplanting. The peasant accessions taxonomy is based on characters related to seed color, form panicle, cycle, and criteria relating to places of culture, type of use and made the supposed origin of accessions. Seeds are collected in the field on the best panicles and diversity management is done by sowing in Bluck all the different accessions. To make this study comprehensive and effectively and sustainably develop this collection, morphological and molecular genetics characterization of accessions are necessary to create a core collection.

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