





# FARMING SYSTEMS

*“To work with a farmer,  
you have to start  
to know his life,  
his knowledge,  
what he can do,  
what he wants to do.”*

[ Proverb from the Niger ]

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NEAR KABELEWA VILLAGE (N'GUIGMI), THE NIGER



THE CHALLENGE OF MODERN FARMING SYSTEMS IS TO CREATE A BALANCE BETWEEN INTENSIFIED PRODUCTION AND MAINTENANCE OF THE ECOSYSTEM

## INTRODUCTION

For centuries human beings have been the builders of their environment. The large savannah ecosystems of the Lake Chad Basin, dominated by *Acacia* trees, have been managed by people through fire and movements of livestock, which transported seeds and grazed the grasslands selectively, and also through the collection of fruit, wild vegetables, tubers and cereals, and the use of wood and water resources. To protect livestock against predators and thieves, pastoralists tended to plant spiny trees, such as *Ziziphus* and *Commiphora*, around settlements <sup>[5.1]</sup>.

Human beings have also modified the environment through the introduction of agriculture and, in the Lake Chad Basin, which is part of the larger Sahelian zone, several important crops have been domesticated. These include millet (*Pennisetum glaucum*), sorghum (*Sorghum bicolor*), water melon (*Citrullus lanatus*), jute (*Corchorus olitorius*), cowpea (*Vigna unguiculata*) and gombo (*Abelmoschus esculentus*) <sup>[5.2]</sup>.

Recurrent droughts and conflicts have caused people to move over large

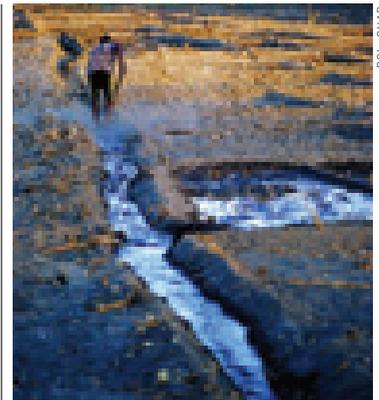


NEAR DIFFA, THE NIGER

THE LAKE CHAD BASIN HOSTS A MOSAIC OF CROPS, RANGING FROM THOSE CULTIVATED FOR DOMESTIC CONSUMPTION TO CASH CROPS

distances, bringing with them their domesticated crops, cultivation practices, food habits and preferences, religious beliefs and social organizations. In the Lake Chad Basin all these different practices and requirements, combined with local soil types, water regimes and existing indigenous vegetation, have resulted in a mosaic of different agricultural systems, each specific to an ethnic group and ecosystem. Traditionally, all these systems have the following features in common.

- > **Mobility:** to avoid overexploitation of poor soils and search for water.
- > **Integration with pastoralism:** to obtain manure and produce meat, milk and skins.
- > **Integration with natural vegetation:** to collect food, medicines and materials for the construction of houses, canoes and mats.
- > **Integration with fisheries:** in rivers, lake and ponds.
- > **Wise use of water fluctuations:** to crop in recessional land and obtain additional food.



BOL, CHAD

TRADITIONAL WATER MANAGEMENT TECHNIQUES SUPPORT MANY FARMING SYSTEMS



FARMS ARE GENERALLY SMALL, AVERAGING FROM 0.25 TO 2.5 HA IN AREA AND EMPLOYING UP TO FIVE PEOPLE. MANY FARMERS COMBINE AGRICULTURE WITH FISHING AND LIVESTOCK PRODUCTION

## AGRICULTURAL SYSTEMS

Today, growing populations and the consequent need to expand the limited amount of land available for agriculture and to increase production per land unit have put more pressure on agriculture and natural resources. Shorter fallow periods and encroaching agriculture have reduced the area of available grasslands, overexploited soils are degrading and water is becoming increasingly polluted and scarce.

Conflicts between farmers and pastoralists have increased because they are competing for natural resources.

At the same time, the variety of agricultural crops has increased and currently includes crops for domestic consumption (sorghum, millet, maize, *gombo*, pepper and wheat) and cash crops (cotton, peanuts, vegetables, rice, etc.). The cultivation of these crops on different soil types (ranging from sand to clay) and in areas of different water availability (rainfed, irrigated and recessional lands) has resulted in a mosaic of traditional and new farming methods and cropping calendars. Socio-economic factors, such as labour availability and farm size, also play their

part in determining the cropping system. An average farm in the Niger part of the Lake Chad Basin has an area of 0.25 to 2.5 ha and employs five people <sup>(5,3)</sup>.

Traditional farming systems are therefore undergoing a transformation towards intensive systems, although they still consist mostly of a combination of traditional subsistence cropping, fishing and livestock production with the production of cash crops. Examples of this evolution in four different ecosystems are described in the following pages.



NEAR MALAM FAYORI, NIGERIA

ABOVE AND BELOW: THE SUSTAINABILITY OF IRRIGATED AGRICULTURE MUST BE CAREFULLY EVALUATED, BOTH ECONOMICALLY AND ENVIRONMENTALLY



NEAR MALAM FAYORI, NIGERIA

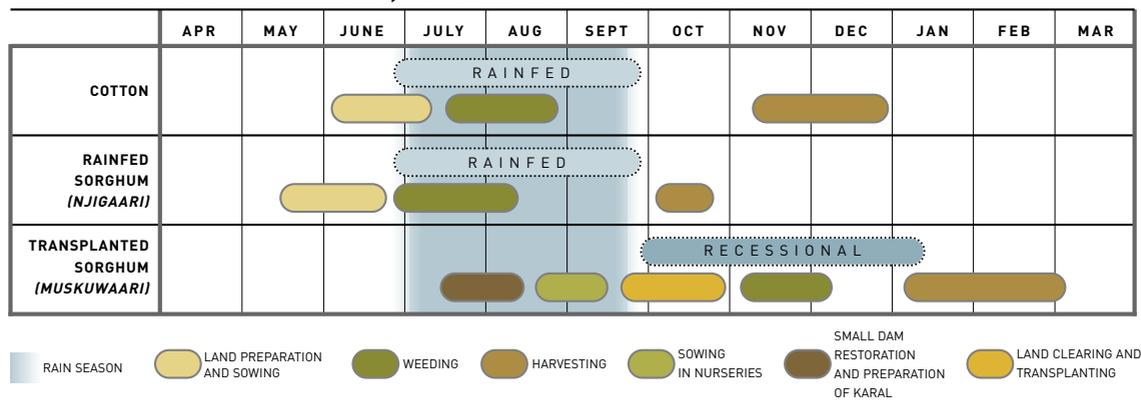
## 1. Subsistence and market farming

At Balaza, (Cameroon) domestic consumption is based on a combination of short-cycle rainfed sorghum (named njigaari) and of

transplanted sorghum (mukuwaari) which is cultivated in clay soils at the end of the rainy season; rainfed cotton is cultivated as a cash crop. The trend is to increase cotton production instead of rainfed sorghum in

order to guarantee a regular income, and maximize the cultivation of transplanted sorghum to ensure subsistence.

TABLE 7 COMPLEMENTARITY OF COTTON, RAINFED SORGHUM AND TRANSPLANTED SORGHUM



Source: extrapolated from B. Mathieu 2002 <sup>[5.4]</sup>

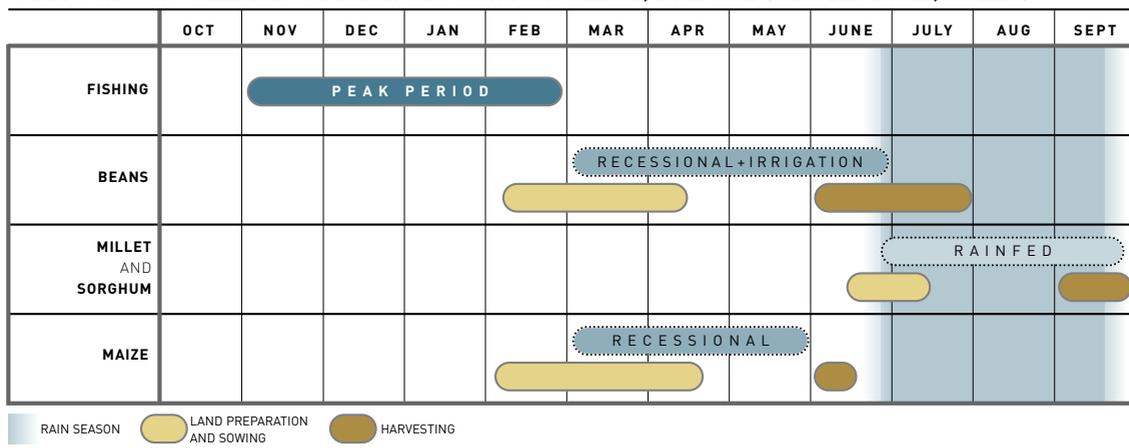
## 2. Farming and fishing

The activity calendar for Dabar Shatta Kwatta village, Lake Chad (western shore,

Nigeria) shows the integration of fishing and the agricultural system, and the efficient use of the lake's fluctuations in order to provide for both domestic

consumption and the market. Furthermore, this arrangement enables the harvest to be distributed evenly over the year in order to best meet domestic and market demands.

TABLE 8 ACTIVITY CALENDAR FOR DABAR SHATTA KWATTA VILLAGE, LAKE CHAD (WESTERN SHORE, NIGERIA)



Source: extrapolated from A. E. Neiland et al., 1994 <sup>[5.5]</sup>

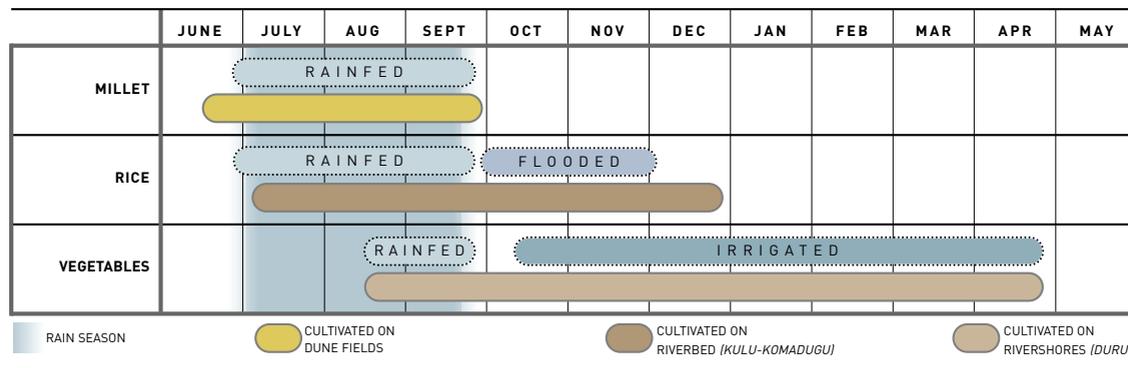
### 3. Complementarity of wet/irrigated and dry ecosystems

From the end of June until the end of December, the Mobber people of the Komadugu-Yobé have an intensely busy agricultural calendar because they have to

work in two different environments: the river shores and sandy dunes. Rainfed millet is cultivated on sandy dunes for domestic consumption. Rice is sown in July-August on dry soils for domestic and market consumption. Rice rises with rainfall and is subsequently flooded by the

river and is harvested in December. Mobber people used to fish from October to January but recurrent droughts and the additional request for rice have reduced fishing activities. Vegetables are cultivated on the rivershore from August, using irrigation after the end of the rains.

TABLE 9 AGRICULTURAL CALENDAR OF THE MOBBER PEOPLE IN KOMADUGU-YOBÉ



Source: extrapolated from C. Bouquet, 1990 <sup>(1.5)</sup>

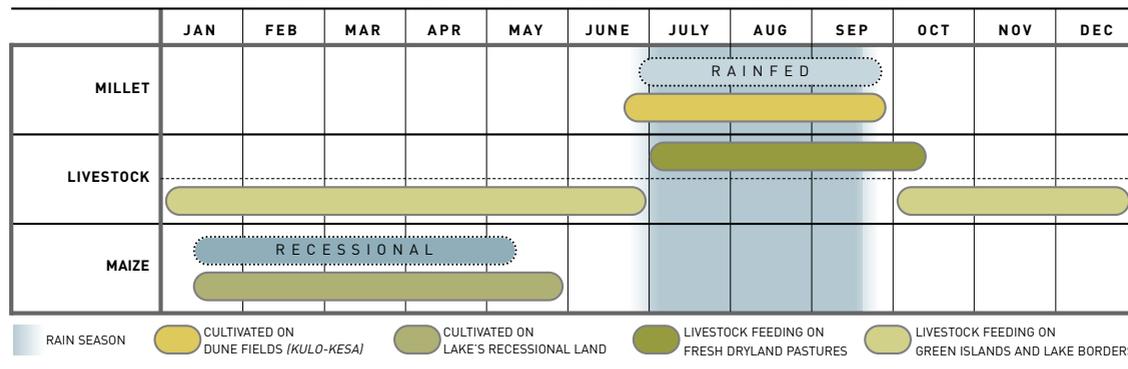
### 4. Agriculture and pastoralism

Buduma agropastoralists from the Lake Chad islands have adapted their calendar to fulfil both agriculture and pastoral requirements. They also combine fishing but this will be left out from the scheme below. At the onset of the rainy season,

when the presence of insects forces livestock towards drier environments, millet is grown on sand dune soils for harvest at the end of the rainy season. Animals are also kept around the dunes, grazing on fresh dryland pastures. From October, after the harvesting of millet and drying of natural grasslands, the animals return to

the islands, and lake fluctuations allow maize cropping in recessional land. The wet island environment produces additional and very precious green feed for livestock from February to June. This corresponds to the difficult hot dry season of the ecosystem around the Lake Chad Basin, when animals suffer from lack of fresh forage.

TABLE 10 AGROPASTORAL CALENDAR OF THE BUDUMA PEOPLE LIVING ON THE LAKE CHAD ISLANDS



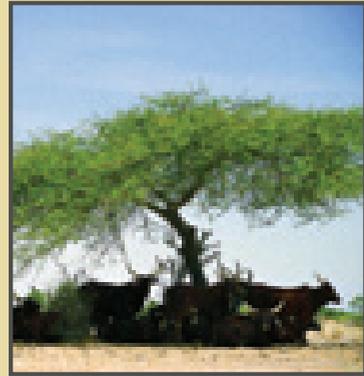
Source: extrapolated from C. Bouquet, 1990 <sup>(1.5)</sup>

## The fallow system

Farmers in the Lake Chad Basin have traditionally used the fallow system, allowing cultivated land to rest for several years before each new planting. In the region, where land has always been plentiful – unlike water and good soil, which are both in short supply – this technique was important for allowing regeneration of soils and vegetation. However, pressure on the land from the growing population means that this system

is now being practised on a much-reduced scale, as more intensive farming takes over.

The fallow system has a role to play in preserving biodiversity because, on land that is left fallow for more than four years, plants, soil organisms, insects and small vertebrates start to develop, and these species support birds and rodents. These, in turn, attract predators, such as jackals, owls and birds of prey, and the entire wildlife habitat is maintained. Native grasses allow grazing of wildlife and livestock, and shrubs and trees protect soils from erosion and provide timber, firewood and shade.



THE WELL NEAR KABELEWA VILLAGE (N'GUIGONI), THE NIGER



DIFFA, THE NIGER

FALLOW PERIODS ARE PROGRESSIVELY REDUCED TO INTENSIFY AGRICULTURAL PRODUCTION, BUT IN THE LONG TERM THIS CAUSES LOSS OF BIODIVERSITY AND LOSS OF LOCAL RESOURCES SUCH AS FIREWOOD

## TRADITIONAL CEREALS

The main traditional cereals cultivated for domestic consumption are millet and sorghum, although wheat, rice and maize are increasingly replacing them, mainly because they are consumed in towns and cities and their preparation is often easier and quicker. The Peul use the word *gawri* for both millet and sorghum.

### MILLET

The millets (meaning “small seed”) are a group of various millet species that produce small seed. They comprise a dozen crop species belonging to different genera. Statistical documentation for millet is generally poor since most national statistics do not distinguish between the various botanical species. Among them, pearl millet (*Pennisetum glaucum*) and finger millet (*Eleusine coracana*) are the major millets and West Africa minor millets are fonio (*Digitaria exilis*), black fonio (*Digitaria iburua*) and guinea millet (*Brachiaria deflexa*). Some 20.6 million ha were sown with millet in Africa in 2002, with a total production of 13.6 million tonnes; it was the third most widespread cereal, after maize and sorghum, and before rice and wheat <sup>[5.6]</sup>. Pearl millet, like all other millets, is adapted to arid and semi-arid conditions and to sandy soils with very low fertility. It tolerates downy mildew, stem borer and head caterpillar. Production rates are very low (around 400–500 kg per ha in the Niger and Chad, and 900–1 000 kg per ha in Nigeria and Cameroon) but it gives the farmers a chance to survive in very arid environments and also provides some fodder for the animals, which feed on stalks after the harvest <sup>[5.7]</sup>.

Pearl millet has a long growing season which, although agronomically inefficient,



MILLET IS PERFECTLY ADAPTED TO ARID CONDITIONS AND SANDY SOILS OF LOW FERTILITY

allows the grains to dry well after the end of the rains, thus reducing the risk of moulds forming during storage <sup>[5.8]</sup>.

As they do for their livestock, farmers maintain a high level of heterogeneity in their seed stock. They traditionally perform

what scientist call “population breeding”, a technique of maintaining a cluster of genotypes to ensure that the population has as many different genes as possible. In this way, it has the plasticity to respond and produce in varying conditions (droughts, pest attacks, wind and floods).



FARMERS GROW SORGHUM, DESPITE ITS LOW PRODUCTIVITY, BECAUSE IT HAS GOOD RESISTANCE TO DROUGHT: THIS REPRESENTS A LOW-YIELD, LOW-RISK STRATEGY

## SORGHUM

Sorghum (*Sorghum bicolor*) has adapted well to local conditions down the years, achieving a good balance between production and sustainability. Some varieties of sorghum are cultivated as a rainfed cereal while others are transplanted on to recessional land. There is evidence to suggest that *durra* varieties were already being eaten in Egypt as early as 4000 BC. Chad and eastern Nigeria form a centre of diversity for the *caudatum* variety<sup>[5,2]</sup>. In 2002, 23.6 million ha of sorghum were cultivated in Africa, with a total production

of 20.3 million tonnes. Together with millet, sorghum represents the main source of calories for people living in the world's semi-arid tropical regions. Sorghum is rich in carbohydrates but contains relatively little protein.

Yields vary greatly according to the conditions in which it is grown. In the United States, the yield may be as high as 4 tonnes per ha, while the average harvest in developing countries is just 1 tonne per ha. In Chad, the average falls even further, to 0.6 tonnes per ha, while in the Niger it is around 200 kg per ha<sup>[5,6]</sup>.

The reason for such large differences lies partly in the varieties that are cultivated and in the low-input cultural practices of the Sahel. However, it is mostly because, in areas of low yield, sorghum is mainly grown on marginal soils where rainfall is unreliable and often inadequate, and diseases (smuts) and bird attacks are frequent. In such hostile conditions, it is often better to sacrifice high yields in favour of balance and food security. Therefore low-yield, high drought-resistant varieties are used. In some cases, the straw is even more important than the grain because it is used as construction material.

Another consideration is the relatively low market price of this crop. For this reason, farmers in the Lake Chad Basin have little interest in producing any more than they need for themselves, given the extra effort, cost and stress on the land that this would entail. Only 15 percent of total sorghum production in the region is sold on the open market.

With this in mind, farmers in the Lake Chad region select seeds that will keep risks to a minimum, favouring those that have a good flavour, adapt well to difficult conditions, are resistant to drought and disease, and produce sufficient residues to feed their animals. A high yield is not the prime objective and, therefore, is generally not an overriding criterion when it comes to selecting a new variety. When farmers do need to increase their production of sorghum or millet, they tend to extend the cultivation of existing varieties into more marginal lands, rather than opting for a more intensive production on land already in use <sup>[5.9]</sup>.

NGUISMI, THE NIGER



15 PERCENT ONLY OF SORGHUM PRODUCTION IS FOR THE MARKET



DANOUWANE VILLAGE (NGUISMI), THE NIGER

SORGHUM AND MILLET REPRESENT THE MAIN SOURCE OF CALORIES FOR PEOPLE LIVING IN THE WORLD'S SEMI-ARID TROPICAL REGIONS