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THE COLLECTING OF FORAGES AND WILD CROP RELATIVES
IN CENTRAL AND SOUTHEASTERN CHAD
OCTOBER TO DECEMBER, 1987

INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES (IBPGR)
ROME, ITALY

LABORATOIRE DE RECHERCHES VETERINAIRES ET ZOOTECHNIQUES DE FARCHA
N'DJAMENA, CHAD

IBPGR OFFICE FOR WEST AFRICA
NIAMEY, NIGER

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THE COLLECTION OF FORAGES AND WILD SPECIES RELATED TO CROPS.
IN CENTRAL AND SOUTHEASTERN CHAD
OCTOBER TO DECEMBER, 1987

1. INTRODUCTION

As a continuation of the Sahel Survey a joint IBPGR/Chadian mission collected forage and crop resources in, mainly, the sahelian zone of Chad from October to December, 1987.

The mission was organized jointly by the IBPGR Office for West Africa and the 'Laboratoire de Recherches Veterinaires et Zootechniques' of the Chadian Ministry of Livestock. The 'Direction des Forets et des Parcs et Reserves' of the Ministry of Tourism and the Environment participated and the mission was financed by the IBPGR.

Chad, in common with other countries in the Sahel, is experiencing increasing desertification from the combined onslaughts of persistent droughts and overexploitation of the land. Degradation of the natural vegetation is resulting in a rapid decline in both the diversity of species and infraspecific variation. As ecotypes disappear so too are lost many distinctive adaptations which could be important in the regeneration of pastures and introduction and reintroduction of well-suited crops.

The droughts and resulting crop failures are also leading to the loss of traditional crop varieties. These landraces together with their related wild species, constitute the reservoir of genetic diversity on which future crop improvement depends.

There is, therefore, an urgent need to survey, sample and conserve the crop and forage resources of Chad for both immediate and future evaluation and utilization. There has been little past germplasm collecting in Chad. In 1977 an IBPGR/IRAT/ORSTOM mission collected rice in mainly the southwest of the country. ICRISAT has a collection of sorghum and millet from Chad, but the IBPGR is not aware of the exact origin of this seed. Past collections made by the French institutes have been dispersed or lost for various reasons. Through the activities of IEMVT mainly, a number of studies have been carried out on the composition and productivity of the natural vegetation, particularly in the western part of the country. However, no seed collections of the important forage and browse species of Chad are known to exist. Chad requires urgent assistance with both the collecting and conservation of its plant genetic resources.

Following visits by the IBPGR Field Officer for West Africa to the Ministries of Livestock and Agriculture in N'Djamena and subsequent discussions with IITA and ICRISAT, two complementary missions were planned for Chad in 1987 : .

1) With priority on forage species and wild species in crop gene pools of the sahelian zone ; organised jointly by the IBPGR and the 'Laboratoire de Farcha' ; presented in this report,

2) With priority on IITA and ICRISAT mandate crops (and their wild relatives) in the sudanian zone ; organised jointly by IITA and the 'Direction de la Recherche Agronomique' Ministry of Agriculture, reported by IITA. ICRISAT were unable to participate on this mission.

2. ORGANIZATIONS AND PERSONNEL

1. IBPGR Field Office for West Africa
c/o ICRISAT Sahelian Center (ISC)
B.P. 12404, Niamey - Niger
 - Jane TOLL : IBPGR Field Officer
participation : 6 Oct - 14 Dec
 - Evans LAGUDAH : IBPGR Intern undertaking research on the Pennisetum genepool c/o USDA ARS Coastal Plain Station, Tifton-USA
Participation : 6 Oct - 23 Nov
 - Adamou SOUNON : ISC Driver on loan to the IBPGR
Participation : 6 Oct - 14 Dec
2. Laboratoire de Recherches Veterinaires et Zootechniques de Farcha
B.P. 433, N'Djamena - Chad
 - Directeur : Dr A. IDRISSE
 - Chef Section Agrostologie : Dr A. ICKOWICZ
 - Queddo DASSERING : Chef Adjoint du Service Agropastoralisme
Participation : 8 Nov - 11 Nov ; 25 Nov - 1 Dec
 - Parfou GONGNET : Chef Departement de Zootechnie et Nutrition
Participation : 19 Oct - 5 Nov
3. Direction des Forets, Chasse et Lutte Contre la Desertification, NDjamena - Chad
 - Directeur : Mr A. MAHAMAT
 - CTP Project UNDP/FAO/CHD/85/003 : Mr T. HOUNTO-HOTEGBE
 - Bardoum DJEKOURBIAN : Chef Service Reboisement
Participation : 8 Nov - 1 Dec.
4. Direction de Tourisme, des Parcs Nationaux et Reserves de Faune, N'Djamena - Chad
 - Directeur : Mr DABOULAYE
 - Chef du Parc Zakouma : Baissekim TINAN
Participation : 29 - 30 Nov

3. ITINERARY

6 - 11 October, From Niamey to N'Djamena overland via N'guigmi (Niger) and Bol (Chad). Collecting along northern shore of Lake Chad.

12 - 18 October, N'Djamena. Preparation for the mission at Laboratoire de Farcha, Direction des Forets, FAO, UNDP.

19 - 22 October, Collecting in the region of Lake Fitri : Moito-Bokoro - Abourda - Ngolo (shore of Lake Fitri) - Bokoro - Am N'Djamena Bilala - Yao - Ati.

23 - 27 October, Preparations at the Prefecture of Batha, Ati. Collecting in the region of the basin of the river Batha : Ati - Djedda - Ati - Koundjourou - Birketfatime - Oum Hadjer - Am Sak - Haraz Djombo - Wadi Enne - Am Sak - Abeche.

28 October - Preparation for mission in Ouaddai Prefecture

29 - 31 October, Collecting in Southern Ouaddai region : Abeche - Abdi - Am dam - Deressa - Abeche.

1 - 2 November, Collecting in Central Ouaddai mountains : Abeche - Am Zoer - Abeche.

3 - 4 November, Return to N'Djamena via Ati.

5 - 7 November, Preparation for 2nd trip.

8 - 13 November, Collecting in the region of Lake Chad and Bahr el Ghazal : N'Djamena - Mao - Marat - Mao - Moussoro - Massakori - Tourba - Karal - Douguia - N'Djamena.

14 November, N'Djamena

15 - 20 November, Collecting in the region southeast of N'Djamena : N'Djamena - Dourbali - Bokoro - Ngama - Bili - Dourbali - Massenya - N'Djamena.

21 - 24 November, N'Djamena. Departure of E. LAGUDAH. Preparations for final trip.

25 - 26 November, Travel to Sahr

27 November - 1 December, Collecting in southeast (Salamat) : Singako - Am Timan - Parc Zakouma - Abou Gara - Am Timan.

2 - 5 December, Return to N'Djamena

6 - 9 December, N'Djamena. Preparations for departure.

10 - 14 December, Return to Niamey via Kouesseri (Cameroon) and Maiduguri, Kano (Nigeria).

4. REGIONS EXPLORED

4.1. INTRODUCTION.

Chad's territory, 1 284 000 km², covers the eastern part of the Lake Chad Basin. The average altitude of the basin is approximately 300 m and the lake itself lies at 280 m. This low relief is broken by the central plateau of Guera and, locally, by much eroded granite outcrops. The highlands of Tibesti and Ouaddai border the basin to the north and east, respectively.

The Lake Chad Basin is drained by three major rivers : the Chari, Logone and Batha. The Chari, the major feeder of the Lake,

rises in the mountains of the Central African Republic and its tributaries (Bahr Erguig, Bahr Azoum, Bahr Salamat) drain the swampy region of southeastern Chad (Salamat). The Logone has its source in the Adamoua mountains of Cameroon and, when in flood, inundates vast areas of lowlying land along its course to Lake Chad. The Batha, a semi permanent river, rises in the Ouaddai and drains into Lake Fitri.

The rivers, Lake Chad and Lake Fitri, experience large seasonal fluctuations and, between years, major differences in their volumes. With the droughts of recent years there has been a considerable drying of the lakes and rivers. The Bahr el Ghazal, which formerly drained Lake Chad to the northeast, no longer functions and both Lake Chad and Lake Fitri have diminished significantly in size.

According to the duration and amount of the annual rains, Chad can be divided into 5 major climatic and corresponding vegetational zones : Saharan (<100mm), Sahelian (100 - 400mm) Sahelo-Sudanian (400 - 800mm), Sudanian (800-1200), Guinean(>1200mm). Due to the higher relief in the east and the related SW - NE trend of the isohyets, Sudanian vegetation extends further north in the east.

4.2 AREAS SURVEYED AND COLLECTED

The mission concentrated on the sahelian and sahelo-sudanian zones and explored, relatively intensively, a band, east-west across the country, between latitudes 11 deg N and 14 deg N. In addition, the Salamat region of southeastern Chad, which lies in the Sudanian zone, was also explored.

The different ecological areas surveyed and collected, are as follows :

- Region north of Lake Chad
- Bahr el Ghazal and southern edge of Lake Chad
- Lake Fitri Region
- Basin of the River Batha
- Ati - Wadi Enne - Abeche, triangle
- Ouaddai Highlands
- Region southeast of N'Djamena
- Salamat Region

The collection sites are shown on the map, page

The region north of Lake Chad

Prefecture : Lac-Kanem

Sites : 1- 6

This is a very sandy region with characteristic depressions, 'ouaddis', between the dunes. The Kanem region has been particularly hard hit by drought in recent years and the

precipitation recorded this year for Mao was only 119 mm.

Over much of the region, the dunes are practically devoid of vegetation with only *Leptadenia pyrotechnica* resisting the shifting sand and dunes. Other patches of vegetation were characterized by sparse cover of the sahelian annual grass species, *Aristida funiculata* and *Cenchrus biflorus* and the legume *Tephrosia*. Where the soil is less sandy and more loamy, *Balanites aegyptiaca*, *Eragrostis tremula* and *Dactyloctenium aegyptium* are found.

Pearl millet is cultivated on the dunes, but in recent years, harvest failure is common as it was this year. Consequently cultivation of the 'ouaddis' is extremely important in the subsistence of the region. A few of these depressions are permanent ponds with fish, but the majority dry out after the rains and wells and channels are constructed to irrigate gardens. Maize, sorghum, potatoes, okra, tomatoes, onions, peppers etc. are grown on the clay soils during the cool months. Some 'ouaddis' are reserved for date palm plantations.

Bahr el Ghazal and southern edge of Lake Chad

Prefectures : Kanem, Chari Baguirmi

Sites : 43 - 54

The Bahr el Ghazal ceased to flow during the 17th century. The vegetation along its course is now much degraded and was particularly sparse this year due to exceptional low rainfall.

It was thought that wild millet may grow along the northern parts of the Bahr el Ghazal. However, in view of the severe drought this year, no attempt was made to explore the area. Furthermore, from discussions with local people and observations of the vegetation and habitat of the Bahr, it seems unlikely that wild millet given its annual growth habit, would be present.

Wild millet, *Pennisetum glaucum* subsp. *monodii*, was present as a component of the wooded grassland on the sandy loams of the southern shore of Lake Chad. The woodland comprised of *Balanites aegyptiaca*, *Acacia senegal*, *A. nilotica* var. *adansonii* and, but very rare, *Maerua crassifolia* with a grass cover of *Aristida*, *Dactyloctenium*, *Chloris* and *Brachiaria*. *A. albida* was also present, but the trees had been planted by a CARE project. It was not uncommon to find wild millets in areas with a predominantly *Calotropis prolera* flora cover.

On the heavier soils of the seasonally waterlogged depressions, *A. nilotica* var. *tomentosa*, *A. seyal*, occasionally *A. sieberana* and also *Zizyphus mauritania*, *Pilostigma reticulatum* and *Bauhinia rufescens* were present.

These temporary ponds and seasonally waterlogged depressions with their black cracking clay soils (vertisols) were a characteristic habitat for the wild rice species, *Oryza barthii*, *O. longistaminata* and *O. punctata* and, occasionally for wild sorghum, *Sorghum bicolor* subsp. *arundinaceum*. Some depressions were being used for the cultivation of rice (*O. sativa*) and sorghum alongside their respective wild relatives. Pools which

retain their water well into the dry season were colonized by *Echinochloa stagnina* with, often, *E. pyramidalis* and *E. colona* around the periphery. In addition, patchy areas of well grazed *P. purpureum* were observed.

The temporary ponds and seasonally waterlogged depressions are a common feature throughout central and southern Chad. The very important role they play in both the agricultural and livestock systems of Chad is discussed later.

Lake Fitri region

Prefecture : Chari Baguirmi, Batha

Sites : 7 - 16

Balanites aegyptiaca was the predominant tree of the sahelian wooded grassland of this region. The sandy loam soils supported a grass cover including *Schoenefeldia gracilis*, *Cenchrus biflorus*, *C. pieurii*, *Aristida funiculata*, *Chloris virgata*, *Dactyloctenium aegyptium* and *Panicum laetum* with the legumes *Zornia glochidiata* and *Alysicarpus* sp. *P. laetum*, locally known as 'kreb', was harvested, partly to supplement the poor millet harvest this year, but also because its flavour in the making of 'boul' is highly appreciated. 'Kreb' commands a higher market price than millet.

The millet harvest had been hit by both drought and cricket damage this year. Some sorghum had been grown, but this too had largely failed because of the poor rains. At the time of the mission, the 'berbere' sorghum was still at the vegetative stage, but was expected to produce a crop. In addition, groundnuts, cowpeas, okra, cucumbers and roselle are grown.

Three habitats, typical of the region, were the shore of Lake Fitri, temporary ponds and granite outcrops. The latter are mounds of huge granite boulders piled up to a height of about 200m. The crevices between the boulders were characteristically occupied by *Pennisetum pedicellatum*.

Wild rices were common in the temporary pools but no cultivation of rice or harvesting of the wild species, was seen. *Acacia nilotica*, *A. seyal* and *Echinochloa* sp. were also common in the waterlogged depressions.

Where soils were clayey, but not waterlogged, wild sorghum was present and at one of these sites *Andropogon gayanus* was found, but it was a small population with sterile florets. Wild millet, *P. glaucum* subsp. *monodii* (coll: no 13) was found growing amongst the clumps of *Hyphane thebaica* on sandy loam soil. Although it was not adjacent to a crop, millet was cultivated in the area.

Large populations of *Echinochloa pyramidalis* and some wild rice and *P. purpureum* was found together with *H. thebaica* on the shore of lake Fitri. The *Echinochloa* was being cut for forage.

Basin of the River Batha

Prefecture : Batha

Sites : 19-24

The area along the northern bank of the river Batha, between Ati and Oum Hadjer, was explored. It is densely cultivated, but the millet and sorghum harvest were badly damaged by crickets this year. Cowpeas, groundnuts and sesame were also grown.

Women were seen labouriously harvesting 'kreb' (*P. laetum*) to supplement this year's harvest and *O. barthii* was being sold at a village market.

Acacia albida shaded the town of Koundjourou, but was not found in the natural woodlands of *Balanites aegyptiaca*, *A. mellifera* and *Guiera senegalensis*.

Seasonal ponds were also a feature of this region and samples of *Echinochloa*, *Oryza*, *Sesbania* and *Aeschynomene*, were collected.

The Ati-Wadi Enne - Abeche triangle

Prefectures : Batha, Ouaddai

Sites : 17-18, 24-27

The region between Ati and Abeche and north to Wadi Enne, was explored. There has been 5 years of drought in the region and consequently many of the trees were dead and the grass cover gone or very poor.

Of those trees still surviving, *Balanites aegyptiaca* was dominant with some *Capparis decidua* and occasionally *A. tortilis*. On heavier soils, *A. mellifera* was present. The legumes *Zornia glochidiata* and *Alysicarpus* sp. plus the 'weeds' *Sesame* sp. and *Chorchorus* sp. were colonizing badly degraded areas and abandoned fields, where the natural grass cover had disappeared.

Collections were made from the temporary ponds, seasonal depressions and the pools left in the wadis. The cracking clay soils and high water levels supported *A. nilotica* var *tomentosa*, *Bauhinia rufescens* and *Zizyphus mauritania*. At the pond near the village of Am Sak (site 25), an aged population of *A. albida* was found and last year's seed pods collected. This pond, together with others in the region, was colonized by *Echinochloa* sp and wild rices. *O. barthii* was being harvested and, at a pond near the village of Djedda (site 18), *O. longistaminata* was collected for the first time.

Ouaddai highlands

Prefectures : Ouaddai, Biltine

Sites : 28 - 42

The Ouaddai highlands mark the eastern border of the Chad Basin. The granite mountains are much eroded and almost drowned in their accumulated weathered products. In the north, the mountains are more prominent and higher, but, because of the

drought this year, the mission concentrated on the southern Ouaddai. Here, the elevated plain, 550m to 880m, is dotted with ridges and peaks and cut by wadis.

With the higher altitudes and rainfall, elements of the sudanian flora extend further north in the Ouaddai. *Pennisetum pedicellatum* was found north of 14 deg, but elsewhere in central and western Chad, at the lower altitudes, it was not found north of 12deg30'. *Andropogon gayanus* which was extremely rare at the same latitude in central and western Chad, was fairly common in the Ouaddai.

A typical habitat for both *P. pedicellatum* and *A. gayanus* and, more rarely, *P. polystachion*, *P. glaucum* subsp. *monodii* and *Sorghum bicolor* subsp. *arundinaceum*, was the border of seasonal rivers such as the river Batha at Am Guereda and the numerous wadis in the region. Along these wadi edges, the soil was more silty resulting in a high moisture retention. *A. gayanus* was also found together with wild rice (*O. barthii*) and species of *Echinochloa* in the seasonal pools where the soils were heavy, cracking clays. In common with the other regions explored, the crevices between the granite boulders of the outcrops, were typically colonized by *P. pedicellatum*.

Combretum, *Gardenia* and other trees of the sudanian zone were present in the woodlands largely dominated by *Balanites aegyptiaca*. Where the soils were heavier, along wadis and in depressions, *Pilostigma reticulatum*, *A. seyal*, *A. nilotica* and *Mitragyna inermis* were found. At the higher altitudes, northeast of Abeche, *A. mellifera* was common with some *A. tortilis* and *A. ehrenbergiana*. Along the wadi edges were found *Zizyphus mauritania* and *Bauhinia rufescens* and occasionally, a few aged *A. albida* trees.

The millet and sorghum harvest was poor this year because of the drought. In the region of Am Zoer, fruit trees, guava, mango and citrus, are grown in the wadis and during the dry season, vegetables are cultivated under irrigation.

Region southeast of N'Djamena

Prefecture : Chari Baguirmi, Guera
Sites : 55 - 73

The region explored, Doubali - Bokoro - Ngama - Massenya - Doubali, falls within the sahel - sudanian transition zone. The woodlands included species of *Combretum*, *Khaya senegalensis*, *Anogeissus leiocarpus*, *Dichrostachys cinerea*, *Guiera senegalensis*, *Boscia senegalensis*, and on the heavier soils, *Pilostigma reticulatum*, *Mitragyna inermis*, *Zizyphus mauritani*, *A. seyal*, *A. nilotica*, *A. pennata*, *Diospyros mespiliformis* plus the ubiquitous *Balanites aegyptiaca*. The area between Doubali and Bokoro was dominated by *A. senegal* which, since it had already mature pods, was collected.

Pennisetum pedicellatum was a common species throughout the region. It occurred in two distinctive habitats : in the crevices between boulders on the granite outcrops and in thickets (around the trees in closed woods). In the latter habitat plants were often found with an 'intermediate' head morphology characteristic of both less common species *P. polystachion* and *P. pedicellatum*

Andropogon gayanus was markedly more common in this region than in zones further north. Typically it was growing in depressions where the soils were heavier and clayish, but it was also found in the crevices on the granite outcrops.

Seasonal pools colonized by *Echinochloa* sp., *Aeschynomene* sp. and wild rice were also a feature of this region.

Sorghum was a major crop and since the drought was less severe in this region, it was possible to collect a diversity of types.

Salamat region

Prefecture : Salamat

Sites : 74 - 92

Salamat receives an average annual rainfall in excess of 800mm and lies within the sudanian zone. The whole region is extensively flooded during and for two months following the rainy season. For half the year, Am Timan, the prefectural capital, can be reached by air only. The clayey soils become waterlogged and vast low-lying areas are inundated.

The trees and grasses of the woodlands were typical of sudanian vegetation. The grass cover was dominated by tall species of *Loudetia*, *Andropogon*, *Hyparrhenia* and the perennials *Andropogon gayanus* and *A. africanus*. *Aristida*, *Setaria*, *Chloris*, *Eragrostis* were locally common. The trees were mainly non-spiny: *Anogeissus*, *Mitragyna*, *Combretum*, *Gardenia*, *Tamarindus*, *Balanites*.

Under the trees, in closed woods and thickets, *Pennisetum pedicellatum* and *P. polystachion* were common. On the heavy clay soils of the seasonally flooded plains, *P. atrichum*, *Sorghum bicolor* subsp. *arundinaceum*, *S. purpureo sericeum*, *A. gayanus* and *Panicum arundinaceum* were locally common. *Cassia* sp. *Alysicarpus rugosus* and wild *Abelmoschus* were also typically found in this habitat. In the very swampy depressions, *Aeschynomene* sp. *Echinochloa* sp., *Oryza barthii* and *O. longistaminata* predominated.

This region showed none of the stark signs of desertification familiar in the more northern latitudes. However, the region is crossed by major routes of transhumance. In the vicinity of these tracks and around the ponds and water points along their routes, the vegetation is badly degraded.

Bush fires are widespread in the region in October and November at the time of the transhumance. As the pastures dry the nomads move southwards from the Sahel through Salamat to southwestern Chad and into the Central African Republic. The bush fires may be caused accidentally by camp fires or cigarettes, but may be set deliberately by the villagers to keep the cattle out of their fields. Also they may be lit by the herders in order to produce a regrowth for their cattle to eat during the ascent the following March. The effects of cash fires on the vegetation, its species composition and development, needs further study.

Due to its flooding and inaccessibility, the region is only sparsely inhabited. Near the larger towns, Kyabe and Sahr, cotton is the major crop. The major cereals were millet and sorghum and there was variety of local landraces of the latter. Other crops included groundnut, cowpea, okra.

5. SPECIES ENCOUNTERED AND SAMPLES COLLECTED

The samples collected are listed in the table and the sites explored are shown on the map.

TABLE 1 - SAMPLES COLLECTED IBPGR/LAB FARCHA CHAD 1987

SPECIES	NUMBER OF SAMPLES COLLECTED	STATUS: W WILD C CULT	DISTRIBUTION						
			A	B	C	D	E	F	G
CROP GENEPOOLS									
Pennisetum glaucum subsp glaucum	14	C	+	+	+	-	-	-	+
P. glaucum subsp monodii	5	W	+	+	+	-	+	-	-
P. ramosum	3	W	+	+	+	-	+	-	-
P. pedicellatum	12	W	+	+	+	-	+	-	-
P. polystachion	8	W	+	+	+	-	+	-	-
Sorghum bicolor subsp bicolor	30	C	+	+	-	-	-	-	+
S. bicolor subsp arundinaceum	5	W	+	+	+	-	+	-	-
S. purpureo-sericeum	3	W	+	+	+	-	+	1	-
Oryza barthii	11	W	+	+	+	-	-	-	-
O. longistaminata	3	W	+	+	+	-	-	-	-
O. punctata	1	W	+	+	+	-	-	-	-
Vigna subterranea	1	C	+	+	-	-	-	-	+
V. unguiculata subsp unguiculata	4	C	+	+	-	-	+	-	+
V. unguiculata subsp dekindtiana	1	W	+	+	-	-	+	-	-
V. ambacensis	1	W	+	+	-	-	+	-	-
Vigna sp.	1	W	+	+	-	-	+	-	-
Abelmoschus esculentus	3	C	+	+	+	-	-	-	+
Abelmoschus sp.	2	W	+	+	+	-	-	-	-
Arachis hypogea	2	C	+	+	+	-	-	-	+
Canavalia ensiformis	1	C	+	+	-	-	-	-	+
Citrullus lanatus	1	C	+	+	+	-	-	-	+

<i>Citrullus lanatus</i>	3	W	+	+	+	-	-	-	-
<i>Sesamum indicum</i>	3	C	+	+	+	-	-	-	+
<i>Sesamum sp.</i>	2	W	+	+	+	-	-	-	-
<i>Zea mays</i>	3	C	+	-	-	-	-	-	+
FORAGE HERBS									
<i>Andropogon gayanus</i>	10	W	+	+	-	+	+	-	-
<i>Bulboschoenus maritimus</i>	1	W	+	+	-	+	+	-	-
<i>Dactyloctenium aegyptiaca</i>	2	W	+	+	-	+	+	-	-
<i>Cynodon dactylon</i>	1	W	+	+	-	+	+	-	-
<i>Echinochloa colona</i>	1	W	+	+	-	+	+	-	-
<i>E. pyramidalis</i>	3	W	+	+	-	+	+	-	-
<i>E. stagnina</i>	3	W	+	+	-	+	+	-	-
<i>Alysicarpus glumaceus</i>	1	W	+	+	-	+	+	-	-
<i>A. ovalifolius</i>	2	W	+	+	-	+	+	-	-
<i>A. rugosus</i>	2	W	+	+	-	+	+	-	-
<i>Aeschynomene indica</i>	4	W	+	+	-	+	+	-	-
<i>Aeschynomene sp.</i>	1	W	+	+	-	+	+	-	-
<i>Desmodium sp.</i>	1	W	+	+	-	+	+	-	-
<i>Sesbania rostrata</i>	1	W	+	+	-	+	+	-	-
<i>Tephrosia pumilia</i>	1	W	+	+	-	-	+	-	-
<i>T. purpurea</i>	1	W	+	+	-	-	+	-	-
<i>Zornia glochidiata</i>	5	W	+	+	-	+	+	-	-
Unidentified legume	1	W	-	+	-	-	-	-	-
FORAGE TREES									
<i>Acacia albida</i>	2	W	+	+	-	-	-	+	-
<i>A. mellifera</i>	3	W	+	+	-	-	+	+	-
<i>A. nilotica</i>	1	W	+	+	-	-	-	+	-
<i>A. senegal</i>	1	W	+	+	-	-	-	+	-
<i>Balanites aegyptiaca</i>	3	W	+	+	-	-	-	+	-
<i>Bauhinia rufescens</i>	2	W	+	+	-	-	-	+	-

Dichrostachys cinerea	1	W	+	+	-	-	-	+	-
Prosopis africana	1	W	+	+	-	-	+	+	-

- A - IBPGR designated base collections
- B - IBPGR/ISC working collection
- C - Others (see p. 20)
- D - ILCA
- E - CHAD : Laboratoire de Farcha
- F - CHAD : Direction des Forets
- G - CHAD : Direction de l'Agriculture

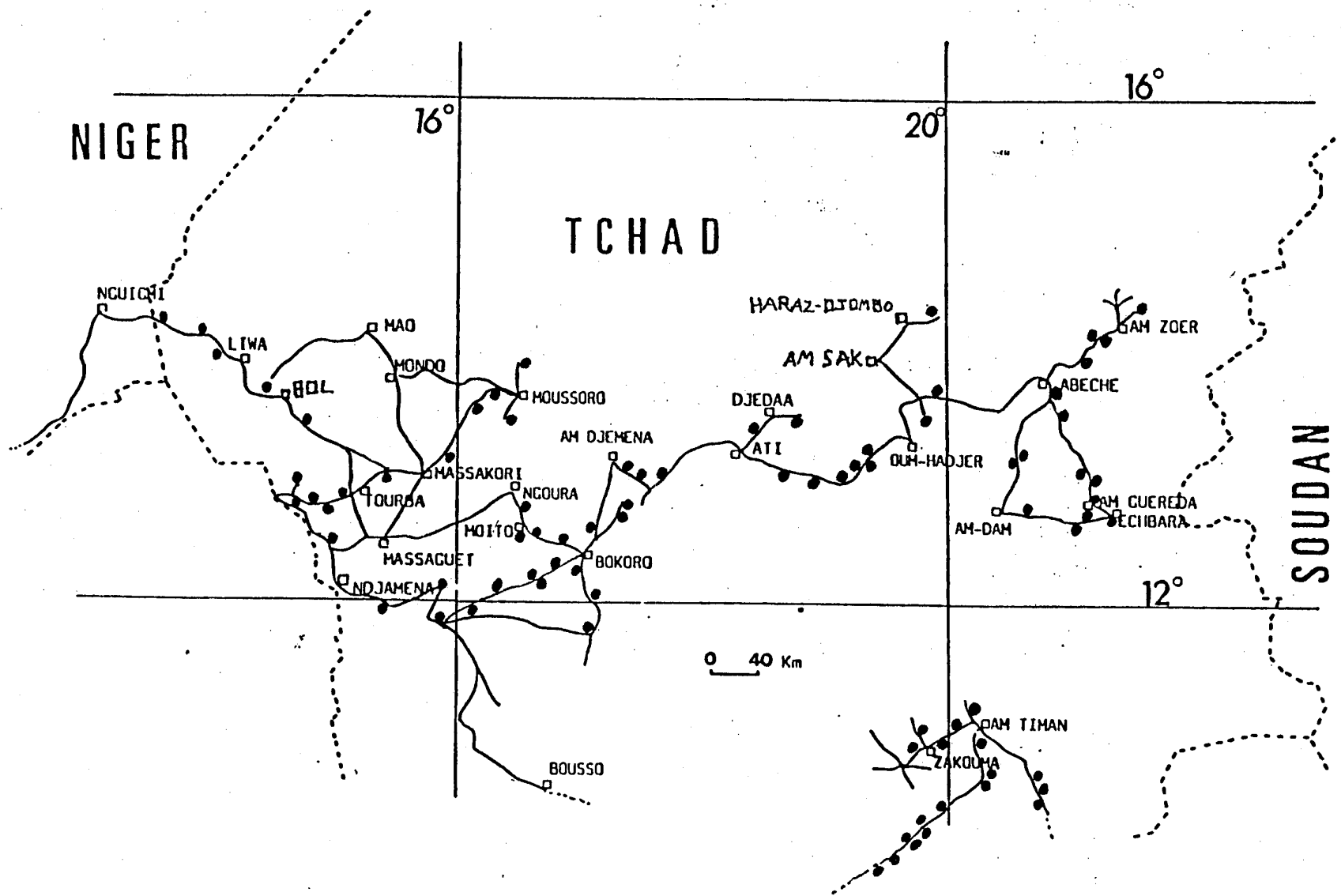


Figure 1 : Route and sites of collection

5.1. COLLECTING METHOD

All samples were of seed and except for the crops and a few selected accessions, they were gathered randomly throughout the site or as large a part of it as was feasible from as many individual plants as was possible. The objective was to ensure that a very high percentage of the genetic diversity at the site (in the population) was sampled and the amount of seed collected was sufficient for division into subsamples still largely representative of the original population.

The samples were gathered in cloth bags and kept in a shaded wire cage on the vehicle roof rack, in order to facilitate drying. Periodically the samples were checked and leguminous species with bad insect infestation were treated with Lindane powder.

Sample and site data was recorded on the standard IBPGR collecting forms and observations noted on the regions explored and species encountered. Where possible, herbarium specimens were taken. For future missions, it would be interesting to collect rhizobia from the legume species and more ecological parameters such as soil PH.

5.2. TIMING OF THE MISSION

It was not always possible to collect large samples. Many species showed high sterility resulting in poor seed set, particularly in extreme habitats. *Oryza longistaminata* was always highly sterile. *O. barthii* seeded poorly where its habitat had dried out early and quickly. At the northern limit of its distribution, *Andropogon gayanus* populations showed very low seed set.

The majority of crop samples were taken from the farmer's stores and, in some cases, the number of plants was few. Throughout much of central Chad the harvest had failed because of drought and/or cricket attack this year.

Overall, the timing of the mission was appropriate. However, by mid October the vegetation, in particular, the annual grasses in the northern parts of the sahelian zone had already dried and shattered. Because of the drought this year, there was very little to collect in this region, however, for future expeditions mid to end of September would be the appropriate time to collect the annual sahelian pastures. In addition, the last trip to southeastern Chad, at the end of November, was 2 to 3 weeks too late for the collection of species which shatter quickly at maturation, such as wild Vigna.

As expected the period of collecting was not optimum for the trees species. January would be the appropriate month for the sahelian *Acacia* species and a little later for the sudanian trees. Some collections were made from precose populations or, as in the case of *Acacia albida*, Collection no. 58 ; a conspicuously early maturing individual.

5.3. SPECIES SAMPLED

Prior to the mission, a list of target species was drawn up from information on species occurrence and distribution in Chad, their forage value, importance to crop breeding, risk of genetic erosion etc. Priority was given to the collection of wild species in crop gene-pools, in particular *Pennisetum*, and to the sahelian legumes and perennial grasses of known forage potential. However, during the mission, as the team became more familiar with the species, their ecogeographic distributions and status, priorities were adjusted. More attention than originally planned was given to the forages of the temporary pools and seasonally waterlogged depressions, in view of their importance as a source of green matter over periods extending well into the dry season and the problem of increasing drying out and overexploitation. Observations on the different species collected are given below.

Pennisetum gene-pool

Due to the severe drought, exploration of the north, Faya, Fada and northern Ouaddai, where it was hoped to find *P. glaucum* subsp. *monodii* isolated from cultivation, was abandoned. Serge TOSTAIN, of the ORSTOM laboratory, Niamey, who is currently investigating the variation within wild millet and its relationship with the cultivated form using biochemical markers, cancelled his participation. The team did specifically explore the lower portion of the Bahr-el-Ghazal and the area of Wadi Enne for wild millet. Both areas were extremely dry, the vegetation highly degraded and local people were unfamiliar with the species.

Extrapolation from the findings regarding the ecogeographic distribution of wild millet in Niger and Mali, indicates that the species is or was present in northern Chad. Exploration of the Faya, Fada, Tibesti, Ennedi and northern Ouaddai regions is necessary to confirm this.

P. glaucum subsp. *monodii* was sampled 5 times, never adjacent to the crop, but always within the zone of millet cultivation. It was found on the southern edge of Lake Chad, in the area south of Lake Chad and west of Lake Fitri and in the southern Ouaddai at sites from 310 to 550 m and rainfall - to -. In the Ouaddai it was found along the borders of wadis including the border of the dried-up river Batha at Am Guerreda. Elsewhere, it was sampled from around trees on sandy loam soils.

Three species of the tertiary gene-pool were sampled : *P. pedicellatum*, *P. polystachion* and *P. ramosum*. *P. pedicellatum* was sampled from the distinct and very different habitats under trees in thickets and from the much more exposed site of the granite outcrops of central Chad (Lake Fitri region) and the Ouaddai where it grew in the crevices between the boulders. There was no obvious phenotypic differences between these ecotypes, but it will be interesting to see if they represent different cytotypes.

Under the much higher rainfall of southern Chad, *P. pedicellatum* was more abundant. Although it grew along side tracks, wadis and ponds where the soils were moister, it was most commonly found in the shade, under trees and frequently mixed with the much less abundant *P. polystachion*. The observed

intermediate spikelet characters has implications for possible hybridization between the species. However, this would be contrary to the expected apomictic reproduction of *P. pedicellatum* and polystachion. It thus remain to be verified whether this population of the species are obligate apomicts.

In southeastern Chad, on the clay soils of the seasonally inundated areas, *P. ramosum* was found associated with *Sorghum purpureo-sericeum*, *Andropogon gayanus*, *Alysicarpus rugosus*, wild okra and *Acacia seyal*, *Cassia* sp, and *Combretum* sp. Three samples were collected.

Cultivated pearl millet was collected in those areas not explored by the IITA/Ministry of Agriculture team, viz. the regions of Lake Chad, Ouaddai and Salamat and the central north of Chad. Few samples were collected from the sahelian zone because the drought and crickets had largely destroyed the harvests.

Sorghum gene pool

Wild sorghum, *S. bicolor* subsp. *arundinaceum* was found as far north as 13deg30' always in seasonally wet depressions on clayish soil. It was also found and sampled under the higher rainfall regime of southeastern Chad where the tertiary gene pool species, *S. purpureo-sericeum* was a common component of the grassland of the seasonally flooded plains.

Chad is rich in Sorghum diversity. Rainfed sorghum is a major crop from the southern sahelian zone southwards. Collections were made to complement the material collected by the IITA/Ministry of Agriculture team.

In addition, in the sahelian and sudanian zones, sorghum is grown as an off-season crop on the vertisols of the wadis temporary pools and seasonally waterlogged depressions. As the water recedes in October nurseries are established on the edges of the depressions. When the plants are about 50 cm high they are transplanted across the now dry and cracking clay pans. The varieties are of the race *durra* and invariably goose-necked and known locally as 'berbere'. It would be worthwhile to mount a separate mission to collect the berbere sorghums. February/March would be the appropriate time.

Oryza gene pool

No cultivated rice was collected. The main rice growing regions which are in southwestern Chad were explored by an IBPGR/IRAT/ORSTOM expedition in 1977. This year, the IITA/Ministry of Agriculture team collected additional landraces in southern Chad.

The areas explored by this mission were outside of the rice cultivation zones and only on one occasion was *O. sativa* encountered. In contrast, wild rices were frequently found. In southeastern Chad, *O. barthii* and its perennial progenitor *O. longistaminata* were found in the wetter depressions of the seasonal flood plains and the temporary pools. Seasonal pools and waterlogged depressions with grey cracking clays (vertisols) are also a feature of central Chad. *O. barthii* was common in these habitats and *O. longistaminata* and *O. punctata*, more rarely encountered.

A lot of effort was made to collect these wild rices both in the southeast and, particularly, in the northern central zone where their habitats, the pools and depressions, are at risk from increasing drying out. A total of 15 samples were collected of which 13 originated from central Chad distributed from Lake Chad to the southern Ouaddai and north to 14deg. In the southeast, the wild rices had already shattered at the time of the mission and only a few collections could be made.

The 1977 IBPGR/IRAT/ORSTOM team collected wild rice, but except for along the route from N'Djamena to Ati, they did not cover the same zones. The IITA/Ministry of Agriculture team this year collected wild rice, but again mostly in the south except for sites close to the tracks to Oum Hadjer and Mongo.

The material collected by the mission adds substantially to the existing collections of wild rice from Chad. Furthermore, it is of particular value since it represents populations from the northern limits of *Oryza* distribution.

All populations sampled showed a very high degree of spikelet abortion and it was particularly difficult to find seed of *O. longistaminata* which is notoriously sterile. In northern central Chad, a substantial number of the depressions and pools explored were occupied by wild rice, principally *O. barthii*, but there was no seed to collect because the water had receded and soil dried out before the grain had filled. There is no doubt that if these droughts persist and the habitats continue to dry out each year, then eventually the populations will be wiped out and the wild rices eliminated from the Sahel.

In addition, the wild rices are under threat from the exploitation and over-grazing of their habitats. The temporary pools and seasonally flooded depressions are often used for cool vegetable gardens and the cultivation of 'berbere' so the wild rices are uprooted before maturity. Although these sites could be exploited for the cultivation of rice, this was seen only once. However, the harvesting of *O. barthii* is practised throughout the region and the grain can be found on sale in the village markets.

Protection of the wild rice for later harvesting or the cultivation of vegetables and 'berbere' in the depressions and pools, conflicts with the other role of these habitats which serves as a source of green forage well into the dry season. To the villagers, who traditionally hold much livestock as well, this latter use of the ponds, temporary pools and seasonally flooded depressions is equally important and a balance is reached between their exploitation for crops and grazing.

The wild rices are sometimes grazed, but always heavily trampled as the cattle eat the associated species of *Echinochloa*, *Aeschynomene* and trees. Many pools and depressions were found which were completely barren from overgrazing, particularly those close to large villages or along the routes of transhumance.

Other crop gene-pools

Except for the southeast, the areas explored by the mission lay north of the distribution zone of wild Vigna. In the Salamat region, different species of wild Vigna were found, but only 3 collections were made since the plants had already dried up and shattered, making identification and sampling difficult. The IITA/Ministry of Agriculture team which explored southern Chad earlier in the season and more extensively, did make a number of collections including wild cowpea.

Also in the Salamat region, wild okra was found and collected. It grew, together with *S. purpureo-sericeum*, *Alysicarpus rugosus* and *P. atrichum* on the flood plains. Okra is a major ingredient of the sauce that accompanies the staple starch of millet 'pate' (boul) and is cultivated widely throughout Chad.

Sesame is also a widespread crop throughout Chad. Wild sesame was found and collected in the sahelian zone, where it thrives in disturbed habitats, such as abandoned fields.

Wild forms and landraces of the watermelon (*Citrullus*) and cucumber (*Cucumis*) were found, including *Cucumis metuliferus*. Some samples were collected, but these genera should be the object of further study and collection on a future mission.

Forage grasses

Priority was given to the perennial grasses with emphasis particularly in the sahelian zone, on *Andropogon gayanus*. This valuable forage is abundant under the higher rainfall regime of southern Chad, but the persistent droughts in the Sahel are leading to its elimination. Except for sites at higher altitudes in the Ouaddai, *A. gayanus* was found only twice north of 12° and both these populations were small and sterile.

The species is well known to the local people both as a good forage when young and for its stems which are used to make mats and fences. They said that before the recent droughts, *Andropogon gayanus* was much more widespread and abundant and confirmed that it has now almost entirely disappeared from the sahelian zone. In the Ouaddai it was found and collected up to 780m and north to 14°10'. The higher rainfall in the Ouaddai is enabling the species to persist this far north.

A. gayanus was always found on the heavier moisture -holding clays or loams, around temporary pools, in depressions or along the borders of wadis. In addition, it was twice found with *Pennisetum pedicellatum* in the crevices between the boulders on granite outcrops. Unfortunately, on both these occasions there was no seed. Not only is *A. gayanus* a poor seeder, but this year the plants had been badly attacked by crickets. Despite the difficulties of collecting seed, it was decided to give the species special attention in view of the rapid diminution of its ecogeographic distribution, its value as a forage and its potential in the regeneration of badly degraded pools and depressions or its cultivation in these sites as a cutting grass.

Attention was also given to other species of the temporary pools and seasonally waterlogged depressions, particularly species of *Echinochloa*. The forage that these and the other

species of the pools and depressions provide after the annual pastures have dried up is crucial in the sustenance of livestock through the dry season.

The other priority perennial grasses, *Cenchrus ciliaris*, and *Chloris gayana* were not encountered.

Very few collections were made of the annual sahelian grasses for two reasons. Firstly, the mission was two to three weeks too late and the plants had already shattered. Secondly, the zones where priority attention should be given are those where desertification is the worst viz. the central north, northern Ouaddai and northwest (kanem). This year, with the drought in these zones, there was nothing to collect as the vegetation cover was so poor. However the annual pastures of these regions should be the object of a future mission.

Forage legumes

Prior to the mission, *Zornia glochidiata* and *Stylosanthes fruticosa* were given highest priority for collection. Although *S. fruticosa* has been reported from west of Abeche, it was not found on this mission. It is present in Niger at similar latitudes, but obviously rare in Chad.

In contrast *Z. glochidiata* is ubiquitous. It was distributed throughout the region explored from the north sahelian to southern sudanian zones. It was found on sand, sandy loams and clayish soils as a component of the grassland, but it showed a clear preference for disturbed habitats. It is an aggressive pioneer on degraded and ruderal sites and this character could be exploited in the regeneration of these areas. The plant is well liked by cattle and has good forage value, but it gives a limited input because it senesces so quickly.

Z. glochidiata does deserve further study particularly of the role it could play as a pioneer species on degraded sites. However, it does not warrant priority status for collection, at least, not in Chad.

Other species which were found to thrive in disturbed habitats were of the genus *Alysicarpus*. *A. rugosus* was found on the flood plains in southeastern Chad and *A. glumaceus* and *A. ovalifolius* were found together and hybridizing. The samples of *A. ovalifolius* and *A. glumaceus* require careful botanical study since they do not conform in pod characters to the descriptions in the Flora of Tropical East Africa.

Another genus which caused problems of identification was *Aeschynomene*. Three different species were encountered growing together with *Echinochloa* and *Oryza* in the seasonal pools. *Aeschynomene* was often the only leguminous herb found at these sites and was grazed, but, reportedly, only by goats.

Trees

A number of sahelian and sudanian tree species were targeted for collection. Highest priority was given to those with known high forage value, viz. *Acacia albida*, *A. senegal*, *A. tortilis*, *Balanites aegyptiaca*, *Bauhinia rufescens*, *Combretum aculeatum*, *Commiphora africana*, *Maerua crassiflora*.

As expected, the majority of species were only at the flowering stage at the time of the mission. January/February would be the appropriate time to collect. However, collections were made of precose populations of *A. albida*, *B. aegyptiaca*, *B. rufescens*, *A. mellifera*, *A. nilotica*, *A. senegal*, *Dichrostachys cinerea* and *Prosopis africana*.

Balanites aegyptiaca was distributed throughout the region explored. It showed not only a wide ecological adaptation, but also much tolerance to drought. It was found on a range of soil types, from the sand dunes (coll.no 6) of Kanem to the heavy cracking clays of seasonal ponds, the Bahr-el.Ghazal (col.no 73) and the swampy plains of Salamat. Its distribution ranged from the northern sahelian to the southern sudanian zone and from 300m at the shore of Lake Chad to 800m in the Ouaddai highlands, although it was conspicuously less common at the higher altitudes.

Particularly impressive stands were found in the sahelo-sudanian transition zone on the sandy loam soils (Lake Fitri, coll.no 16, Massenya - Ngama - Doubali). Populations were almost uniform, dense with good recruitment. In areas devastated by drought with almost 100 % tree mortality, the few individuals still living were invariably either *B. aegyptiaca* or *Capparis decidua*.

In view of its ecological flexibility, apparent tolerance to drought and its well documented food, forage and medicinal value, *B. aegyptiaca* is certainly worthy of further collection and study. It would seem worthwhile to sample stands across its ecogeographic distribution for evaluation and study. In addition to its wide ecological adaptability, the populations surveyed appeared highly variable in a number of morphological and agronomic characters, notably time of fruiting, fruit size and habit. Despite its long growing period, *B. aegyptiaca* could have an important role to play in the reforestation of, particularly, the sahelo-sudanian transition zone.

In contrast to *Balanites aegyptiaca*, *Acacia albida* was found to be surprisingly rare. *A. albida* is widely distributed in Africa in a variety of habitats, but although it is common in neighbouring areas of Niger and Nigeria it was of markedly rare occurrence in the regions explored in Chad. Indeed, no really viable (ie. significant numbers of healthy, mature trees and recruits) natural populations were found. Only where trees had been planted (CARE, region of Tourba) were they found in substantial numbers. The natural populations found were typically a few aged trees either shading a village or around a pond where they were probably protected by the villagers.

To know how widespread and abundant *A. albida* was in the past in Chad, it would be necessary to thoroughly search the literature and question the villagers. However, the local people indicated that it was once more common and that overexploitation, grazing of the young trees and drought have lead to its elimination.

Another tree which is reported to be disappearing is *Maerua crassifolia*. A few trees were found in the region south and east of Lake Chad, but they were not yet fruiting. This tree has very

good forage value and warrants collecting and evaluation with a view to its re-establishment in the sahelian zone.

5.4. DISTRIBUTION AND CONSERVATION OF THE COLLECTIONS

The distribution of the different species collected is shown in the table. Details of which accessions have been sent where, are appended to this report.

The samples were deposited with the relevant institutes in Chad and sent to the IBPGR Seed Handling Unit, Kew, UK for distribution to the designated base genebanks.

In addition, subsamples of all the accessions (except maize) are kept in active collection (in foil sachets in a freezer) by IBPGR/ISC and have been distributed to ICRISAT and other collaborating projects for multiplication and early evaluation, as follows :

- Forages : ILCA
- Sorghum and wild sorghum, pearl millet, groundnuts, cowpea : relevant ICRISAT West African Program
- Wild pearl millet : ORSTOM ISC Program ; IBPGR/USDA project at Tifton, USA
- Forage herbs and trees : ICRISAT Resource Management Program, ISC
- Vegetables (wild and cultivated) : AVRDC/USAID Vitamin A project, Niger
- Oryza and Abelmoschus : ORSTOM, Bondy, France (via Adiopodoume)
- Sesamum : University of Jerusalem, Israel.

Samples requiring immediate multiplication are indicated in the appendix.

The collection data and information on the distribution of the material will be distributed with the samples and held in a database at the IBPGR Office in Niamey. When available, characterization and evaluation data will be added to this database and forwarded to the 'Laboratoire de Farcha' and other Chadian institutes.

The voucher herbarium specimens are deposited at the 'Laboratoire de Farcha' and duplicated at the IBPGR Seed Handling Unit, Kew, UK. The voucher photos are filed with the data forms at IBPGR, Rome.

6. CONCLUSIONS

A joint IBPGR/'Laboratoire de Farcha', N'Djamena mission from October to early December collected 178 samples of mainly forage species and wild species in crop genebanks from central and southeastern Chad.

This year the rainfall was poor in both amount and distribution with only 119mm recorded at Mao in the west and 140mm at Abeche in the east. Consequently, development of the vegetation cover in the central north was very poor, and exploration of the region was abandoned.

It was also planned to survey the central plateau region which falls within the Prefecture of Guera. However, the team did

not receive authorization to travel in this region. A 'permit de circuler' is required for travel within Chad. This should be requested through the collaborating national institute and the names of all the towns and villages to be visited should be specified.

Southern Chad, which falls within the sudanian zone, has a rich diversity of interesting forages and species of the Pennisetum and Vigna gene pool. A return visit to Salamat (southeast) a little earlier in the season, would be worthwhile and exploration of the mountainous region in the southwest, which borders Cameroon, could be rewarding. However, with the severe desertification of the north, the sahelian zone must remain priority for action.

The Kanem, Bahr el Ghazal, Faya and central northern area, northern Ouaddai and Ennedi regions must be surveyed. However, in view of their fragile climates and vegetation, its unlikely they will yield much unless there has been a reasonable rainfall.

DISTRIBUTION OF SAMPLES
IBPGR/LABORATOIRE DE FARCHA
CHAD 1987

COLL NO	SPECIES	SUBSPECIES	A	B	C	D	E	F	G
123	?		-	I	-	-	+	-	-
** 136	ABELMOSCHUS ?		-	+	-	-	-	M	+
143	?		-	+	-	-	-	+	+
128	ESCULENTUS		+	+	-	-	-	+	+
153	ESCULENTUS		+	+	-	-	-	+	+
172	ESCULENTUS		+	+	-	-	-	+	+
** 041	ACACIA ALBIDA		+	-	-	-	+	-	+
058	ALBIDA		+	-	-	-	+	-	+
043	MELLIFERA		+	-	-	-	+	-	+
059	MELLIFERA		+	-	-	-	+	-	+
034	MELLIFERA/LAETA		+	-	-	-	+	-	+
078	NILOTICA		+	-	-	-	+	-	+
089	SENEGAL		+	-	-	-	+	-	+
** 036	AESCHYNOMENE INDICA		+	+	+	-	-	-	+
037	INDICA		+	+	+	-	-	-	+
042	INDICA		+	+	+	-	-	-	+
107	?		+	+	+	-	-	-	+
111	INDICA		+	+	+	-	-	-	+
** 024	ALYSICARPUS GLUMACEUS		+	+	+	-	+	-	+
010	OVALIFOLIUS		+	+	+	-	+	-	+
025	OVALIFOLIUS		+	+	+	-	+	-	+
135	RUGOSUS		+	+	+	-	+	-	+
142	RUGOSUS		+	+	+	-	+	-	+

** ANDROPOGON									
049 GAYANUS	+	+	M	-	+	-	-	-	-
054 GAYANUS	+	+	M	-	+	-	-	-	-
060 GAYANUS	+	+	M	-	-	-	-	-	-
061 GAYANUS	+	+	M	-	+	-	-	-	-
088 GAYANUS	+	+	M	-	+	-	-	-	-
110 GAYANUS	+	+	M	-	+	-	-	-	-
114 GAYANUS	+	+	M	-	+	-	-	-	-
121 GAYANUS	+	+	M	-	+	-	-	-	-
140 GAYANUS	+	+	M	-	+	-	-	-	-
177 GAYANUS	+	+	M	-	+	-	-	-	-
** ARACHIS									
127 HYPOGEA	+	-	-	-	+	-	-	+	-
147 HYPOGEA	+	-	-	-	+	-	-	+	-
** BALANITES									
006 AEGYPTIACA	+	-	-	-	+	-	-	+	-
016 AEGYPTIACA	+	-	-	-	+	-	-	+	-
073 AEGYPTIACA	+	-	-	-	+	-	-	+	-
** BAUHINIA									
040 RUFESCENS	+	-	-	-	+	-	-	+	-
074 RUFESCENS	+	-	-	-	+	-	-	+	-
** BULBOSCHOENUS									
071 MARITIMUS	+	-	+	-	+	-	-	+	-
** CANAVALIA									
171 ENSIFORMIS	+	-	-	-	-	-	-	+	-
** CITRULLUS									
007 LANATUS	-	+	-	-	-	+	-	+	-
008 LANATUS	-	+	-	-	-	+	-	+	-
033 LANATUS	-	+	-	-	-	+	-	+	-
064 LANATUS	+	+	-	-	-	+	-	+	-
** CYNODON									
081 DACTYLON	+	+	+	-	+	-	-	+	-

** CYPERUS	!	!	!	!	!	!	!	!	!	!				
071 ?	+	!	+	!	+	!	-	!	-	!	+	!		
** DACTYLOCTENIUM	!	!	!	!	!	!	!	!	!	!	!	!		
003 AEGYPTIUM	+	!	+	!	+	!	-	!	+	!	-	!	+	!
019 AEGYPTIUM	+	!	+	!	+	!	-	!	-	!	-	!	+	!
** DESMODIUM	!	!	!	!	!	!	!	!	!	!	!	!	!	!
157 ?	+	!	+	!	+	!	-	!	+	!	-	!	+	!
** DICHROSTACHYS	!	!	!	!	!	!	!	!	!	!	!	!	!	!
108 CINEREA	+	!	-	!	-	!	-	!	+	!	-	!	+	!
** ECHINOCHLOA	!	!	!	!	!	!	!	!	!	!	!	!	!	!
020 COLONA	+	!	+	!	+	!	-	!	-	!	-	!	+	!
017 PYRAMIDALIS	+	!	+	!	+	!	-	!	-	!	-	!	+	!
029 PYRAMIDALIS	+	!	+	!	+	!	-	!	-	!	-	!	+	!
082 PYRAMIDALIS	+	!	+	!	+	!	-	!	-	!	-	!	+	!
021 STAGNINA	+	!	+	!	+	!	-	!	-	!	-	!	+	!
113 STAGNINA	+	!	+	!	+	!	-	!	-	!	-	!	+	!
120 STAGNINA	+	!	+	!	+	!	-	!	-	!	-	!	+	!
** ORYZA	!	!	!	!	!	!	!	!	!	!	!	!	!	!
023 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
039 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
056 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
083 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
084 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
087 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
097 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
097 A BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
106 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
112 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
138 BARTHII	-	!	+	!	-	!	-	!	-	!	+	!	+	!
015 LONGISTAMINATA	-	!	+	!	-	!	-	!	-	!	+	!	+	!
028 LONGISTAMINATA	-	!	+	!	-	!	-	!	-	!	+	!	+	!
160 LONGISTAMINA	-	!	+	!	-	!	-	!	-	!	+	!	+	!

022	PUNCTATA		-	!	+	!	-	!	-	!	-	!	+	!	+	!
**	PENNISETUM															
009	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
011	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
030	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
031	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
062	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
069	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
075	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
090	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
103	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
115	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
125	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
149	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
170	GLAUCUM	GLAUCUM	+	!	+	!	-	!	+	!	+	!	-	!	+	!
013	GLAUCUM	MONODII	+	!	+	!	-	!	+	!	+	!	-	!	+	!
044	GLAUCUM	MONODII	+	!	+	!	-	!	+	!	+	!	-	!	+	!
051	GLAUCUM	MONODII	+	!	+	!	-	!	+	!	+	!	-	!	+	!
079	GLAUCUM	MONODII	+	!	+	!	-	!	+	!	+	!	-	!	+	!
080	GLAUCUM	MONODII	+	!	+	!	-	!	+	!	+	!	-	!	+	!
014	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
047	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
055	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
057	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
065	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
067	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
085	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
095	PEDICELLATUM		+	!	M	!	-	!	+	!	-	!	-	!	-	!
104	PEDICELLATUM		+	!	+	!	-	!	+	!	-	!	-	!	+	!
134	PEDICELLATUM		-	!	M	!	-	!	-	!	-	!	-	!	-	!

144	PEDICELLATUM		+	+	-	+	-	-	+
175	PEDICELLATUM		+	+	-	+	-	-	+
002	POLYSTACHION		-	M	-	-	-	-	-
048	POLYSTACHION		+	+	-	+	-	-	+
105	POLYSTACHION		+	+	-	+	-	-	+
109	POLYSTACHION		+	+	-	+	-	-	+
122	POLYSTACHION		-	M	-	-	-	-	-
145	POLYSTACHION		+	+	-	+	-	-	+
146	POLYSTACHION		+	+	-	+	-	-	+
174	POLYSTACHION		-	M	-	+	-	-	-
133	RAMOSUM		+	+	-	+	-	-	+
141	RAMOSUM		+	+	-	+	-	-	+
178	RAMOSUM		+	+	-	+	-	-	+
**	PROSOPIS								
158	AFRICANA		+	-	-	-	+	-	+
**	SESAMUM								
004	?		-	+	-	-	-	+	+
027	?		-	+	-	-	-	+	+
094	INDICUM		+	+	-	-	-	+	+
148	INDICUM		+	+	-	-	-	+	+
161	INDICUM		+	+	-	-	-	+	+
**	SESBANIA								
038	ROSTRATA		+	+	+	-	+	-	+
**	SORGHUM								
018	BICOLOR	ARUNDINACEUM!	+	+	-	+	+	-	+
050	BICOLOR	ARUNDINACEUM!	+	+	-	+	+	-	+
070	BICOLOR	ARUNDINACEUM!	+	+	-	+	+	-	+
077	BICOLOR	ARUNDINACEUM!	+	+	-	+	+	-	+
156	BICOLOR	ARUNDINACEUM!	+	+	-	+	+	-	+
077A	BICOLOR	HYBRID	-	+	-	+	+	-	+
012	BICOLOR	BICOLOR	+	+	-	-	+	-	+

045	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
046	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
063	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
072	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
076	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
086	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
091	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
092	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
093	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
096	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
099	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
100	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	M	!	-	!	-	!
101	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
102	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
116	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
117	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
118	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
124	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
126	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
150	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
151	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
154	BICOLOR	BICOLOR	!	-	!	-	!	-	!	-	!	-	!	-	!	-	!
162	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
163	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
164	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
165	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
167	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
168	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
169	BICOLOR	BICOLOR	!	+	!	+	!	-	!	-	!	+	!	-	!	+	!
132	PURPUREO-SERICUM		!	+	!	+	!	-	!	+	!	-	!	-	!	+	!

139	PURPUREO-SERICEUM		+	+	-	+	-	-	+
176	PURPUREO-SERICEUM		+	+	-	+	-	-	+
**	TEPHROSIA								
001	PUMILA		+	+	-	-	+	-	+
005	PURPUREA	LEPTOSTACHYA	+	+	-	-	+	-	+
**	VIGNA								
119	UNGUICULATA	DEKINDTIANA	-	+	M	-	+	-	-
137	AMBACENSIS		+	+	M	-	+	-	-
155	?		+	+	M	-	+	-	-
129	SUBTERRANEA		+	-	-	-	-	-	+
032	UNGUICULATA	UNGUICULATA	+	-	-	-	+	-	+
068	UNGUICULATA	UNGUICULATA	+	-	-	-	+	-	+
166	UNGUICULATA	UNGUICULATA	+	-	-	-	+	-	+
173	UNGUICULATA	UNGUICULATA	+	-	-	-	+	-	+
**	ZEА								
130	MAIS		+	-	-	-	-	-	+
131	MAIS		+	-	-	-	-	-	+
152	MAIS		+	-	-	-	-	-	+
**	ZORNIA								
026	GLOCHIDIATA		+	+	+	-	-	-	+
035	GLOCHIDIATA		+	+	+	-	-	-	+
053	GLOCHIDIATA		+	+	+	-	-	-	+
066	GLOCHIDIATA		+	+	+	-	-	-	+
098	GLOCHIDIATA		+	+	+	-	-	-	+

A = Chad
B = IBPGR Niamey
C = ILCA
D = IBPGR Research (at USDA, Tifton GA USA).
E = ICRISAT West Africa Programs
F = for vegetables - AVRDC Projet Horticole Vit A, Niger
= for rice and okra - ORSTOM, Bondy (via Adiopodoume)-
= for sesame - Univ. Jerusalem, Israel
G = IBPGR base collections (via IBPGR SHU Kew, Wakehurst, UK).
I = for identification
M = for multiplication

SAMPLES COLLECTED

COLL NO	GENUS	SPECIES	SUBSPECIES	SITE NO
001	TEPHROSIA	PUMILA		001
002	PENNISETUM	POLYSTACHION		001
003	DACTYLOCTENIUM	AEGYPTIUM		002
004	SESAMUM	?		002
005	TEPHROSIA	PURPUREA	LEPTOSTACHYA	003
006	BALANITES	AEGYPTIACA		004
007	CITRULLUS	LANATUS		005
008	CITRULLUS	LANATUS		005
009	PENNISETUM	GLAUCUM.	GLAUCUM	006
010	ALYSICARPUS	OVALIFOLIUS		007
011	PENNISETUM	GLAUCUM.	GLAUCUM	008
012	SORGHUM	BICOLOR	BICOLOR	008
013	PENNISETUM	GLAUCUM.	MONODII	009
014	PENNISETUM	PEDICELLATUM		009
015	ORYZA	LONGISTAMINATA		010
016	BALANITES	AEGYPTIACA		011
017	ECHINOCHLOA	PYRAMIDALIS		012
018	SORGHUM	BICOLOR	ARUNDINACEUM	013
019	DACTYLOCTENIUM	AEGYPTIUM		013
020	ECHINOCHLOA	COLONA		014
021	ECHINOCHLOA	STAGNINA		014
022	ORYZA	PUNCTATA ?		015
023	ORYZA	BARTHII		016
024	ALYSICARPUS	GLUMACEUS		017
025	ALYSICARPUS	OVALIFOLIUS		017
026	ZORNIA	GLOCHIDIATA		017
027	SESAMUM	?		017
028	ORYZA	LONGISTAMINATA		018
029	ECHINOCHLOA	PYRAMIDALIS		018
030	PENNISETUM	GLAUCUM.	GLAUCUM	019
031	PENNISETUM	GLAUCUM.	GLAUCUM	019
032	VIGNA	UNGUICULATA	UNGUICULATA	019
033	CITRULLUS	LANATUS		020
034	ACACIA	MELLIFERA/LAETA		021
035	ZORNIA	GLOCHIDIATA		022
036	AESCHYNOMENE	INDICA		023
037	AESCHYNOMENE	INDICA		023
038	SESBANIA	ROSTRATA		023
039	ORYZA	BARTHII		024
040	BAUHINIA	RUFESCENS		025
041	ACACIA	ALBIDA		025
042	AESCHYNOMENE	INDICA		026
043	ACACIA	MELLIFERA		027
044	PENNISETUM	GLAUCUM.	MONODII	028
045	SORGHUM	BICOLOR	BICOLOR	029
046	SORGHUM	BICOLOR	BICOLOR	029
047	PENNISETUM	PEDICELLATUM		030
048	PENNISETUM	POLYSTACHION		030
049	ANDROPOGON	GAYANUS		031
050	SORGHUM	BICOLOR	ARUNDINACEUM	032

SAMPLES COLLECTED

COLL NO	GENUS	SPECIES	SUBSPECIES	SITE NO
051	PENNISETUM	GLAUCUM	MONODII	032
052	PENNISETUM	GLAUCUM	GLAUCUM	033
053	ZORNIA	GLOCHIDIATA		034
054	ANDROPOGON	GAYANUS		035
055	PENNISETUM	PEDICELLATUM		035
056	ORYZA	BARTHII		036
057	PENNISETUM	PEDICELLATUM		037
058	ACACIA	ALBIDA		038
059	ACACIA	MELLIFERA		039
060	ANDROPOGON	GAYANUS		039
061	ANDROPOGON	GAYANUS		040
062	PENNISETUM	GLAUCUM	GLAUCUM	041
063	SORGHUM	BICOLOR	BICOLOR	041
064	CITRULLUS	LANATUS		041
065	PENNISETUM	PEDICELLATUM		042
066	ZORNIA	GLOCHIDIATA		042
067	PENNISETUM	PEDICELLATUM		042
068	VIGNA	UNGUICULATA	UNGUICULATA	041
069	PENNISETUM	GLAUCUM	GLAUCUM	043
070	SORGHUM	BICOLOR	ARUNDINACEUM	044
071	BULBOSCHOENUS	MARITIMUS		044
072	SORGHUM	BICOLOR	BICOLOR	045
073	BALANITES	AEGYPTIACA		046
074	BAUHINIA	RUFESCENS		046
075	PENNISETUM	GLAUCUM	GLAUCUM	047
076	SORGHUM	BICOLOR	BICOLOR	048
077	SORGHUM	BICOLOR	ARUNDINACEUM	049
078	ACACIA	NILOTICA		049
079	PENNISETUM	GLAUCUM	MONODII	049
080	PENNISETUM	GLAUCUM	MONODII	050
081	CYNODON	DACTYLON		051
082	ECHINOCHLOA	PYRAMIDALIS		052
083	ORYZA	BARTHII		053
084	ORYZA	BARTHII		054
085	PENNISETUM	PEDICELLATUM		055
086	SORGHUM	BICOLOR	BICOLOR	056
087	ORYZA	BARTHII		056
088	ANDROPOGON	GAYANUS		057
089	ACACIA	SENEGAL		058
090	PENNISETUM	GLAUCUM	GLAUCUM	059
091	SORGHUM	BICOLOR	BICOLOR	059
092	SORGHUM	BICOLOR	BICOLOR	059
093	SORGHUM	BICOLOR	BICOLOR	059
094	SESAMUM	INDICUM		059
095	PENNISETUM	PEDICELLATUM		060
096	SORGHUM	BICOLOR	BICOLOR	061
097	ORYZA	BARTHII		061
097A	ORYZA	BARTHII		062
098	ZORNIA	GLOCHIDIATA		063
099	SORGHUM	BICOLOR	BICOLOR	064

SAMPLES COLLECTED

COLL NO	GENUS	SPECIES	SUBSPECIES	SITE NO
100	SORGHUM	BICOLOR	BICOLOR	064
101	SORGHUM	BICOLOR	BICOLOR	064
102	SORGHUM	BICOLOR	BICOLOR	064
103	PENNISETUM	GLAUCUM	GLAUCUM	064
104	PENNISETUM	PEDICELLATUM		065
105	PENNISETUM	POLYSTACHION		065
106	ORYZA	BARTHII		066
107	AESCHYNOMENE	?		066
108	DICHRSTACHYS	CINEREA		067
109	PENNISETUM	POLYSTACHION		068
110	ANDROPOGON	GAYANUS		069
111	AESCHYNOMENE	INDICA		070
112	ORYZA	BARTHII		070
113	ECHINOCHLOA	STAGNINA		071
114	ANDROPOGON	GAYANUS		072
115	PENNISETUM	GLAUCUM	GLAUCUM	073
116	SORGHUM	BICOLOR	BICOLOR	073
117	SORGHUM	BICOLOR	BICOLOR	073
118	SORGHUM	BICOLOR	BICOLOR	073
119	VIGNA	UNGUICULATA	DEKINDTIANA	074
120	ECHINOCHLOA	STAGNINA		075
121	ANDROPOGON	GAYANUS		076
122	PENNISETUM	POLYSTACHION		076
123	?	?		077
124	SORGHUM	BICOLOR	BICOLOR	078
125	PENNISETUM	GLAUCUM	GLAUCUM	078
126	SORGHUM	BICOLOR	BICOLOR	078
127	ARACHIS	HYPOGEA		078
128	ABELMOSCHUS	ESCULENTUS		078
129	VIGNA	SUBTERRANEA		078
130	ZEAMIS	MAIS		078
131	ZEAMIS	MAIS		078
132	SORGHUM	PURPUREO-SERICEUM		079
133	PENNISETUM	RAMOSUM		079
134	PENNISETUM	PEDICELLATUM		079
135	ALYSICARPUS	RUGOSUS		080
136	ABELMOSCHUS	?		080
137	VIGNA	ANBACENSIS		080
138	ORYZA	BARTHII		081
139	SORGHUM	PURPUREO-SERICEUM		082
140	ANDROPOGON	GAYANUS		082
141	PENNISETUM	RAMOSUM		082
142	ALYSICARPUS	RUGOSUS		082
143	ABELMOSCHUS	?		082
144	PENNISETUM	PEDICELLATUM		083
145	PENNISETUM	POLYSTACHION		083
146	PENNISETUM	POLYSTACHION		084
147	ARACHIS	HYPOGEA		085
148	SESAMUM	INDICUM		085
149	PENNISETUM	GLAUCUM	GLAUCUM	085

SAMPLES COLLECTED

COLL NO	GENUS	SPECIES	SUBSPECIES	SITE NO
150	SORGHUM	BICOLOR	BICOLOR	085
151	SORGHUM	BICOLOR	BICOLOR	085
152	ZEA	MAIS		085
153	ABELMOSCHUS	ESCULENTUS		085
154	SORGHUM	BICOLOR	BICOLOR	085
155	VIGNA	?		084
156	SORGHUM	BICOLOR	ARUNDINACEUM	086
157	DESMODIUM	?		086
158	PROSOPIS	AFRICANA		087
160	ORYZA	LONGISTAMINATA		088
161	SESAMUM	INDICUM		089
162	SORGHUM	BICOLOR	BICOLOR	089
163	SORGHUM	BICOLOR	BICOLOR	089
164	SORGHUM	BICOLOR	BICOLOR	089
165	SORGHUM	BICOLOR	BICOLOR	089
166	VIGNA	UNGUICULATA	UNGUICULATA	089
167	SORGHUM	BICOLOR	BICOLOR	089
168	SORGHUM	BICOLOR	BICOLOR	089
169	SORGHUM	BICOLOR	BICOLOR	089
170	PENNISETUM	GLAUCUM	GLAUCUM	089
171	CANAVALIA	ENSIFORMIS		089
172	ABELMOSCHUS	ESCULENTUS		089
173	VIGNA	UNGUICULATA	UNGUICULATA	089
174	PENNISETUM	POLYSTACHION		090
175	PENNISETUM	PEDICELLATUM		090
176	SORGHUM	PURPUREO-SERICEUM		091
177	ANDROPOGON	GAYANUS		091
178	PENNISETUM	RAMOSUM		092

COLLECTION SITES

SITE NO	PROVINCE	LOCATION	LAT	LONG	ALT
001	LAC	120km NGUIGMI SE to LIWA, 1km GISKAWA SE to MAGI	1410 N	1400 E	290
001	LAC	120km NGUIGMI SE to LIWA, 1km GISKAWA S to MAGI	1410 N	1400 E	290
002	LAC	20km LIWA NE at MAGI	1400 N	1410 E	300
002	LAC	20km LIWA NE at MAGI	1400 N	1410 E	300
003	LAC	3km LIWA N	1350 N	1410 E	310
004	LAC	15km LIWA SE to BOL	1340 N	1420 E	280
005	LAC	38km BOL E to DOUMDOUM	1320 N	1500 E	290
005	LAC	38km BOL E to DOUMDOUM	1320 N	1500 E	290
006	LAC	7km ARBUT (DOUMDOUM) SE at BELAGA	1300 N	1520 E	300
007	CHARI BAGUIRMI	17km NGOURA S to BOKORO, 25km before MIOTO	1240 N	1630 E	370
008	CHARI BAGUIRMI	MOITO village	1230 N	1630 E	360
008	CHARI BAGUIRMI	MOITO village	1230 N	1630 E	360
009	CHARI BAGUIRMI	1km MOITO SE to BOKORO	1230 N	1630 E	350
009	CHARI BAGUIRMI	1km MOITO SE to BOKORO	1230 N	1630 E	350
010	CHARI BAGUIRMI	63km MOITO S to BOKORO	1220 N	1700 E	360
011	CHARI BAGUIRMI	15km BOKORO NE to ABOURDA	1230 N	1700 E	380
012	BATHA	50km ABOURDA NE to NGOLO, at edge of LAC FITRI	1240 N	1730 E	350
013	BATHA	8/10km NGOLO (L. FITRI) SW to ARBOURDA	1240 N	1720 E	350
013	BATHA	10km NGOLO SW to ABOURDA, near KABARA village	1240 N	1720 E	350
014	BATHA	13km AM NDJAMENA BILALA SE to YAO	1300 N	1720 E	350
014	BATHA	13km AM NDJAMENA BILALA SE to YAO	1300 N	1720 E	350
015	BATHA	12km GORKO S to YAO, near DENI	1250 N	1730 E	350
016	BATHA	12km YAO NE to ATI, on SW edge of TABA village	1250 N	1740 E	360
017	BATHA	24km ATI NE to DJEDAA	1320 N	1830 E	380
017	BATHA	24km ATI NE to DJEDAA	1320 N	1830 E	380
017	BATHA	24km ATI NE to DJEDAA	1320 N	1830 E	380
017	BATHA	24km ATI NE to DJEDAA	1320 N	1830 E	380
018	BATHA	4km DJEDDA E, at AL MOUGRAN	1330 N	1840 E	400
018	BATHA	4km DJEDDA E, at AL MOUGRAN	1330 N	1840 E	400
019	BATHA	42km ATI SE to MONGO, at KOUNDJOUROU	1300 N	1840 E	350
019	BATHA	42km ATI SE to MONGO, at KOUNDJOUROU	1300 N	1840 E	350
019	BATHA	42km ATI SE to MONGO, at KOUNDJOUROU	1300 N	1840 E	350
020	BATHA	37km KOUNDJOUROU SE to SIGOU, 2km before SIGOU	1300 N	1900 E	390
021	BATHA	20km SIGOU E to OUM HADJER, 5km	1250 N	1900 E	400
022	BATHA	73km KOUNDJOUROU E to OUM HADJER nr TABAREK	1300 N	1910 E	400

COLLECTION SITES

SITE NO	PROVINCE	LOCATION	LAT	LONG	ALT
023	BATHA	115km KOUNDJOUROU E to OUM HADJER via SIGOU	1310 N	1920 E	400
023	BATHA	115km KOUNDJOUROU E to OUM HADJER via SIGOU	1310 N	1920 E	400
023	BATHA	115km KOUNDJOUROU E to OUM HADJER via SIGOU	1310 N	1920 E	400
024	BATHA	40km OUM HADJER W, at AJOP	1310 N	1920 E	410
025	BATHA	10km AM SAK S, at AL GIRINTI	1340 N	1950 E	410
025	BATHA	10km AM SAK S, at AL GIRINTI	1340 N	1950 E	410
026	BATHA	45km HARAZ DJOMBO NE, at WADI MIRAT	1420 N	1950 E	420
027	OUADDAI	35km AM SAK E to ABECHE	1340 N	2010 E	460
028	OUADDAI	35km ABECHE SE, 3km WADI AMRUSCHE SE	1330 N	2100 E	350
029	OUADDAI	70km ABECHE SE to GOZ BEIDA, at ABKAR village	1310 N	2910 E	580
029	OUADDAI	70km ABECHE SE to GOZ BEIDA, at ABKAR village	1310 N	2110 E	580
030	OUADDAI	20km AM GUEREDA N	1300 N	2110 E	570
030	OUADDAI	20km AM GUEREDA N	1300 N	2110 E	570
031	OUADDAI	15km AM GUEREDA N, 5km AMIE N	1300 N	2110 E	570
032	OUADDAI	AM GUEREDA at crossing of RIVER BATHA	1250 N	2110 E	550
032	OUADDAI	AM GUEREDA at crossing of BATHA RIVER	1250 N	2110 E	550
033	OUADDAI	110km AM DAM E, at ABDI village	1250 N	2120 E	570
034	OUADDAI	7km ABDI W	1250 N	2130 E	560
035	OUADDAI	93km AM DAM to ABDI E, about 15km ABDI W	1240 N	2120 E	570
035	OUADDAI	93km AM DAM E to ABDI	1240 N	2120 E	570
036	OUADDAI	45km AM DAM E to ABDI	1240 N	2150 E	520
037	OUADDAI	55km AM DAM N to ABECHE, at DERESSA village	1310 N	2030 E	530
038	OUADDAI	36km ABECHE NE to AM ZOER, at DOUROUBARI village	1350 N	2100 E	700
039	BILTINE	56km ABECHE NE to AM ZOER, 15km MINIERI SW	1400 N	2110 E	780
039	BILTINE	56km ABECHE NE to AM ZOER, 15km MINIERI SW	1400 N	2110 E	780
040	BILTINE	78km ABECHE NE to AM ZOER, 10km MINIERI NE	1410 N	2120 E	840
041	BILTINE	5km AM ZOER S	1410 N	2120 E	820
041	BILTINE	5km AM ZOER S	1410 N	2120 E	820
041	BILTINE	5km AM ZOER S	1410 N	2120 E	820
042	BILTINE	7km AM ZOER N	1420 N	2130 E	870
042	BILTINE	7km AM ZOER N	1420 N	2130 E	870
042	BILTINE	7km AM ZOER N	1420 N	2130 E	870
041	BILTINE	5km AM ZOER S	1410 N	2120 E	820
043	KANEM	6km MOUSSORO N	1340 N	1630 E	310
044	KANEM	4km MOUSSORO S	1330 N	1630 E	320
044	KANEM	4km MOUSSORO S	1330 N	1630 E	320

COLLECTION SITES

SITE NO	PROVINCE	LOCATION	LAT	LONG	ALT
045	KANEM	5km MOUSSORO SW, at DELEBANGA village	1330 N	1620 E	320
046	KANEM	55km MOUSSORO W to CHEDDRA, at DELEBANGA village	1330 N	1600 E	320
046	KANEM	55km MOUSSORO W to CHEDDRA, at DELEBANGA village	1330 N	1600 E	320
047	CHARI BAGUIRMI	20km MASSAKORI NE, at LALA KINDILA village	1300 N	1550 E	320
048	CHARI BAGUIRMI	VILLAGE TOURBA	1250 N	1520 E	320
049	CHARI BAGUIRMI	18-20km TOURBA W to GREDIA and KARAL	1250 N	1510 E	310
049	CHARI BAGUIRMI	18-20km TOURBA W to KARAL	1250 N	1510 E	310
049	CHARI BAGUIRMI	20km TOURBA W to KARAL via GREDIA	1250 N	1510 E	310
050	CHARI BAGUIRMI	40km TOURBA W to KARAL, 10km GREDIA W	1250 N	1500 E	320
051	CHARI BAGUIRMI	45km TOURBA W to KARAL, 15km GREDIA W	1250 N	1450 E	310
052	CHARI BAGUIRMI	15km KALAL NE	1250 N	1450 E	330
053	CHARI BAGUIRMI	5km DOUGUIA S to NDJAMENA, at ANDEM village	1240 N	1450 E	300
054	CHARI BAGUIRMI	40km DOUGUIA S to DJERMAYA, 11km DJERMAYA N	1230 N	1500 E	290
055	CHARI BAGUIRMI	62km NDJAMENA SE	1200 N	1530 E	320
056	CHARI BAGUIRMI	89km NDJAMENA E, at MAYO ACHE village	1200 N	1540 E	350
056	CHARI BAGUIRMI	84km NDJAMENA E, 15km SALAMANGA N	1200 N	1540 E	350
057	CHARI BAGUIRMI	7km DOUBALI NW	1150 N	1550 E	360
058	CHARI BAGUIRMI	7km DOUBALI E	1150 N	1550 E	350
059	CHARI BAGUIRMI	36km DOUBALI NE to BOKORO, at DJENERE village	1200 N	1600 E	330
059	CHARI BAGUIRMI	36km DOUBALI NE to BOKORO, at DJENERE village	1200 N	1600 E	330
059	CHARI BAGUIRMI	36km DOUBALI NE to BOKORO, at DJENERE village	1200 N	1600 E	330
059	CHARI BAGUIRMI	36km DOUBALI NE to BOKORO, at DJENERE village	1200 N	1600 E	330
059	CHARI BAGUIRMI	36km DOUBALI NE to BOKORO, at DJENERE village	1200 N	1600 E	330
060	CHARI BAGUIRMI	105km DOUBALI E to BOKORO, 10km MAIGANA E	1210 N	1630 E	350
061	CHARI BAGUIRMI	115km DOUBALI E to BOKORO, at ARBUSUBA village	1210 N	1640 E	350
061	CHARI BAGUIRMI	115km DOUBALI E to BOKORO, at ARBASUBA village	1210 N	1640 E	350
062	CHARI BAGUIRMI	16km BOKORO W to DOUBALI	1220 N	1650 E	350
063	CHARI BAGUIRMI	28km BOKORO S to NGAMA	1210 N	1700 E	340
064	CHARI BAGUIRMI	40km BOKORO S to NGAMA, at DILBINI village	1200 N	1700 E	340
064	CHARI BAGUIRMI	40km BOKORO S to NGAMA, at DILBINI village	1200 N	1700 E	340

COLLECTION SITES

SITE NO	PROVINCE	LOCATION	LAT	LONG	ALT
064	CHARI BAGUIRMI	40km BOKORO S to NGAMA,at DILBINI village	1200 N	1700 E	340
064	CHARI BAGUIRMI	40km BOKORO S to NGAMA,at DILBINI village	1200 N	1700 E	340
064	CHARI BAGUIRMI	40km BOKORO S to NGAMA,at DILBINI village	1200 N	1700 E	340
065	CHARI BAGUIRMI	16km OULED BELI SW to NGAMA	1200 N	1710 E	350
065	CHARI BAGUIRMI	16km OULED BELI SW to NGAMA	1200 N	1710 E	350
066	GUERA	20km NGAMA S	1130 N	1710 E	370
066	GUERA	20km NGAMA S	1130 N	1710 E	370
067	CHARI BAGUIRMI	25km NGAMA W to BILI,5km FORO E	1140 N	1700 E	350
068	CHARI BAGUIRMI	22km BILI NW to DOUBALI	1150 N	1630 E	360
069	CHARI BAGUIRMI	42km BILI NW to DOUBALI	1150 N	1620 E	380
070	CHARI BAGUIRMI	18km DOUBALI S to MASSENYA	1150 N	1600 E	350
070	CHARI BAGUIRMI	18km DOUBALI S to MASSENYA	1150 N	1600 E	350
071	CHARI BAGUIRMI	23km DOUBALI S to MASSENYA	1140 N	1600 E	350
072	CHARI BAGUIRMI	20km MASSENYA S	1120 N	1620 E	370
073	CHARI BAGUIRMI	23km MASSENYA N to DOUBALI,at KARNA village	1130 N	1600 E	330
073	CHARI BAGUIRMI	23km MASSENYA N to DOUBALI,at KARNA village	1130 N	1600 E	330
073	CHARI BAGUIRMI	23km MASSENYA N to DOUBALI,at KARNA village	1130 N	1600 E	330
073	CHARI BAGUIRMI	23km MASSENYA N to DOUBALI,at KARNA village	1130 N	1600 E	330
074	MOYEN CHARI	80km KYABE NE to AM TIMAN,10km SINGAKO NE	0950 N	1930 E	430
075	SALAMAT	112km KYABE NE to AM TIMAN	1000 N	1940 E	430
076	SALAMAT	120km KYABE NE to AM TIMAN	1000 N	1940 E	450
076	SALAMAT	120km KYABE NE to AM TIMAN	1000 N	1940 E	450
077	SALAMAT	123km KYABE NE to AM TIMAN,11km TAKALO SW	1000 N	1940 E	450
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
078	SALAMAT	134km KYABE NE to AM TIMAN,at TAKALO	1010 N	1950 E	470
079	SALAMAT	140km KYABE NE to AM TIMAN,6km TAKALO NE	1010 N	1950 E	490

COLLECTION SITES

SITE NO	PROVINCE	LOCATION	LAT	LONG	ALT
079	SALAMAT	140km KYABE NE to AM TIMAN,6km TAKALO NE	1010 N	1950 E	490
079	SALAMAT	140km KYABE NE to AM TIMAN,6km TAKALO NE	1010 N	1950 E	490
080	SALAMAT	177km KYABE NE to AM TIMAN,2km DJOUNA SW	1020 N	2000 E	410
080	SALAMAT	177km KYABE NE to AM TIMAN,2km DJOUNA SW	1020 N	2000 E	450
080	SALAMAT	177km KYABE NE to AM TIMAN,2km DJOUNA SW	1020 N	2000 E	450
081	SALAMAT	70km AM TIMAN SW to KYABE,45km DJOUNA NE	1030 N	2010 E	450
082	SALAMAT	62km AM TIMAN SW to KYABE,52km DJOUNA NE	1040 N	2010 E	460
082	SALAMAT	62km AM TIMAN SW to KYABE,52km DJOUNA NE	1040 N	2010 E	460
082	SALAMAT	62km AM TIMAN SW to KYABE,52km DJOUNA NE	1040 N	2010 E	460
082	SALAMAT	62km AM TIMAN SW to KYABE,52km DJOUNA NE	1040 N	2010 E	460
082	SALAMAT	62km AM TIMAN SW to KYABE,52km DJOUNA NE	1040 N	2010 E	460
083	SALAMAT	7km AM TIMAN SW to KYABE	1100 N	2010 E	480
083	SALAMAT	7km AM TIMAN SW to KYABE	1100 N	2010 E	480
084	SALAMAT	8km ZAKOUMA NE,inside PARK	1050 N	1950 E	460
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	78km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
085	SALAMAT	70km AM TIMAN SW,at ZAKOUMA village	1050 N	1950 E	450
084	SALAMAT	8km ZAKOUMA NE	1050 N	1950 E	460
086	SALAMAT	1km ZAKOUMA N	1050 N	1950 E	440
086	SALAMAT	1km ZAKOUMA N	1050 N	1950 E	440
087	SALAMAT	12km AM TIMAN W,to ZAKOUMA	1100 N	2010 E	440
088	SALAMAT	12km AM TIMAN NW	1100 N	2010 E	490
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450

COLLECTION SITES

SITE NO	PROVINCE	LOCATION	LAT	LONG	ALT
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
089	SALAMAT	80km AM TIMAN SE,at KOUBO ABOU GARA	1030 N	2040 E	450
090	SALAMAT	65km AM TIMAN SE	1040 N	2040 E	470
090	SALAMAT	65km AM TIMAN SE	1040 N	2040 E	470
091	SALAMAT	58km AM TIMAN SE	1050 N	2040 E	480
091	SALAMAT	58km AM TIMAN SE	1040 N	2040 E	480
092	SALAMAT	46km AM TIMAN SE	1050 N	2030 E	500
*** Total ***					***

STATION	RAINFALL 1987 in mm							AVERAGE RAINFALL 1951-1980
	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	TOTAL	
Mao	0.0	54.0	22.5	38.8	4.6	-	-	294.8
Moussoro	-	-	-	136.0	4.7	-	-	322.6
Massakory	54.2	23.9	22.0	149.0	79.5	5.0	333.6	-
N'Djamena	68.6	67.7	67.3	130.3	44.4	26.8	405.1	586.1
Bokoro	14.4	66.0	59.3	112.5	27.8	10.0	290.0	546.0
Ati	-	19.3	60.4	145.5	62.5	-	-	396.8
Abeche	3.2	5.3	36.5	93.8	6.0	0.0	144.8	427.1
Antiman	-	135.5	244.3	130.3	98.7	-	-	853.9
Bouso	86.5	49.3	97.0	259.2	176.4	-	-	-
Sarh	156.7	141.6	91.6	225.6	121.2	14.4	751.1	1032.0

RAINFALL DATA FOR CHAD