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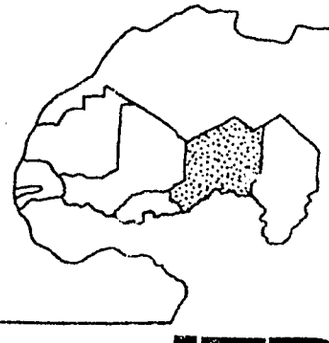

INTERNATIONAL FERTILIZER DEVELOPMENT CENTER IFDC

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by West Africa Study Team
International Fertilizer Development Center

Volume I—Regional Overview
Volume II—Senegal
Volume III—Mali
Volume IV—Upper Volta
Volume V—Niger
Volume VI—Chad
Volume VII—Mauritania

INTERNATIONAL FERTILIZER DEVELOPMENT CENTER
FLORENCE, ALABAMA, U.S.A. 35630

# PREFACE

A series of severe droughts in the late 1960's and early 1970's greatly reduced agricultural production in the Sahelian countries of west Africa. The human suffering during that time led to an international focus on the region in terms of food aid and development assistance.

The U.S. Agency for International Development (USAID) was aware of the contribution of fertilizers to food production and the limited fertilizer use in this region. Thus, USAID requested the International Fertilizer Development Center to determine the current capacity and potential of the Sahelian region to produce, market, and use fertilizers. This series of documents is a result of that assessment. Published and unpublished literature was obtained in each country and from international development agencies. Field level interviews were also conducted.

Principal team members were Ray B. Diamond (team leader), Donald R. Waggoner, and Kham Thanh Pham from IFDC along with Hans Braun on loan from FAO. Many other members of the IFDC staff contributed greatly to the report. Bernard Raistrick (consultant from the United Kingdom) and Travis P. Hignett (consultant from the United States) assisted in preliminary collection and analysis of data before the field visits. Josiah Royce (USAID, REDSO/WA) assisted in data gathering during field visits. Appreciation is expressed to representatives of national agencies, USAID, and other international organizations for assistance.

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# ABBREVIATIONS USED IN THIS REPORT

## FERTILIZERS

N . . . . . Nitrogen
P . . . . . Phosphorus
$P_2O_5$ . . . . . Phosphate
PR . . . . . Phosphate Rock
K . . . . . Potassium
$K_2O$ . . . . . Potash
S . . . . . Sulfur

## Fertilizer Formula % of $N$-$P_2O_5$-$K_2O$ by Weight

AS . . . . . Ammonium Sulfate (21-0-0)
DAP . . . . . Diammonium Phosphate (18-46-0)
KCL . . . . . Potassium Chloride (0-0-60)
PR . . . . . Phosphate Rock
SSP . . . . . Single Superphosphate (0-20-0)
TSP . . . . . Triple Superphosphate (0-45-0)
Urea . . . . . Urea (45-0-0 to 46-0-0)

## MEASURES

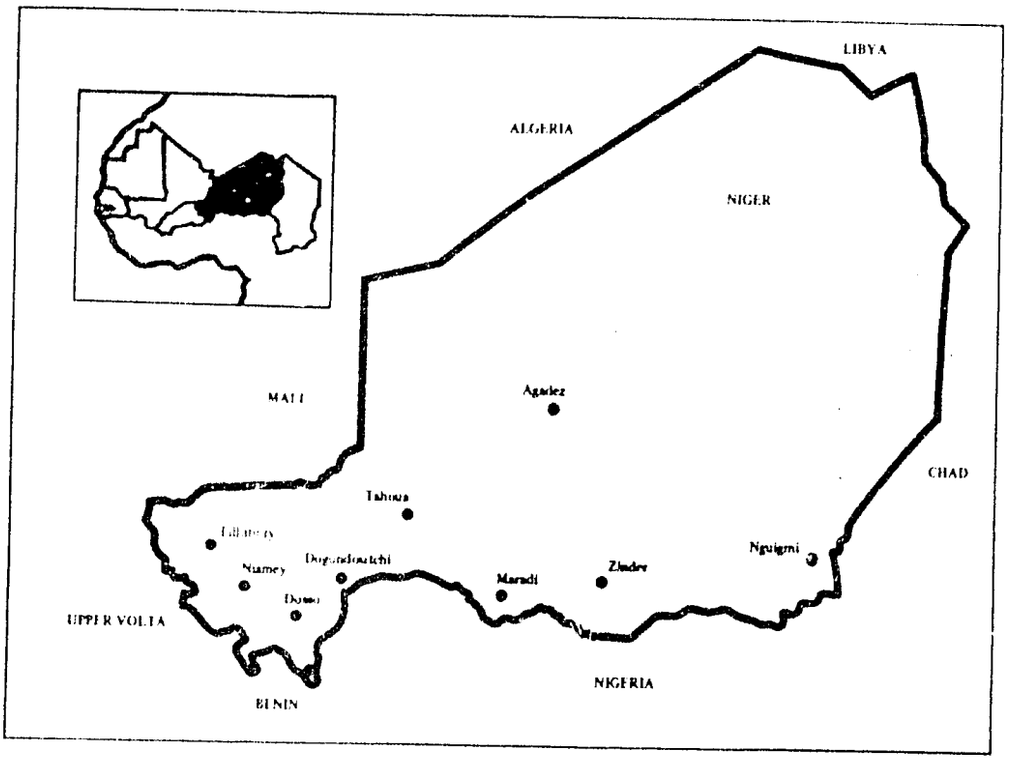
ha. . . . . hectare (2.47 acres)
kg. . . . . kilogram (1 pound = 0.454 kg)
km . . . . . kilometer (1 mile = 1.61 km)
mm. . . . . millimeter (1 inch = 25.4 mm)
mt . . . . . metric ton (2,204 pound = 1,000 kg)
% . . . . . percent

## ECONOMIC AND MONETARY

c.i.f. . . . . cost, insurance, and freight
f.o.b.. . . . . free on board
GDP . . . . . gross domestic product
F CFA. . . . . CFA Franc, currency of the West African Monetary Union (Communante Financieze Africaine Franc = US $1 = 225 F CFA

## GOVERNMENTAL AND INTERNATIONAL AGENCIES

ALC . . . . . Local Association of Cooperatives
BDRN. . . . . Rural Development Bank of Niger
BRGM. . . . French Bureau of Geology and Mining Research
CFDT . . . . . French Textile Development Company
CIDA . . . . . Canadian International Development Agency
CNCA . . . . . National Agricultural Credit Fund
FAC . . . . . Funds of Aid and Cooperation
FAO . . . . . Food and Agriculture Organization
FIAC . . . . . FAO Fertilizer Industry Advisory Committee
FED . . . . . European Development Fund
GMV. . . . . Mutual Village Groupments
GON. . . . . Government of Niger
IBRD . . . . . International Bank for Reconstruction and Development
IFDC . . . . . International Fertilizer Development Center
INRAN . . . . . National Institute of Agronomic Research
IRAT . . . . . Research Institute for Tropical Agriculture
IRCT . . . Research Institute for Cotton and Textile Fibers
IRHO . . . . . Research Institute for Oil and Oil Crops
OCDN. . . . . Dahomey-Niger Common Organization
OPVN . . . . . Food Products Office of Niger
SAFGRAD. . . . . Semi-Arid Food Grain Research and Development
SONARA. . . . . Niger Commercial Peanut Industry
UNCC . . . . . Niger Union of Credit and Cooperation
UNDP . . . . . United Nations Development Program
USAID . . . . . United States Agency for International Development




## SUMMARY OF FINDINGS

1. The series of droughts in the late 1960's and early 1970's drastically reduced cereal (the staple food) production in Niger.

2. Cereal imports reached 259,000 mt in 1973. Average cereal demand is projected to increase by 24,000 mt/year between 1975 and 1980 and 28,000 mt/year between 1980 and 1985. Urban requirements will account for about 20% of the demand.

3. Cereal deficit could reach 325,000 mt in 1980 and 460,000 mt in 1985 if production is not increased over the 1974 level.

4. Niger is conducting a number of integrated rural development and crop production projects. The principal projects are: Project "3M," Badeguichiri Valley, Dosso Productivity, Maradi, and National Cereals Project.

5. Some constraints on production are low levels of use of fertilizer, mechanization, improved seed, and other improvements in technology.

6. Crop reporting statistics are variable depending upon source of information.

7. Agronomic research shows consistent cereal responses to N and P and responses to S under continuous intensive cultivation. No general response to K has been reported.

8. Very little agronomic work has been done on farmers' fields, and much more is needed. It appears that fertilization with N and P is desirable but with S and K only on a selected basis.

9. Crop response to Tahoua PR is obtained. However, more agronomic evaluation is needed to define the nature of responses and the economics of use.

10. Estimated fertilizer nutrient consumption in 1977 is less than 250 mt. With adequate emphasis on increased use, consumption could reach about 2,300 mt and 4,500 mt in 1980 and 1985, respectively.

11. The transportation network appears adequate for moving increased quantities of fertilizer to the more populated areas in the near future if adequate maintenance is performed. But improved or new roads are possibly needed in new production areas.

12. Phosphate ore deposits exist near Tahoua and in the Parc W area.

13. Short-term plans are to develop a small-scale mining and grinding operation for the Tahoua PR deposits and continue exploration and characterization of the Parc W deposits.

## RECOMMENDATIONS

1. Initiate a study of the effect of public policies for price stabilization and equalization for agricultural inputs and crops on regional and national economies.

2. Conduct a study to identify ways to improve agricultural statistical reporting.

3. Begin a concentrated soil fertility project in liaison with current research and extension groups designed to obtain relevant information for crop response to fertilizer nutrients, including PR on small- and medium-sized farms.

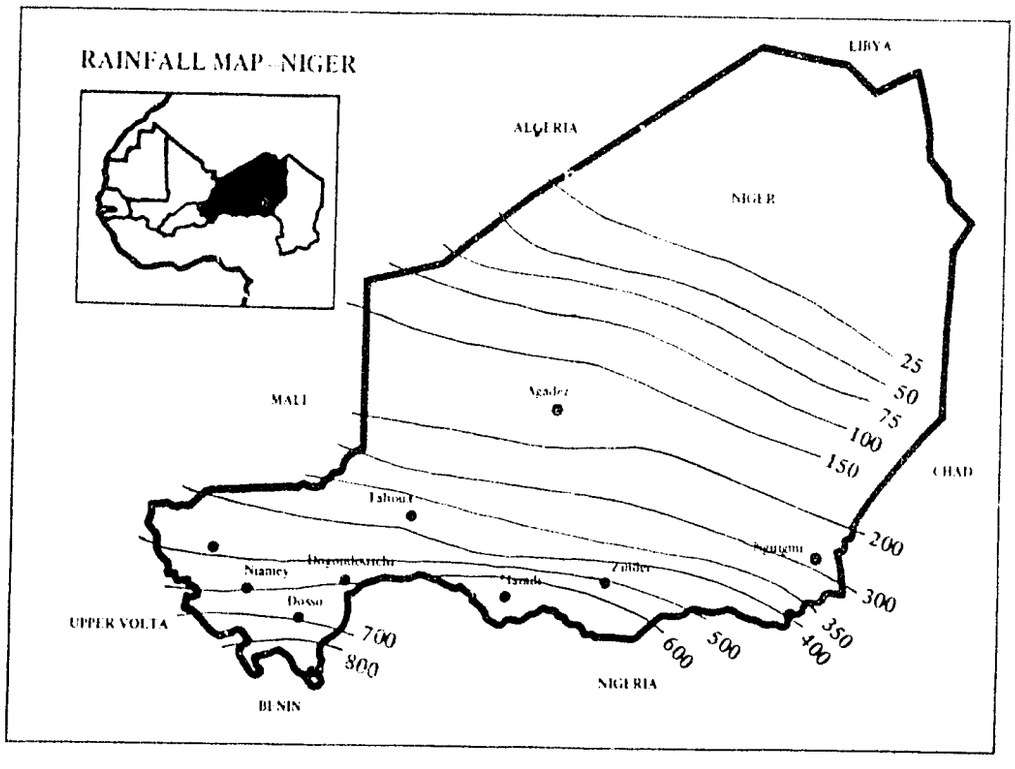
4. If present plans to develop a mining and grinding facility for Tahoua PR and exploration and characterization of Parc W deposits should not materialize, the Government of Niger (GON) should investigate other sources of funds and technical assistance to achieve the plans.

# INTRODUCTION

Niger is located between 0° and 16° east longitude and 12° and 22° north latitude. It is landlocked by Benin and Nigeria on the south and Algeria and Libya on the north and bordered by Mali and Upper Volta on the west and Chad on the east. Niger is the largest country in west Africa. Total area is 1,267,000 km² (489,000 mi²). The estimated population in 1975 was 4.6 million with a growth rate of 2.7%/year. Niamey, the capital city, has a population of 130,000. Cotonou, Benin, the primary port serving western Niger, is 780 km from the Niger border and 1,050 km from Niamey. Central Niger (Maradi and Zinder) is served from the ports of Lagos and Port Harcourt, Nigeria, a distance of about 1,300 km.

## Physical Characteristics

About 75% of Niger is uninhabitable desert lands. Further south, Sahel vegetation prevails and millet is the primary crop. Rainfall in this area is 200-350 mm/year and occurs during a 2-month period. Along the south-central border with Nigeria, annual rainfall averages 650 mm (26 in) during 3 months. Millet and peanuts are the main crops in this area; cotton and sorghum are grown in small, seasonally flooded valleys and depressions. In southwest Niger along



the Benin border annual rainfall may reach 850 mm. Cotton, peanuts, sorghum, and cowpeas are grown here. As the flooding on the Niger River declines, rice and other crops are grown. Livestock have to contend with 9 months of no rainfall. Herds are maintained by moving them further south during dry periods.

Many of the soils of Niger are very sandy; however, there are valleys where silty and sandy clay soils and some hydromorphic soils are found (1). Millet and peanuts are cultivated on the sandy soils; rice, maize, wheat, cotton, and vegetables are grown in alluvial valleys and along river banks with millet; and sorghum and sugarcane in the valleys of coarser-textured soils (2). Nabos, et al., reported that sandy dune soils are very responsive to P while alluvial soils of Maggia, Goulbi Valley, are not responsive to P (3).

## Political Characteristics

Niger gained independence in 1960. Initially, a republican form of government was chosen with a President and Council of Ministers entrusted with executive power and a National Assembly holding legislative power.

In April 1974, a military coup d'etat took control of the government. Its leader, Lt. Colonel Kountche, became chief of state, suspended the constitution, dissolved the national assembly, and banned political groups. A Supreme Military Council of 11 members became the governing body. The ministerial structure was reorganized to orient the government more toward responding to the problems of drought.

## Cultural Characteristics

Niger, more than any other country of former French west Africa, has boundaries that are the outcome of arbitrary colonial partitioning which follows no cultural patterns. French is the official language although Hausa is the main trade language. Seventy-five percent of the population is Negroid, belonging to three general groupings: Hausa, Djerma, and Songhai (4). The remaining 25% of the population is Caucasoid belonging to the Tuareg, Teda, and Fulani groupings. Eighty percent of the population is Moslem with the remaining 20% belonging to animistic religions. Most of the people dwell in villages along the southern border stretching from the Niger River to Lake Chad. This is the only region with sufficient water for trees, savanna, and extensive settlement.

## Economic Characteristics

Niger is one of the world's poorest countries. In 1972, GDP was estimated at $494.1 million (5). In 1973, the GDP dropped 10% and an additional 5% in 1974. The declining GDP, coupled with a 2.7% annual population growth rate, has caused the per capita GDP to fall from the 1972 level of $118 to $93 in 1974. Income per capita in 1970 was estimated at $380 for urban population, $60 for the agricultural population, and even less for pastoral population.

Most of the people in Niger are engaged in subsistence agriculture and livestock rearing. Nearly 95% of the population is engaged in agricultural activities. The main cash crops have traditionally been peanuts, cotton, gum arabic, and sesame. Prior to the drought, about 50% of the country's export earnings came from these crops. Niger's livestock sector in 1972 accounted for 20% of the GDP. The country's cattle stock fell by 48% in the drought period of 1972-1974, prompting the government to place a ban on cattle exports. This ban has been partially removed, although certain qualitative restrictions still exist.

The industrial sector of Niger has an annual output of $65 million or about 14% of the GDP (5). This sector

is largely composed of agricultural processing plants which recently suffered drought-related financial setbacks. Peanut processing plants were most severely affected. Poor yields in recent years have also forced large-scale layoffs and, in some cases, closure of plants. Niger's other major agricultural processing facilities include a paddy rice processing plant, a noodle factory, and three cotton gins. These operations were not as severely affected by the drought.

Commercial exploitation of Niger's mineral resources (primarily uranium but also cassiterite) accounted for about 2.2% of the GDP in 1975. Mining operations accounted for about 39% of Niger's 1975 export earnings and contributed $5.5 million to government revenues. The outlook for commercial mining is quite favorable. A recent joint venture scheme with the French government is expected to increase government revenues from mining to $18 million--this represents about 16% of the country's projected budget of $110.2 million (5).

Niger's foreign trade position has been notably strained by the recent Sahelian drought. Poor years for the major agricultural exports and the rising cost of imports have caused a serious balance of trade deficit in 1974. Exports in 1974 totaled $37.4 million while imports were valued at $105.2 million resulting in a balance of trade deficit of $47.8 million (5).

Despite the drought-related setbacks, Niger's economic prospects are not entirely dismal. The agricultural sector should be able to regain strength when normal rainfall resumes, provided widespread crop diseases do not occur. The government is preparing a 3-year interim development plan to expedite this sector's recovery which emphasizes (1) increasing food production with an emphasis on rainfed agriculture, (2) developing irrigation capacity as a hedge against future drought, and (3) rebuilding and improving the country's livestock herds through breeding centers.

The government is also taking measures to develop its industrial sector. A liberal investment code has encouraged foreign investment in energy production; mineral exploration, production, and processing; consumer goods production and agricultural processing; textiles manufacturing; and fertilizer production.

## POPULATION AND FOOD NEEDS

### Population

In 1975, the country's population was estimated at 4.6 million (table 1). The population distribution by age groups is shown in table 2. One million persons live in Niamey department and 130,000 in Niamey, the capital city of Niger. In 1960, about 95% of the population lived in rural areas. Urban migration decreased the percentage of rural dwellers to about 91% by 1975. Indeed, population in the urban areas is increasing at a rate more than twice that in rural areas. The population consists of Hausa (46%), Djerma-Songhai (19%), Fulani (13%), Tuareg (10%), Kanuri (5%), and others (7%) (4). The Hausa are mainly cultivators.

The estimated distribution of population by department is shown in table 3. Population density in 1975

Table 1. Estimated Population and Growth Rates in Niger (6)

| Section of Population | 1970 | 1975 | 1980 | 1985 | 1990 |
|---|---|---|---|---|---|
| Total, 1,000 persons | 4,016 | 4,579 | 5,287 | 6,156 | 7,196 |
| Rural, % of total | 91.6 | 90.6 | 89.4 | 87.9 | 86.4 |
| Growth rate preceding 5 years | | | | | |
| Total, %/year | - | 2.7 | 2.9 | 3.1 | 3.2 |
| Rural, %/year | - | 2.4 | 2.6 | 2.7 | 2.8 |
| Urban, %/year | - | 5.4 | 5.6 | 5.7 | 5.8 |
| Growth rate of active population preceding 5 years | | | | | |
| Total, %/year | - | 2.3 | 2.6 | 2.9 | 2.9 |
| Rural, %/year | - | 1.7 | 1.9 | 1.9 | 1.9 |
| Urban, %/year | - | 7.9 | 7.7 | 7.6 | 7.4 |

Table 2. Estimated Distribution of Population of Niger by Age Groups, 1968 (7)

| Age Group, Years | Population, 1,000 | Population, % of Total |
|---|---|---|
| Under 4 | 640 | 17 |
| 5-14 | 1,060 | 28 |
| 15-39 | 1,360 | 36 |
| 40-64 | 630 | 16 |
| Over 65 | 110 | 3 |

varied from 0.1 persons/km² (Agadez) to 20 persons/km² (Maradi).

## Total Food Requirements

Food requirement projections were based on Food and Agriculture Organization (FAO) data and are projected through 1990 using two methods (6).

One projection (L) assumes that average per capita private consumption levels will remain constant and projects increases based on population changes. The other projection (H) includes elasticity of demand changes based upon a 1% annual increase in per capita food expenditures and consequent preference changes in food purchases. Neither projection, however, differs much in magnitude from the other.

Estimated per capita food consumption in 1970 and the projections for the period 1975 to 1990 are shown in table 4. Millet/sorghum is the staple food although it is estimated that per capita consumption has

Table 3. Estimated Distribution of Population of Niger by Department (7)

| Department | Population, 1,000 | | Density, No./km² | |
|---|---|---|---|---|
| | 1965 | 1975 | 1965 | 1975 |
| Agadez | 66 | 90 | 0.1 | 0.1 |
| Diffa | 132 | 168 | 0.9 | 1.2 |
| Dosso | 471 | 603 | 15.2 | 19.5 |
| Maradi | 597 | 777 | 15.5 | 20.1 |
| Niamey | 774 | 1,051 | 8.6 | 11.6 |
| Tahoua | 715 | 918 | 6.7 | 8.6 |
| Zinder | 759 | 992 | 5.2 | 6.8 |

Table 4. Estimated Levels of Food Consumption for Niger (6)

| Commodity | Estimated Consumption, kg per Capita/Year[a] | | | | |
|---|---|---|---|---|---|
| | 1970 | 1975 | 1980 | 1985 | 1990 |
| Millet/sorghum | 166.6 | 167.4 | 166.5 | 164.2 | 160.4 |
| Rice | 4.7 | 5.0 | 5.2 | 5.5 | 5.8 |
| Wheat | 1.5 | 1.6 | 1.7 | 1.9 | 2.0 |
| Maize | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Sweet potatoes | 1.7 | 1.8 | 1.8 | 1.8 | 1.9 |
| Cassava | 30.4 | 30.7 | 31.0 | 31.3 | 31.6 |
| Beans/peas | 13.4 | 13.6 | 13.8 | 14.0 | 14.2 |
| Vegetables | 11.0 | 11.2 | 11.5 | 11.8 | 12.0 |
| Peanuts | 5.5 | 5.6 | 5.7 | 5.8 | 5.9 |
| Sugar | 2.5 | 2.7 | 2.9 | 3.2 | 3.4 |
| Fruit | 6.2 | 6.3 | 6.5 | 6.6 | 6.7 |
| Meat | 17.2 | 18.4 | 19.4 | 20.4 | 21.4 |
| Fish | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 |

[a]Figures for 1970 are estimated actual consumption, and others are based upon an elasticity of demand.

Table 5. Estimated Food Requirements in Niger, 1975-1990 (6)

| Commodity | Estimated Food Requirements, 1,000 mt[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1970 | 1975 | | 1980 | | 1985 | | 1990 | |
| | L | L | H | L | H | L | H | L | H |
| Millet/sorghum | 669.0 | 762.8 | 766.5 | 880.7 | 880.5 | 1,025.5 | 1,010.5 | 1,198.7 | 1,154.0 |
| Rice | 19.0 | 21.7 | 22.8 | 25.0 | 27.6 | 29.1 | 33.8 | 34.0 | 41.5 |
| Wheat | 6.0 | 6.8 | 7.4 | 7.9 | 9.2 | 9.2 | 11.5 | 10.8 | 14.5 |
| Maize | 2.0 | 2.3 | 2.3 | 2.6 | 2.7 | 3.1 | 3.2 | 3.6 | 3.8 |
| Sweet potatoes | 7.0 | 8.0 | 8.1 | 9.2 | 9.6 | 10.7 | 11.4 | 12.5 | 13.5 |
| Cassava | 122.0 | 139.1 | 140.5 | 160.6 | 163.8 | 187.0 | 192.6 | 218.6 | 227.3 |
| Beans/peas | 54.0 | 61.6 | 62.5 | 71.1 | 73.2 | 82.8 | 86.5 | 96.8 | 102.5 |
| Vegetables | 44.0 | 50.2 | 51.4 | 57.9 | 60.8 | 67.4 | 72.5 | 78.8 | 86.7 |
| Peanuts | 22.0 | 25.1 | 25.6 | 29.0 | 30.1 | 33.7 | 35.7 | 39.4 | 42.6 |
| Sugar | 10.0 | 11.4 | 12.4 | 13.1 | 15.4 | 15.4 | 19.4 | 17.9 | 24.7 |
| Fruit | 25.0 | 28.5 | 29.1 | 32.9 | 34.2 | 38.3 | 40.6 | 44.8 | 48.4 |
| Meat | 70 | 79.7 | 84.4 | 92.2 | 102.2 | 107.4 | 125.2 | 125.5 | 154.1 |
| Fish | 60 | 6.8 | 7.3 | 7.9 | 8.9 | 9.2 | 11.0 | 10.8 | 13.6 |

[a]L is based upon per capita consumption at estimated level of 1970; H is per capita consumption based upon elasticity of demand.

reached a peak and will decrease slightly through 1990. Rice and wheat per capita consumption will increase but remain as a small portion of the total diet. Other commodities for which a significant percentage increase in per capita consumption is forecasted are beans, meat, and sugar.

**Table 6. Estimated Increased Requirements for Major Cereals Over 1975, Niger[a]**

| Food | 1980 | 1985 | 1990 |
|---|---|---|---|
| | - - - -1,000 mt | - - - | |
| Millet/sorghum | 114.0 | 244.0 | 387.5 |
| Maize | 0.4 | 0.9 | 1.5 |
| Rice | 4.8 | 11.0 | 18.7 |
| Total | 119.2 | 255.9 | 407.7 |

[a]Based upon FAO projections considering elasticity of demand.

**Table 7. Estimated Urban Requirements for Major Cereals in Niger, 1975 to 1990[a]**

| Food | 1975 | 1980 | 1985 | 1990 |
|---|---|---|---|---|
| | - - - - 1,000 mt | - - - - | | |
| Millet/sorghum | 71.8 | 93.7 | 122.0 | 157.4 |
| Maize | 0.2 | 0.3 | 0.4 | 0.5 |
| Rice | 2.1 | 2.9 | 4.1 | 5.7 |
| Total | 74.1 | 96.9 | 126.5 | 163.6 |

[a]Based upon FAO projections considering elasticity of demand and assuming urban consumption pattern similar to national pattern.

Estimated projections for total food requirements to 1990 are shown in table 5. Total demand for millet/sorghum is projected to increase over 1970 levels by 32% in 1980, 51% in 1985, and 72% in 1990. Increased requirements for major cereals over 1975 requirements are shown in table 6. The average annual increase needed to meet food demand is 24,000 mt/year between 1975 and 1980 and 27,000 mt/year between 1980 and 1985.

## Urban Food Requirements

A distinction must be made between urban and rural food demand when analyzing potential food demand. Although subsistence-type farming accounts for much of the agricultural production in Niger, large areas of potentially cultivatable land are available. Thus, subsistence-type farming can expand production and continue to meet much of the growing food demand of rural populations. In contrast, urban food requirements must be supplied through some form of commercial agriculture (domestic or imports). In Niger, the urban sector population is growing at more than twice the rate of the rural population.

Urban food requirements were derived for major cereals using FAO (H) per capita consumption projections and urban population growth rates (table 7). Urban food demand for millet, sorghum, maize, and rice is expected to increase at a rate of 4,600 mt/year between 1975 and 1980 and at a rate of 5,900 mt/year between 1980 and 1985. This is the element requiring an intensive effort to supply food requirements.

## Cereal Supply Situation

The changing cereal supply situation for selected years between 1961 and 1974 is portrayed in table 8. The per capita supply of cereals has ranged from 191 to 243 kg/person since 1970 averaging 216 kg/person for the 5-year period. Adjustment for milling of rice and the typical losses gives an average annual supply of cereals of 185 kg/person which is reasonably close to the FAO estimated consumption. Statistics for individual years are erratic. However, the trend since 1971 is toward increasing imports. Cereal imports, including grain relief aid, increased to 259,000 mt in 1973.

Production in 1974 was similar to 1961-65 levels. Total population, however, has increased 38% over this same period. Thus, to achieve self-sufficiency at per capita consumption levels attained in the early 1960's, production would need to be increased by about 320,000 mt over 1974 production levels.

Table 8. Population and Cereal Supply Situation in Niger, 1961-1974 (9, 10)

| Crop | 1961-65[a] | 1970 | 1971 | 1972 | 1973 | 1974 |
|---|---|---|---|---|---|---|
| | Cereal Production, 1,000 mt | | | | | |
| Total | 844 | 986 | 880 | 744 | 575 | 847 |
| Wheat | <1 | <1 | 1 | <1 | 1 | 1 |
| Rice paddy | 11 | 37 | 27 | 32 | 46 | 43 |
| Maize | 3 | 2 | 2 | 2 | 3 | 3 |
| Millet | 524 | 610 | 550 | 500 | 400 | 550 |
| Sorghum | 306 | 337 | 300 | 210 | 125 | 250 |
| | Cereal Imports, 1,000 mt | | | | | |
| Total | 5 | 8 | 6 | 126 | 259 | 207 |
| Wheat | 3 | 7 | 5 | 6 | 9 | 11 |
| Other[b] | 2 | 1 | 1 | 120[c] | 250[c] | 196 |
| | Cereal Exports, 1,000 mt | | | | | |
| Total | 38 | 58 | 58 | 50 | 30 | 20 |
| | Total Supply, 1,000 mt | | | | | |
| Total | 811 | 936 | 828 | 820 | 804 | 1,034 |
| | Per Capita Supply, 1,000 mt | | | | | |
| Total | 257 | 243 | 209 | 201 | 191 | 238 |

[a]Average annual rate.
[b]Includes grain relief aid.
[c]From reference (11).

If cereal yields average 450 kg/ha, an additional 711,000 ha would need to be brought into cereal production under present technology to meet demand. As an alternative, 71,000 mt of fertilizer nutrients, assuming a response of 10 mt of grain/mt of nutrient, could also produce the needed 711,000 mt of additional grain. However, at practical levels of nutrient application (50 kg/ha), this would require fertilizing 1.4 million ha.

The estimated c.i.f. cost of imported sorghum at Niamey was 41,000 F CFA/mt or 29.2 billion F CFA for 711,000 mt. The imported cost of nutrients is considered to be 160,000 F CFA/mt or 11.4 billion F CFA for 71,000 mt. While fertilizer use, without the appropriate cultural practices, would not produce a 10:1 yield response, the difference in foreign exchange requirements between imported food and imported nutrients (29.2 billion F CFA versus 11.4 billion F CFA) makes increased fertilizer use an attractive alternative in augmenting cereal supply.

It appears that Niger can benefit most by increasing crop production through both expanding cropland area and increasing productivity per unit of land. An in-depth analysis of these alternatives would be a useful guide to the government. Such a study would need to analyze the social costs and benefits from a more rapid expansion of area used for agricultural production as compared to increasing productivity through improved technology on existing land.

Population index has been increasing steadily while indices of total and per capita food and agricultural production have been decreasing since 1967 (table 9).

Agricultural Policy Institutions

The Ministry of Rural Economy through its Department of Agriculture and the Niger Union of Credit and Cooperation (UNCC) have the direct responsibilities of serving and developing agriculture. The Department of Agriculture functions to increase crop production through teaching farmers modern techniques (this function is delegated to UNCC for cooperative members) and to protect crops through inspection and control of packing and storage. In addition, it is responsible for fertilizer imports. The staff includes 16 agriculturists, 52 senior extension workers, and 111 monitors. The administration is carried out through 7 departments, 30 districts, and 149 extension units. Each extension unit serves 3,000-4,000 farmers.

The UNCC's functions are to promote cooperatives, train their personnel, assist in marketing output, provide inputs, provide technical assistance, and manage irrigation schemes. UNCC keeps accounts for cooperatives, supervises the educational and guarantee funds, arranges financing for crop marketing, and is the middleman between cooperatives and marketing agencies. UNCC's production division organizes cotton production and supervises 15 irrigation projects covering 1,900 ha. UNCC has 245 extension workers, 41 of which are in cotton-growing areas.

Table 9. Indices of Population and Agricultural and Food Production, Niger (9)

| | Indices[a] | | | | |
|---|---|---|---|---|---|
| Year | Population | Food Production | Agricultural Production | Per Capita Food Production | Per Capita Agricultural Production |
| 1961 | 95 | 90 | 90 | 95 | 95 |
| 1962 | 97 | 98 | 98 | 101 | 101 |
| 1963 | 100 | 103 | 103 | 103 | 103 |
| 1964 | 103 | 102 | 102 | 100 | 100 |
| 1965 | 105 | 109 | 109 | 103 | 103 |
| 1966 | 108 | 120 | 119 | 110 | 100 |
| 1967 | 112 | 121 | 121 | 108 | 108 |
| 1968 | 115 | 118 | 118 | 103 | 103 |
| 1969 | 118 | 119 | 120 | 101 | 101 |
| 1970 | 122 | 116 | 117 | 96 | 96 |
| 1971 | 126 | 106 | 106 | 84 | 84 |
| 1972 | 130 | 105 | 105 | 81 | 81 |
| 1973 | 134 | 77 | 76 | 57 | 57 |
| 1974 | 138 | 96 | 96 | 70 | 70 |

[a]World--1963 = 100.

Government agricultural policy is attempting to maximize production of crops and livestock in rainfed areas and expand irrigation by 800-1,000 ha annually. Rural development is the joint responsibility of the Ministry of Rural Economy and Ministry of Development. A 1974 decree created the National Development Council to develop policies, screen development programs, and oversee the execution of development programs.

The Ministry of Development's activities in rural development include developing literacy programs, promoting participation by people in their own development, and helping to organize cooperatives. Cooperatives in Niger are actually intervillage cooperatives made up of 5-10 Mutual Village Groupements (GMV). In certain areas, cooperatives form regional associations made up of 3-5 cooperatives, called Local Association of Cooperatives (ALC). In 1975, 2,598 GMVs, 237 cooperatives, and 40 ALCs had been organized with about one-half as many additional units partially organized (table 10). All ALCs are in Dosso, Maradi, and Zinder provinces. Many organized cooperatives and GMVs are located in the Zinder and Maradi provinces. The decision for a GMV to join or not join a cooperative is taken by the whole village after discussion among the heads of families. The members agree to market produce through the cooperative.

Training courses of functional literacy, agricultural production, and cooperative education are conducted each year before and after the marketing season for officers of the cooperatives. This tends to ensure active participation of members in the management of cooperatives. Trainees are expected to serve as demonstrators in their villages.

## Sales of Farm Inputs and Outputs

One of the UNCC functions is the distribution of seeds, fertilizer, animal power, and farm equipment to farmers. UNCC cooperates with other marketing organizations to guarantee farmers a better marketing system for their products.

Individual producers and cooperatives sell peanuts to the Niger Commercial Peanut Industry (SONARA) and cotton to the French Textile Development Company (CFDT). Grain is marketed through the Food Products Office of Niger (OPVN) which primarily purchases grain for reserve storage or for distribution to deficit areas.

**Table 10. Status of Mutual Village Groupments (GMV), Cooperatives, and Local Association of Cooperatives (ALC) in Niger, 1975 (12)**

| | Existing Organized Units | | | | | Partially Organized | | | Planned to be Organized by 1978 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Department | ALC | Coop | GMV | Heads of Households | Population Affected | ALC | Coop | GMV | ALC | Coop | GMV |
| Niamey | - | 17 | 169 | 8,160 | 88,719 | - | 38 | 380 | - | 27 | 270 |
| Dosso | 5 | 14 | 152 | 13,881 | 81,283 | - | 5 | 50 | - | 20 | 200 |
| Maradi | 17 | 72 | 841 | 36,161 | 263,683 | 10 | 50 | 500 | - | - | - |
| Zinder | 18 | 97 | 1,043 | 50,405 | 292,512 | 8 | 39 | 390 | 4 | 20 | 200 |
| Tahoua | - | 35 | 344 | 74,619 | 176,799 | - | 14 | 140 | - | 16 | 160 |
| Diffa | - | - | 20 | 236 | 1,886 | - | 5 | 50 | - | 10 | 100 |
| Agadez | - | 2 | 29 | 562 | 2,810 | - | 6 | 60 | - | 8 | 80 |
| Total | 40 | 237 | 2,598 | 184,024 | 907,692 | 18 | 157 | 1,570 | 4 | 101 | 1,010 |

## Agricultural Credit

Agricultural credit has come from the National Agricultural Credit Fund (CNCA) and the Rural Development Bank of Niger (BDRN). CNCA is the main channel of agricultural credit to the rural sector. CNCA is government owned and has branches in Zinder and Tahoua. In other departments, the CNCA is represented by UNCC. CNCA makes medium- and short-term loans to UNCC to finance crop production and to private corporations to finance marketing of peanuts, cotton, and rice.

Under the International Development Association financed credit project to farmers and cooperatives, UNCC has responsibility for loan appraisal and CNCA has the responsibility for final approval and accounting of loans. Interest rates have been 3-4%. As of June 30, 1975, only 23% of loan targets had been disbursed for agricultural inputs.

Credit applications from villagers are reviewed by the GMV council and approved by a CNCA representative. The credit is guaranteed by all GMV members. UNCC may take the corresponding amount from the net surplus of village sales when credit is delinquent (8).

## Agricultural Prices

Prices paid producers prior to 1974 were below free-market prices. Since 1974, prices have been increased (table 11). Minimum producer prices now appear to be at levels to encourage production.

Farmer prices for equipment in 1974-75 were: 4,000 F CFA for plow, 2,500 for ridger, 3,000 for cultivator, 5,000 for seeder, and 11,000-20,000 for the two sizes of carts (12). A pair of oxen costs 30,000 F CFA.

**Table 11. Trend of Farmer Prices for Crops in Niger**

| | Price, F CFA/kg | | | |
|---|---|---|---|---|
| Year | Peanuts | Seed Cotton | Rice | Millet/ Sorghum |
| 1966 | 14 | 30 | - | - |
| 1967 | 14 | 29 | - | - |
| 1968 | 12 | 29 | - | - |
| 1969 | 14 | 29 | - | - |
| 1970 | 14 | 30 | - | - |
| 1971 | 15 | 30 | - | - |
| 1972 | 15 | 32 | - | - |
| 1973 | 19 | 37 | 30 | 25 |
| 1974 | 40 | 47 | 35 | 25 |
| 1975 | 40 | 47 | 35 | 25 |

## Fertilizer Cost and Prices

Fertilizer prices are highly subsidized (table 12). In 1974, subsidies on ammonium sulfate (AS) and single superphosphate (SSP) were 41% and 38%, respectively. The estimated rates of subsidy for urea and triple superphosphate (TSP) (at 1976 prices) are 60% and 57%, respectively. At present subsidized fertilizer prices, a farmer purchases 42-49% more nutrients in urea and TSP than in AS and SSP for comparable expenditures. Freight cost from Cotonou for a kilogram of N is 40 F CFA more for AS than for urea. This indicates the importance of using high-analysis fertilizer materials to reduce the cost of delivery of plant nutrients.

## Crop Production

Potential cropland estimated by FAO is 10.8 million ha (6). Of potential cropland, 47.5% is in the zone receiving less than 350 mm of annual rainfall; 47.6% receives 350-600 mm; and 4.9% receives 600-800 mm. Only 24.1% of potential cropland (2.604 million ha) is actually in crops (14). Of this, 26,000 ha is irrigated.

Table 12. Fertilizer Cost, Price to Farmers, and Subsidy in Niger (13)

| Fertilizer | Year[a] 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1976[b] |
|---|---|---|---|---|---|---|---|
| | Fertilizer Cost c.i.f. Niamey, F CFA/kg | | | | | | |
| Urea | 20 | 24 | 28 | 42 | 42 | 90 | 75 |
| Ammonium sulfate | 18 | 18 | 19 | 38 | - | 34 | - |
| Single superphosphate | 18 | 18 | 19 | 36 | - | 32 | - |
| Triple superphosphate | 20 | 24 | 28 | 47 | - | - | 69 |
| Potassium chloride | 18 | 22 | 22 | 38 | 38 | - | - |
| Complete (NPK) | 20 | 20 | 22 | 40 | 39 | - | - |
| | Fertilizer Price to Farmer, F CFA/kg | | | | | | |
| Urea | 20 | 24 | 28 | 32 | 30 | 30 | 30 |
| Ammonium sulfate | 18 | 18 | 19 | 20 | 20 | 20 | 20 |
| Single superphosphate | 18 | 18 | 19 | 20 | 20 | 20 | 20 |
| Triple superphosphate | 20 | 24 | 28 | 30 | 30 | 30 | 30 |
| Potassium chloride | 18 | 22 | 22 | 25 | 25 | 25 | 25 |
| Complete (NPK) | 20 | 20 | 22 | 25 | 25 | 25 | 25 |
| | Subsidy, F CFA/kg | | | | | | |
| Urea | - | - | - | 10 | 12 | 60 | 45 |
| Ammonium sulfate | - | - | - | 18 | - | 14 | - |
| Single superphosphate | - | - | - | 16 | - | 12 | - |
| Triple superphosphate | - | - | - | 17 | - | - | 39 |
| Potassium chloride | - | - | - | 13 | 13 | - | - |
| Complete (NPK) | - | - | - | 15 | 14 | - | - |
| | Nutrient Cost to Farmer, F CFA/kg | | | | | | |
| Urea | 44 | 53 | 62 | 71 | 67 | 67 | 67 |
| Ammonium sulfate | 86 | 86 | 90 | 95 | 95 | 95 | 95 |
| Single superphosphate | 90 | 90 | 95 | 100 | 100 | 100 | 100 |
| Triple superphosphate | 44 | 53 | 62 | 67 | 67 | 67 | 67 |
| Potassium chloride | 30 | 37 | 37 | 42 | 42 | 42 | 42 |
| Complete (NPK) | 44 | 44 | 49 | 56 | 56 | 56 | 56 |

[a]No fertilizer was purchased in 1975 or 1976. Fertilizer was received from donors.
[b]USAID Mission estimate.

Table 13. Crop Area by Department in 1974 (14)

| Department | Millet | Sorghum | Rice | Maize | Cowpeas | Cotton | Peanuts | Others | Total |
|---|---|---|---|---|---|---|---|---|---|
| | ha | | | | | | | | |
| Diffa | 13,383 | 18,287 | 152 | 190 | 2,612 | - | 2,585 | 810 | 38,019 |
| Dosso | 305,528 | 22,298 | 474 | 949 | 122,259 | 263 | 8,065 | 14,587 | 474,423 |
| Maradi | 208,813 | 95,167 | - | 1,386 | 89,460 | 1,850 | 52,203 | 13,096 | 461,975 |
| Niamey | 481,647 | 67,904 | 9,059 | 1,510 | 189,586 | - | 755 | 4,432 | 754,933 |
| Tahoua | 227,758 | 110,301 | - | 421 | 57,356 | 13,104 | 8,841 | 3,214 | 420,995 |
| Zinder | 211,597 | 45,213 | 62 | 270 | 118,824 | 20 | 73,245 | 2,900 | 452,131 |
| Total | 1,448,726 | 359,170 | 9,747 | 4,726 | 580,097 | 15,237 | 145,694 | 39,039 | 2,602,476 |

**Table 14. Crop Yields by Department, 1974 (14)**

| Department | Yield, kg/ha | | | | | | |
|---|---|---|---|---|---|---|---|
| | Millet | Sorghum | Rice | Maize | Niebe | Cotton | Peanuts (Shell) |
| Diffa | 329 | 956 | 850 | 600 | 50 | - | 300 |
| Dosso | 374 | 282 | 400 | 963 | 150 | 525 | 452 |
| Maradi | 435 | 314 | - | 603 | 189 | 394 | 536 |
| Niamey | 312 | 464 | 2,190 | 552 | 118 | - | 420 |
| Tahoua | 417 | 413 | - | 263 | 147 | 537 | 308 |
| Zinder | 522 | 398 | 750 | 696 | 144 | 550 | 509 |

**Table 15. Cropped Area, Yield, and Production in Niger (9)**

| Crop | Area Harvested 1,000 ha | Yield kg/ha | Production 1,000 mt |
|---|---|---|---|
| | -1961-1965- | | |
| Cereals, total | 1,818 | 464 | 844 |
| Wheat | 1 | 1,159 | 1 |
| Rice paddy | 9 | 1,187 | 11 |
| Maize | 4 | 712 | 3 |
| Millet | 1,340 | 391 | 524 |
| Sorghum | 464 | 659 | 306 |
| Sweet potatoes | 2 | 13,326 | 25 |
| Cassava | 17 | 4,624 | 78 |
| Beans, dry | 479 | 154 | 74 |
| Peanuts in shell | 325 | 639 | 208 |
| Seed cotton | 12 | 452 | 6 |
| Tomatoes | 1 | 6,019 | 4 |
| Onions, dry and green | 1.4 | 21,989 | 32 |
| Sugarcane | 2 | 17,839 | 36 |
| | -1970-1974- | | |
| Cereals, total | 1,886 | 427 | 806 |
| Wheat | <1 | 878 | <1 |
| Rice paddy | 18 | 2,056 | 37 |
| Maize | 4 | 588 | 2 |
| Millet | 1,338 | 390 | 522 |
| Sorghum | 525 | 466 | 244 |
| Sweet potatoes | 2 | 7,375 | 12 |
| Cassava | 26 | 5,500 | 143 |
| Beans, dry | 923 | 106 | 98 |
| Peanuts in shell | 347 | 559 | 194 |
| Seed cotton | 18 | 456 | 8.21 |
| Tomatoes | <1 | 7,602 | 2.8 |
| Onions, dry and green | 9.7 | 15,909 | 154 |
| Sugarcane | 1.7 | 32,619 | 55.4 |

Crop area by department in 1974 is shown in table 13. About 29% of the crop area is in the Niamey Department. Millet is grown on about 56% of the cropland and cowpeas on 22%. These are followed in importance by sorghum and peanuts. Yields of major crops by departments are shown in table 14. In 1974 yield of millet and sorghum was less than 450 kg/ha and that of niebe, less than 150 kg/ha. Comparisons of crop area, yields, and production during the early 1960's and 1970's are shown in table 15. Most crop yields were lower in the early 1970's than in the early 1960's.

Production of cereals, pulses, and root crops has decreased since 1970 (table 16). Peanut production was drastically decreased in 1973 due to the severe drought. Yields are restricted by weather and use of local variety unimproved seed.

The above trends in crop statistics may reasonably describe the relative situations but should not be taken as absolute. There is great variability among sources of data.

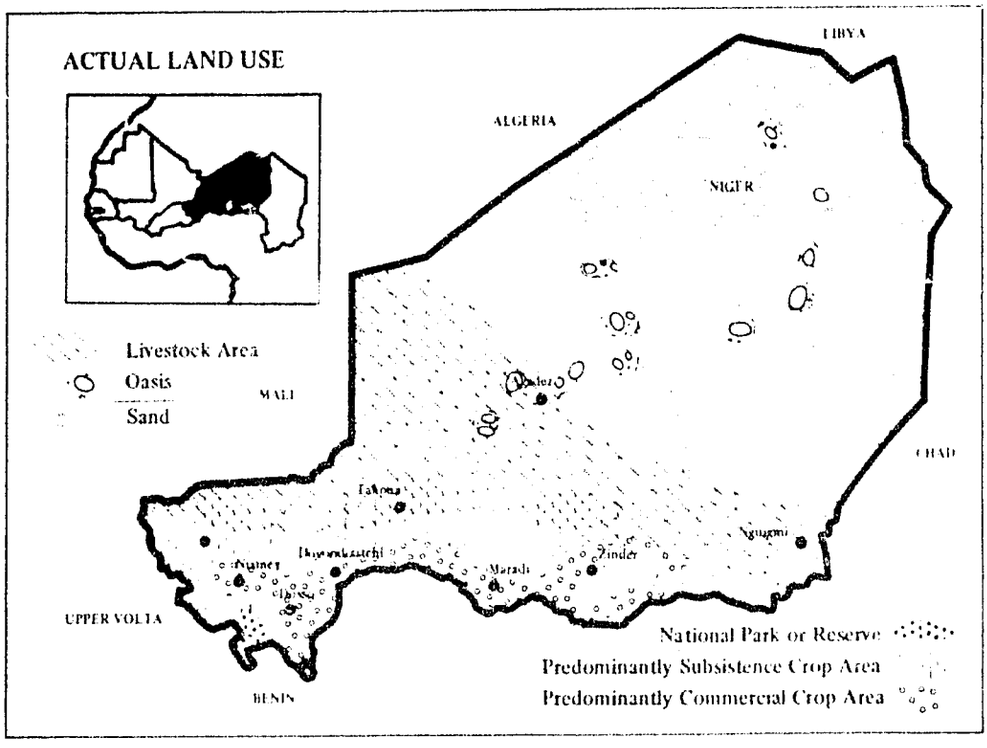
## Pattern of Land Use

Land tenure in Niger is mostly based on use rather than outright or titled ownership. Most of the cereal farmers in the south hold their farmland collectively. Fallowing and crop rotation are practiced wherever population pressure allows them. Agricultural activity in the north is predominantly animal raising, and in the south it is growing crops.

The International Bank for Reconstruction and Development (IBRD) gives the characteristics of farms for three areas in Maradi Department as

**Table 16. Trends of Crop Production, Niger (9)**

| Crop | Production, 1,000 mt | | | | | |
|---|---|---|---|---|---|---|
| | 1961-65 | 1970 | 1971 | 1972 | 1973 | 1974 |
| Cereals, total | 844 | 986 | 880 | 744 | 575 | 847 |
| Millet | 524 | 610 | 550 | 500 | 400 | 550 |
| Sorghum | 306 | 337 | 300 | 210 | 125 | 250 |
| Rice | 11 | 37 | 27 | 32 | 46 | 43 |
| Maize | 3 | 2 | 2 | 2 | 3 | 3 |
| Wheat | <1 | <1 | <1 | <1 | 1 | 1 |
| Dry beans | 74 | 84 | 69 | 145 | 90 | 100 |
| Dry cowpeas | 21 | 25 | 30 | 15 | 20 | - |
| Peanuts, in shell | 208 | 220 | 230 | 260 | 80 | 180 |
| Cassava | 78 | 154 | 130 | 100 | 150 | 180 |
| Sweet potatoes | 25 | 8 | 7 | 12 | 16 | 16 |
| Onions, green and dry | 32 | 35 | 22 | 22 | 16 | 31 |
| Tomatoes | 4 | 2 | 3 | 3 | 3 | 4 |
| Sugarcane | 36 | 36 | 36 | 55 | 75 | 75 |
| Dates | 4 | 5 | 5 | 5 | 5 | 5 |
| Seed cotton | 6 | 10 | 9 | 6 | 8 | 8 |
| Cottonseed | 4 | 7 | 6 | 4 | 5 | 5 |
| Cotton lint | 2 | 4 | 3 | 2 | 1 | 2.5 |
| Tobacco leaves | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |




shown in table 17 (8). Although the farm size is similar in the north and south areas of the Maradi Rural Development Project, more than twice the area is devoted to peanuts in the southern area (higher rainfall) than in the area to the north. In the western area an average of 26% of the crop area is on a flood plain where sorghum, cotton, and vegetables are grown. Labor requirements are estimated at 37.5 man-days/ha for millet

Table 17. Characteristics of Farms in Three Areas of the Maradi Rural Development Project (8)

| Characteristic | Northern, 500-600 mm Rainfall | Southern, >600 mm Rainfall | Western[a] |
|---|---|---|---|
| Family size, number | 6.2 | 6.3 | 6.3 |
| Cropped area, ha | 5.8 | 5.5 | 3.7 |
| Millet area, ha[b] | 4.8 | 3.3 | 2.2 |
| Peanut area, ha | 1.0 | 2.2 | 0.6 |
| Sorghum area, ha | - | - | 0.7 |
| Cotton area, ha | - | - | 0.1 |
| Vegetable area, ha | - | - | 0.1 |

[a]Sorghum, cotton, and vegetables are grown on a flood plain.
[b]About 1 ha of millet is grown in association with cowpeas.

**Table 18. Labor Requirements on Farms in the Maradi Rural Development Project (8)**

| | Labor, Man-Days | | | |
|---|---|---|---|---|
| | North Area | | South Area | |
| | Millet--4.8 ha | Peanuts--1.0 ha | Millet--3.3 ha | Peanuts--2.2 ha |
| Land preparation | 48 | 8 | 33 | 18 |
| Sowing | 19 | 6 | 13 | 12 |
| First weeding | 19 | 4 | 13 | 9 |
| Second weeding | 19 | 12 | 13 | 28 |
| Harvesting | 32 | 25 | 22 | 55 |
| Threshing | 43 | 25 | 30 | 55 |
| Total | 180 | 80 | 124 | 177 |

and 80.5 man-days/ha for peanuts. Time required for various tasks is shown is table 18. Average yield of peanut and millet is similar and estimated to be 400 kg/ha in the northern area and 500 kg/ha in the southern area. Value of production would then be 83,200 and 101,750 F CFA/farm in the northern and southern areas, respectively.

The cotton-growing system is rather well organized and documented. Animal traction is not widely used, even in cotton production. The average area in rainfed cotton is 0.47 ha/exploitation with an extension agent covering 325 exploitations or 153 ha of cotton (12). Of the 14,560 ha of rainfed cotton, 844 ha had land preparation by plows or ridgers. There were only 686 pairs of oxen owned by cotton growers in 1974. There were 245 implements used, giving a utilization of 3.44 ha/implement. For the irrigated cotton there were 17 extension agents covering 1,066 ha or one agent for each 63 ha. Each plow or ridger was used in preparing about 10 ha of land. Estimates of available implements in the country are shown in table 19.

**Table 19. Estimates of Available Agricultural Equipment in Niger (1, 12)**

| | Number of Implements | |
|---|---|---|
| Implement | Existing in 1972 | Sold in 1974/75 |
| Plow | 313 | 127 |
| Ridger | 509 | 100 |
| Cultivator | 222 | 263 |
| Seeder | 80 | 112 |
| Cart | 324 | 193 |

## Crop Production Projects

Project "3M"--European Development Fund (FED) is funding this project in Zinder for the period 1973 to 1977, and the project is managed by UNCC. The objectives are: (1) to develop cooperatives through assistance with training, construction, and equipment; (2) to create technical training centers; (3) to assist in extension activities; and (4) to improve roads. The project area is in Zinder Department and involves 568,000 people cultivating 468,000 ha (339,000 ha of cereals and 129,000 ha of peanuts). The growth of cooperatives during the project is (12):

| Year | ALC | Cooperatives | GMV |
|---|---|---|---|
| 1973 | 9 | 43 | 464 |
| 1974 | 17 | 92 | 964 |
| 1975 | 17 | 92 | 1,012 |

There are 41 UNCCs and 18 Department of Agriculture extension agents working in the project which gives about one agent for each 1,000 exploitations.

Badeguichiri Valley Development Project--The project is funded by FED for the period 1972 to 1976 and is managed by UNCC. It involves 6,000 exploitations on 20,000 ha in Tahoua Department. The objectives are to strengthen cooperatives and extension, introduce animal traction, develop well irrigation, plant trees, and improve rural roads. By 1975, 2,188 ha of land had been improved, 120 multicultivators had been distributed, and 420 ha had been planted in vegetables in the off-season (12).

Dosso Productivity Project--The productivity project is funded by Funds of Aid and Cooperation (FAC) and USAID for the period of 1975 to 1977 and is managed by UNCC. The objectives are to intensify cropping of pure culture of cowpeas and cotton and to increase animal production. Production plans call for (12):

| | 1974 | 1975 | 1976[a] |
|---|---|---|---|
| | - - - - - | ha | - - - - - |
| Pure cowpeas | 1,836 | 6,565 | 12,000 |
| Cotton | 263 | 254 | 500 |
| Millet | - | - | 12,000 |

Maradi Rural Development Project--IBRD is funding the Maradi project for a 3-year period, 1976-1978. It involves 37,500 farm families in 750 villages grouped into 150 primary cooperatives which, in turn, are grouped into 15 ALCs. Objectives are to strengthen cooperatives and extension activities, improve infrastructure, and develop a pilot irrigation scheme from underground water. The project includes extension, credit, and supply of inputs as well as a marketing scheme. Planned areas for cultivation are (8):

| | 1976 | 1977 | 1978 |
|---|---|---|---|
| | - - - - - | ha | - - - - - |
| Peanuts | 24,500 | 46,000 | 64,500 |
| Millet, sorghum | 45,000 | 93,800 | 146,300 |
| Cowpeas | 400 | 1,000 | 1,000 |
| Total | 69,900 | 140,800 | 211,800 |

A pilot ground-water program, planting 500 ha of fuel wood, and construction of 80 km of feeder roads are also included in this project.

National Cereals Project--This project, funded by USAID for the period 1976 to 1979, involves development of improved varieties of millet, seed multiplication, production practice demonstrations, expansion of cooperatives, and expansion and improvement of training centers.

Others--Other national projects focus on cotton, peanuts, and rice production. A cotton project receives funding from FAC and is managed by UNCC with technical assistance from CFDT. In 1974, 16,200 ha of cotton was grown in the departments of Tahoua, Maradi, and Dosso. About 15,500 ha was grown under rainfed conditions and 700 ha under irrigation.

The peanut program is funded by FAC and FED. The Research Institute for Oil and Oil Crops (IRHO) is assisting in research for the seed program in Zinder, Maradi, and Dosso. Since planted area in peanuts decreased from 418,000 ha in 1972 to 254,000 ha in 1974, efforts are being made to increase planted area above 400,000 ha.

A rice program is funded by FED, FAC, Germany, and mainland China. In 1974, 2,720 ha of irrigated rice was grown in 10 projects ranging from 70 to 900 ha in size. Another 2,285 ha of irrigated rice will be added by 1978.

An 8-year project in the Niamey Department has been proposed by GON

for funding. The project involves production of millet, cowpeas, vegetables, fruit, and poultry. Improved seed and cultural practices on 180,000 of the 246,000 ha of millet grown within 8 years are proposed. The area planted in cowpeas would be increased from 17,000 to 100,000 ha, with improved seed being used on 70,000 ha by the eighth year.

## AGRICULTURAL RESEARCH

Agricultural research in Niger is the responsibility of the National Institute of Agronomic Research (INRAN) within the Ministry of Rural Economy. INRAN receives technical assistance from the Research Institute for Tropical Agriculture (IRAT), IRHO, Research Institute for Cotton and Textile Fibers (IRCT), and USAID. Research includes studies on variety selection and improvement, cultural practices, and response to fertilizer. General fertilizer recommendations derived from this work are shown in table 20.

### Crop Response to Fertilizer

It is generally admitted that, for small farmers to use fertilizer, the value of the last increment of yield increase must be twice the cost of fertilizer needed to produce the increased yield. This calculation is called the marginal "value:cost ratio."

In this report, average value: cost ratios are used to indicate the profitability of fertilizer use. When using average value:cost analysis, ratios somewhat greater than 2 would be necessary to provide an economic incentive to the farmer to adopt or increase the use of fertilizer.

Several research reports were reviewed and data for crop response to rates of individual nutrients were analyzed by regression techniques where appropriate. Data were utilized from IRAT and INRAN reports (3, 15, 16, 17). Optimum nutrient rates were determined for several cost:price ratios, including those existing in the country for subsidized and unsubsidized fertilizer. Some data unsuitable for regression analysis are used in other ways.

Millet--Yield response of millet and economic returns to N for various cost:price ratios are shown in table 21. The data are results of regression analysis for 11 experiments conducted at Tarna, Kala-Pate, and Magaria between 1973 and 1975. Using 1976 farmer prices for N and millet, the cost:price ratio is 2.23 (67:30). At this cost:price ratio the optimum rate of N is 75 kg/ha for the experimental data. This

**Table 20. General Fertilizer Recommendations in Niger**

| Crop | Nutrient Rate, kg/ha | |
|---|---|---|
| | N | $P_2O_5$ |
| Millet[a] | 23 | 15 |
| Sorghum | 45 | - |
| Rice[b] | 80 | - |
| Cowpeas | - | 15 |
| Peanuts | - | 30 |
| Cotton | 23 | - |

[a]No $P_2O_5$ following peanuts.
[b]Irrigated rice--135 kg N/ha.

Table 21. Yield Response and Economics of N Fertilization of Millet at Tarna, Magaria, and Kala-Pate, Niger (15, 16, 17)

| Cost:Price Ratio | N Rate, kg/ha | Yield Increase[a] kg/ha | Yield Increase[a] kg/kg N | Value:Cost Ratio |
|---|---|---|---|---|
| | For Economically Optimum N Levels | | | |
| 2.00 | 76 | 515 | 6.8 | 3.40 |
| 2.23 | 75 | 512 | 6.8 | 3.05 |
| 3.00 | 68 | 494 | 7.3 | 2.43 |
| 4.00 | 59 | 461 | 7.8 | 1.95 |
| 5.00 | 52 | 430 | 8.3 | 1.66 |
| | For Recommended N Level | | | |
| 2.23 | 23 | 231 | 10.0 | 4.48 |

[a] $\Delta Y = 11.50N - 0.0622N^2$.

yields 512 kg of millet/ha or 6.8 kg/kg of N. The average value:cost ratio is 3.05. If farmers can obtain this type of response, it is to their benefit to use 75 kg of N/ha for millet. A change in the cost:price ratio from 2 to 5 decreases the optimum N rate by 32% but decreases the value:cost ratio by 51%. Based upon this response data, farmers would not be encouraged to use fertilizer at cost:price ratios greater than 4. Using the unsubsidized cost of fertilizer, the cost:price ratio is 6.5. The average return is 4.48 F CFA/F CFA invested in N at the recommended rate of N (23 kg/ha).

Table 22. Yield Response and Economics of N Fertilization of Millet at Tarna, Niger (3)

| Yield Increase[a] kg/ha | Yield Increase[a] kg/kg N | Value:Cost Ratio[b] |
|---|---|---|
| 309 | 15.4 | 5.91 |
| 296 | 14.8 | 6.64 |
| 126 | 6.3 | 2.83 |
| 136 | 6.8 | 3.05 |
| 38 | 1.9 | 0.85 |

[a] N applied at 20 kg/ha.
[b] Based upon a cost:price ratio of 2.23.

Additional data from experiments in which only one rate of N was used are considered in table 22 (3). These experiments were conducted from 1968 to 1972 when drought was prevalent. These data show that the cost of the N was recovered in four of the five trials. Also, the average value:cost ratios were greater than 2 for those four.

Experimental data on millet response to P suitable for regression analysis were obtained for eight experiments conducted between 1968 and 1973 (3, 16). However, regression analysis was made only for the six experiments at Tarna since the response appeared to be quite different at Tarna and the other locations. Research data at Tarna indicate a greater response to P than at other locations. Also, millet response is greater to P than to N at Tarna.

Yield increases of millet and value in terms of cost of $P_2O_5$ are shown in table 23. At the 1976 cost:price ratio, the optimum rate of $P_2O_5$ is 25 kg/ha, and it gives 590 kg of millet/ha. This results in 23.6 kg of millet/kg of $P_2O_5$ and gives a return of 10.58 F CFA/F CFA spent for $P_2O_5$. Even with a cost:price ratio of 5

Table 23. Yield Response and Economics of P Fertilization of Millet at Tarna, Niger (3, 16)

| Cost:Price Ratio | $P_2O_5$ Rate, kg/ha | Yield Increase kg/ha | Yield Increase kg/kg $P_2O_5$ | Value:Cost Ratio |
|---|---|---|---|---|
| | For Economically Optimum $P_2O_5$ Levels | | | |
| 2.00 | 25 | 590 | 23.6 | 11.80 |
| 2.23 | 25 | 590 | 23.6 | 10.58 |
| 3.00 | 24 | 588 | 24.5 | 8.17 |
| 4.00 | 24 | 588 | 24.5 | 6.12 |
| 5.00 | 23 | 584 | 25.4 | 5.08 |
| | For Recommended $P_2O_5$ Level | | | |
| 2.23 | 15 | 486 | 32.4 | 14.53 |

[a] $\Delta Y = 45.59P - 0.8793P^2$.

(slightly less than unsubsidized $P_2O_5$ cost), fertilization with P is highly profitable for response data obtained in these experiments. At the recommended rate of P application (15 kg of $P_2O_5$/ha), 32.4 kg of grain/kg of $P_2O_5$ was obtained providing a return of 14.53 F CFA/F CFA spent for $P_2O_5$.

An analysis of data from several other experiments with only one rate of P is shown in table 24. The response to P was significantly less at Kala-Pate and Magaria than at Tarna. The four trials at Magaria generally gave a return greater than two times the subsidized cost of fertilizer. At Kala-Pate farmer cost of $P_2O_5$ was recovered in four of the five trials. In three trials, the return was greater than 2. It is likely that similar responses would

Table 24. Yield Response and Economics of P Fertilization of Millet at Kala-Pate, Magaria, and Tarna, Niger (3, 17)

| Location | $P_2O_5$ Rate, kg/ha | Yield Increase kg/ha | Yield Increase kg/kg $P_2O_5$ | Value:Cost Ratio[a] |
|---|---|---|---|---|
| Kala-Pate | 35 | 56 | 1.6 | 0.72 |
| | | 239 | 6.8 | 3.05 |
| | | 434 | 12.4 | 5.56 |
| | | 160 | 4.6 | 2.06 |
| | | 129 | 3.7 | 1.66 |
| Magaria | 20 | 494 | 24.7 | 11.08 |
| | | 240 | 12.0 | 5.38 |
| | | 260 | 13.0 | 5.83 |
| | | 86 | 4.3 | 1.93 |
| Tarna | 23 | 637 | 27.7 | 12.42 |
| | | 467 | 20.3 | 9.10 |

[a] Based upon a cost:price ratio of 2.23.

have been obtained with 15-20 kg of $P_2O_5$/ha giving value:cost ratios greater than 2 in four of the five trials.

The research data indicate that, at 1976 cost:price ratios for N and $P_2O_5$, fertilization of millet is profitable at the recommended rate of 23 kg/ha of N and 15 kg/ha of $P_2O_5$. On sandy dune soils, such as those at Tarna, considerably higher rates are profitable, especially in years with adequate rainfall.

Few fertilizer trials have been conducted on farmers' fields. Results of five trials conducted in 1974 show quite variable yield responses. From an economic standpoint, profitable yield responses (value:cost > 2) were obtained to N at three locations; to P at two locations; and to the combination of N and P at two locations (table 25). However, no response to N or P was obtained at one location, and response to only one nutrient was obtained at two other locations.

In 1975 the results of four demonstrations on the 3M project in southern Zinder showed yield increases of 75-300 kg of millet/ha from an application of 15 kg/ha of N and 40 kg/ha of $P_2O_5$. A yield response of 300 kg/ha was profitable with a value:cost ratio of 2.4:1.0. Many more fertilizer trials for millet are needed to determine the nature of response on farms. A fertilizer trial program must include documentation of variety, seeding rate and date, adequacy of weeding, rainfall distribution and quantity, and incidence of pests.

**Table 25. Results of Preextension Trials for Millet Conducted in 1974 (16)**

| Location | Yield Increase kg/ha | Yield Increase kg/kg Nutrient | Value:Cost Ratio[a] |
|---|---|---|---|
| | Response to N (23 kg/ha) | | |
| Niamey | 310 | 13.5 | 6.05 |
| Dosso | - | - | - |
| Maradi | 131 | 5.7 | 2.56 |
| Tahoua | 131 | 5.7 | 2.56 |
| Tahoua | 3 | 0.1 | 0.04 |
| | Response to $P_2O_5$ (15 kg/ha) | | |
| Niamey | 150 | 10.0 | 4.48 |
| Dosso | 220 | 14.7 | 6.59 |
| Maradi | 64 | 4.3 | 1.93 |
| Tahoua | - | - | - |
| Tahoua | - | - | - |
| | Response to N + P | | |
| Niamey | 460 | 12.1 | 5.43 |
| Dosso | 107 | 2.8 | 1.26 |
| Maradi | 195 | 5.1 | 2.29 |
| Tahoua | 82 | 2.2 | 0.99 |
| Tahoua | - | - | - |

[a]Based upon a cost:price ratio of 2.23.

Table 26. Yield Response and Economics of N Fertilization of Rice, Niger, 1972-1973 (15)

| Cost:Price Ratio | N Rate, kg/ha | Yield Increase[a] kg/ha | Yield Increase[a] kg/kg N | Value:Cost Ratio |
|---|---|---|---|---|
| | For Economically Optimum N Levels | | | |
| 1.68 | 83 | 535 | 6.4 | 3.81 |
| 2.00 | 80 | 529 | 6.6 | 3.30 |
| 3.00 | 72 | 509 | 7.1 | 2.37 |
| 4.00 | 63 | 478 | 7.6 | 1.90 |
| | For Recommended N Level | | | |
| 1.68 | 135 | 469 | 3.5 | 2.08 |

[a] $\Delta Y = 11.19N - 0.0572N^2$.

Rice--Results for irrigated rice from five experiments conducted at Kolo and Libore in 1972 and 1973 with N rates from 0-90 kg/ha were studied (15). Yield increases of paddy rice and returns relative to the cost of N are shown in table 26 for various cost:price ratios and N rates.

At the 1976 cost:price ratio for N and paddy rice (67:40 = 1.68), the optimum rate of N for irrigated rice in these experiments is 83 kg/ha. This yields 6.4 kg of rice/kg of N with a value:cost ratio of 3.81 for subsidized N. Based upon the present cost:price ratio, the recommended level of N fertilization is greater than the economic optimum although this rate gave a return of 2 times the cost of fertilizer.

Peanuts--No useful data for regression analysis were encountered on peanut response to P. However, the data in table 27 were obtained in single rate experiments conducted between 1967 and 1975 (3, 15, 16, 17).

Table 27. Yield Response and Economics of P Fertilization of Peanuts, Niger, 1967-1975 (3, 15, 16, 17)

| Location | $P_2O_5$ Rate, kg/ha | Yield Increase kg/ha | Yield Increase kg/kg $P_2O_5$ | Value:Cost Ratio[a] |
|---|---|---|---|---|
| Kala-Pate | 35 | 245 | 7.0 | 5.74 |
| | 35 | 87 | 2.5 | 2.05 |
| | 15 | 64 | 4.3 | 3.52 |
| | 15 | 42 | 2.8 | 2.30 |
| Tarna | 15 | 279 | 18.6 | 15.25 |
| | 15 | 15 | 1.0 | 0.82 |
| Magaria | 20 | 119 | 6.0 | 4.92 |
| Bengou | 20 | 213 | 10.6 | 8.69 |

[a] Based upon a cost:price ratio of 67.55 = 1.22.

**Table 28. Crop Response to Phosphate Rock in Niger (3, 17)**

| Applied $P_2O_5$[a] | | Average Peanut Response | | | Average Millet Response | | | |
|---|---|---|---|---|---|---|---|---|
| | Rate/Year | Yield | Increase | | Yield | Increase | | Last Year |
| Source | kg/ha | kg/ha | kg/ha | kg/kg $P_2O_5$ | kg/ha | kg/ha | kg/kg $P_2O_5$ | % of Check |
| Kala-Pate (Peanuts--2 Years; Millet--4 Years) | | | | | | | | |
| - | - | 1,261 | - | - | 763 | - | - | 100 |
| TSP | 34 | 1,493 | 232 | 6.8 | 985 | 222 | 6.5 | 114 |
| PR (Tahoua) | 25 | 1,446 | 185 | 7.4 | 848 | 85 | 3.4 | 117 |
| PR (Tahoua) | 50 | 1,300 | 39 | 0.8 | 816 | 53 | 1.1 | 115 |
| Magaria (Peanuts--1 Year; Millet--3 Years) | | | | | | | | |
| - | - | 1,091 | - | - | 450 | - | - | 100 |
| TSP | 20 | 1,200 | 109 | 5.4 | 781 | 331 | 16.6 | 166 |
| PR (Tahoua) | 20 | 1,062 | - | 0 | 447 | - | 0 | 96 |
| PR (Tahoua) | 40 | 1,192 | 101 | 2.5 | 720 | 270 | 6.8 | 132 |
| Tarna (Peanuts--4 Years; Millet--4 Years) | | | | | | | | |
| - | - | 1,041 | - | - | 1,139 | - | - | 100 |
| PR (Tahoua) | 5.6 | 1,193 | 152 | 27.1 | 1,346 | 207 | 37.0 | 111 |
| PR (Tahoua) | 11.2 | 1,150 | 109 | 9.7 | 1,425 | 286 | 25.5 | 115 |
| PR (Tahoua) | 16.9 | 1,205 | 164 | 9.7 | 1,538 | 399 | 23.6 | 122 |
| Tarna (Peanuts--1 Year; Millet--4 Years) | | | | | | | | |
| - | - | 1,819 | - | - | 1,065 | - | - | 100 |
| PR (Tahoua) | 12 | 1,837 | 18 | 1.5 | 1,237 | 172 | 14.3 | 111 |
| PR (Tahoua) | 24 | 1,783 | - | - | 1,350 | 285 | 11.9 | 118 |
| Magaria--Fallow (Peanuts--2 Years; Millet--5 Years) | | | | | | | | |
| - | - | 925 | - | - | 420 | - | - | 100 |
| PR (BAYLIFOS) | 6 | 1,186 | 261 | 43.5 | 713 | 293 | 48.8 | 208 |
| PR (BAYLIFOS) | 13 | 1,085 | 160 | 12.3 | 721 | 301 | 23.2 | 259 |
| Magaria--Green Manure (Peanuts--2 Years; Millet--5 Years) | | | | | | | | |
| - | - | 1,115 | - | - | 621 | - | - | 100 |
| PR (BAYLIFOS) | 6 | 1,135 | 20 | 3.8 | 747 | 126 | 21.1 | 104 |
| PR (BAYLIFOS) | 13 | 1,158 | 43 | 3.3 | 876 | 255 | 19.6 | 129 |

[a]PR is phosphate, all of which was applied prior to the first crop. TSP is triple superphosphate which was applied annually.

Table 29. Crop Response to Phosphate Rock and TSP at Tarna, Niger (17)

| Applied $P_2O_5$ | | Millet Yield, kg/ha | | | Yield Increase | | Relative Value, % |
|---|---|---|---|---|---|---|---|
| Source | Rate, kg/ha | 1974 | 1975 | Average | kg/ha | kg/kg $P_2O_5$ | |
| - | - | 1,676 | 1,015 | 1,345 | - | - | - |
| TSP | 23 | 2,313 | 1,482 | 1,898 | 533 | 24.0 | 100 |
| PR (Tahoua) | 23 | 2,095 | 1,238 | 1,666 | 321 | 14.0 | 58 |

The data show that peanuts, with a relatively high value, require little response to pay for the cost of fertilizer. With the 1976 farmer cost of P and peanut prices, research data indicate that it is profitable to fertilize peanuts with 15-20 kg of $P_2O_5$/ha.

Crop Response to Phosphate Rock--Phosphate rocks (PR) from the Tahoua deposit in Niger and from Senegal have been tested for several years in Niger. In most tests, PR was applied at a rate of 80-150 kg/ha of $P_2O_5$, and the crops were grown for several years (table 28). However, at Kala-Pate and Magaria single applications of PR were compared with annual applications of TSP. Results are variable but, generally, PR was 50-60% as effective as TSP. At Kala-Pate, even though average (4 years) millet response was about 50% as great for PR as for TSP, yield responses in the sixth year were similar (15% greater than control).

On Tarna soil, which is very responsive to P, Tahoua PR gave responses of 27 kg of peanuts/kg of $P_2O_5$ and 37 kg of millet/kg of $P_2O_5$ at the lowest rate of application during 8 years of crops. This rate gave a 10% yield increase over the no-phosphate treatment in the eighth year after application. BAYLIFOS from Senegal also gave excellent responses for peanuts and millet in a rotation experiment for 7 years.

An experiment was started at Tarna recently to determine crop

Table 30. Effect of Soil Preparation upon Yield of Peanuts and Millet in Niger (17)

| Crop | No. of Observation Years | Crop Yield, kg/ha | | | Crop Yield, % of Control | |
|---|---|---|---|---|---|---|
| | | Soil Preparation | | | | |
| | | Control | Harrow | Plow | Harrow | Plow |
| | | Dune Soil | | | | |
| Peanuts | 9 | 1,305 | 1,420 | 1,519 | 109 | 116 |
| Millet | 17 | 705 | 880 | 1,029 | 125 | 146 |
| | | Sandy Clay Soil | | | | |
| Peanuts | 4 | 541 | 597 | 1,186 | 110 | 219 |
| Millet/sorghum | 4 | 405 | 461 | 750 | 114 | 185 |

Table 31. Effect of Improved Cultivation Techniques on Yield of Peanuts and Millet, Niger (17)

| Crop | Years of Observations | Crop Yield, kg/ha[a] Traditional Culture | Extension Recommendations |
|---|---|---|---|
| Peanuts | 6 | 665 | 1,209 |
| Millet | 12 | 622 | 1,238 |

[a]Means of two cycles of a peanut-millet-millet rotation at Magaria, Tarna, and Kala-Pate.

response to annual applications of Tahoua PR and TSP. Millet yield response was 58% as great to PR as to TSP for 2 years' data (table 29). It appears that PR is most useful when applied in a relatively large single application with crops grown for 3-5 years or more. Additional field-trial work conducted on farms would be useful to determine the relative value of PR in comparison with soluble P fertilizers.

Cultural Practices--Several experiments to determine the effect of soil preparation have shown that harrowing or plowing is beneficial for peanuts and millet on dune soils and sandy clay soils. On dune soils, plowing gave an average peanut yield increase of 16% and increased millet yield by 46% over no soil preparation (table 30). On sandy clay soils, plowing gave 119% and 85% increased yields of peanuts and millet. Harrowing increased yield 10-25%.

A series of continuous cropping experiments at Magaria, Tarna, and Kala-Pate has shown the potential for increasing yields over traditional culture on dune soils. Experiments at each location were conducted through two cycles of a peanut-millet-millet rotation. Extension recommendations included soil preparation with harrow, proper planting and weeding, using fertilizer and good varieties, and seed treatment. The combination of recommended practices gave yield increases of 82 and 99% for peanuts and millet, respectively (table 31).

## FERTILIZER USE AND POTENTIAL

### Fertilizer Use

The level of fertilizer use in Niger is very low. About 1,400 mt of fertilizer materials was apparently used in 1975. The history of nutrient consumption is shown in table 32. Nutrient consumption has fluctuated from year to year but has been between 200 and 300 mt/year since 1970. Distribution of nutrient use by departments is shown in table 33 for 1973 and 1974. During the 2 years, 88% of the N, 35% of $P_2O_5$, and 76% of the $K_2O$ was used in the Niamey Department primarily for rice and vegetables. In other departments, phosphates are used for peanut production and N for cotton.

Table 32. Estimated Nutrient Consumption in Niger (1, 18)

| Year | N | $P_2O_5$ | $K_2O$ | Total |
|---|---|---|---|---|
| | mt | | | |
| 1964 | - | - | - | - |
| 1965 | 22 | - | - | 22 |
| 1966 | 116 | 81 | 36 | 233 |
| 1967 | 150 | 84 | 32 | 266 |
| 1968 | 146 | 74 | 22 | 242 |
| 1969 | 203 | 83 | 54 | 340 |
| 1970 | 72 | 72 | 26 | 170 |
| 1971 | 128 | 77 | 34 | 239 |
| 1972 | 151 | 101 | 57 | 309 |
| 1973 | 220 | 100 | 58 | 378 |
| 1974 | 80 | 63 | 14 | 157 |
| 1975 | 67 | 170 | - | 237 |

In 1976, it is planned to use 2,200 mt of fertilizer materials containing 290, 300, and 40 mt of N, $P_2O_5$, and $K_2O$, respectively (18). More than 50% of the material will be single superphosphate and 20% will be urea.

## Potential Fertilizer Use

The cost:price ratios for fertilizers and crops generally appear to be favorable to promote fertilizer use if on-farm response is near that obtained in experiments. The greatest impediment to fertilizer use in Niger appears to be that of supply. With the increased cost of fertilizer in 1973-1975, it has been difficult for GON to finance purchases. Also, in

Table 33. Nutrient Consumption by Departments, Niger (14)

| Year | Agadez | Diffa | Dosso | Maradi | Niamey | Tahoua | Zinder | Total |
|---|---|---|---|---|---|---|---|---|
| | Department | | | | | | | |
| | N, mt of Nutrient | | | | | | | |
| 1973 | - | - | 2.3 | - | 207.9 | - | 9.9 | 220.1 |
| 1974 | - | 0.8 | 4.8 | 2.0 | 56.3 | 15.5 | 1.0 | 80.4 |
| | $P_2O_5$, mt of Nutrient | | | | | | | |
| 1973 | - | - | 9.3 | - | 47.7 | - | 43.1 | 100.1 |
| 1974 | - | 0.8 | 26.0 | 20.9 | 9.6 | - | 5.8 | 63.1 |
| | $K_2O$, mt of Nutrient | | | | | | | |
| 1973 | - | - | 0.8 | - | 47.7 | - | 9.9 | 58.4 |
| 1974 | - | 0.8 | 2.9 | 1.9 | 7.0 | - | 1.0 | 13.6 |
| | Total, mt of Nutrient | | | | | | | |
| 1973 | - | - | 12.4 | - | 303.3 | - | 62.9 | 378.6 |
| 1974 | - | 2.4 | 33.7 | 24.8 | 72.9 | 15.5 | 7.8 | 157.1 |
| | Nutrients, % of Total | | | | | | | |
| 1973 | - | - | 3.3 | - | 80.1 | - | 16.6 | 100 |
| 1974 | - | 1.5 | 21.5 | 15.7 | 46.4 | 9.9 | 5 | 100 |

Table 34. IFDC Estimated Potential Use of Fertilizer by Departments, 1980 and 1985, Niger

| | Estimated Nutrient Consumption, mt | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | | | | 1985 | | | |
| Department | N | $P_2O_5$ | $K_2O$ | Total | N | $P_2O_5$ | $K_2O$ | Total |
| Agadez | 4 | 4 | 3 | 11 | 16 | 7 | 9 | 32 |
| Diffa | 16 | 3 | 1 | 20 | 21 | 4 | 2 | 27 |
| Dosso | 108 | 366 | 7 | 481 | 417 | 646 | 18 | 1,081 |
| Maradi | 104 | 265 | 75 | 444 | 228 | 423 | 113 | 764 |
| Niamey | 692 | 175 | 180 | 1,047 | 1,034 | 239 | 237 | 1,510 |
| Tahoua | 7 | 25 | 1 | 33 | 19 | 63 | 5 | 87 |
| Zinder | 71 | 171 | 11 | 253 | 399 | 617 | 27 | 1,043 |
| Total | 1,002 | 1,009 | 278 | 2,289 | 2,134 | 1,999 | 411 | 4,544 |

times of fertilizer shortages, it was difficult to obtain bids on low-volume orders.

The Department of Agricultural Services estimates fertilizer nutrient use to reach about 2,300 mt in 1977 and 4,500 mt in 1980 (19). The IFDC study team considers that those projections are overly optimistic since less than 300 mt of nutrients was used in 1975. It does appear that fertilizer use can increase relatively fast if GON makes a real effort. The study team considers that the estimate for 1977 by the Department of Agricultural Services is more likely attainable by 1980 and their 1980 estimate by 1985. The estimation of distribution by departments is shown in table 34.

## FERTILIZER SUPPLY

### Raw Material for Fertilizer

Phosphates--Phosphate outcroppings exist in the vicinity of Tahoua near In Akker. This deposit was studied by Watts, Griffis, and McQuat Company under funding from the Canadian International Development Agency (CIDA). The deposit is nominal--22-25% $P_2O_5$. Mining and grinding for direct application are to begin soon with West German financing.

In addition to the Tahoua deposit, deposits have been discovered in the Parc W region south of Niamey in the Tapoa and Mekrou Valleys near the Upper Volta border. Reserves of about 100,000,000 mt have been identified in the Tapoa Valley deposit. The $P_2O_5$ content is approximately 23% (aluminum phosphate). Phosphatic iron ore deposits of 100-700 million mt are reported near Say. If a steel industry develops, the basic slag would be a potential P fertilizer.

The Mekrou Valley deposit is predominately calcium phosphate and has been studied by the Bureau of Geology and Mining Research (BRGM). A contract has recently been signed for BRGM to continue study of deposits in the Tapoa and Mekrou Valley regions. Appendix 1 contains additional data on potential fertilizer raw materials.

Other--Some oil exploration has been conducted by Texaco, Continental, and others, but no exploration drilling has begun. Coal deposits have been found in the area of Teferoye and south of Tcherezrin. Reserves are estimated at 4,500,000 tons.

Production and Plans

There is no existing fertilizer production in Niger. There are plans, however, to start small-scale mining and grinding of Tahoua PR in 1976 for direct application. The $P_2O_5$ content is 22-25%. The rock will be ground to less than 100 microns (approximately 140-mesh). The Tahoua deposit is located near In Akker, and the mining and grinding is to be undertaken using German funding. The expected cost is 23 F CFA/kg (about $US 100/mt) in bags.

The IFDC study team was told by a GON official that, in 1980, about 150,000 mt of phosphate rock will be mined in the Park W region, processed, and exported to Nigeria. The expected $P_2O_5$ content is 25-27% with the $Al_2O_3$ content being 1%.

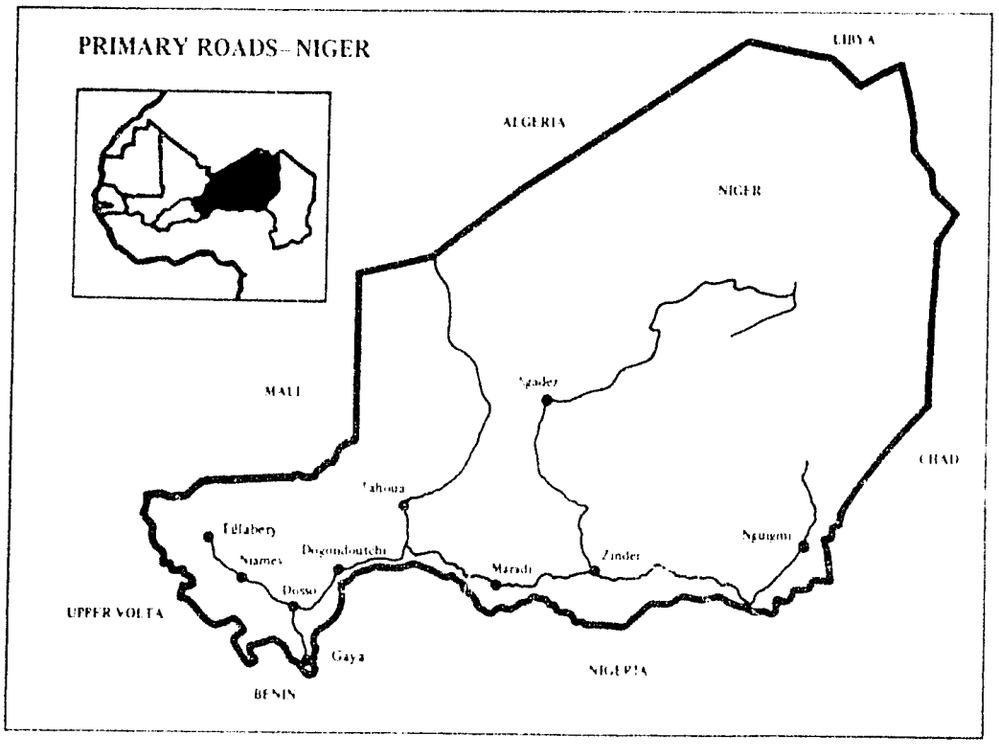
## TRANSPORTATION

Three-fourths of the country is desert. The major economic centers and most of the population are located in the south and along the Niger River. This landlocked country has little traffic to the sparsely populated areas and uses four routes to access the sea.

International Transportation

The Benin route is the shortest and most economical international route. Transport costs are 20-25% less than alternate routes from Niamey, Niger's capital, to the sea. Niamey is 1,050 km from the Port of Cotonou via Benin; a railway extends 440 km to Parakou, Benin, and a road from Parakou to Niamey, 610 km. The road from Parakou to Niamey is hard surfaced, except for a short distance (80 km), and is not subject to seasonal flooding. Approximately 80% of the traffic to and from Niamey depends on this route. Approximately 25% of the total annual cargo handled at Cotonou (about 700,000 mt) is Niger traffic. Trip time generally ranges from 4.5-6 days. An extension of the railroad from Parakou to Niamey is planned. When completed, transportation costs and delivery time from Cotonou to Niamey should be reduced.

The Ivory Coast route is lengthy--1,650 km. Low-cost rail transport from Abidjan to Ouagadougou and shorter travel time render it a feasible outlet for Niger. Niamey imports enter the Port of Abidjan, Ivory Coast, and move by rail to Ouagadougou, Upper Volta (1,120 km). From Ouagadougou to Niamey (530 km), truck transport is required. The road linking Ouagadougou and Niamey is not in good condition; however, it does not appear to be affected by seasonal




flooding. This route is approximately 20% more expensive than the Benin route, although trip time is only 4.5-5 days.

The Nigerian route is the primary route serving the central and eastern regions of Niger. The market areas of Maradi and Zinder (Niger) are both accessed via this route. Products may be imported via Port Harcourt or the Port of Lagos. A railway extends 1,120 km from the Port of Lagos to Kaura Namoda, Nigeria. From Kaura Namoda to Maradi, a distance of 160 km, road transportation is required. The road is hard surfaced and all weather. The route via Port Harcourt also involves rail and road transport--a 1,120-km railway to Kano, Nigeria, and 265 km by all-weather road to Zinder. Total distance to Maradi via the Port of Lagos is 1,280 km and to Zinder via Port Harcourt, 1,335 km. However, since the railways from Lagos and Port Harcourt junction in Kaduna, either port may be accessed by Maradi or Zinder. Trip time to Agadez via Port Harcourt or Lagos is 7.5-10 days.

The Algerian route through the Sahara has been used in emergency situations (floods preventing access via the more economical routes) to serve Agadez in central Niger. The Algerian route is very long (3,000 km) and expensive. The entire distance must be traveled by road vehicles. Imports take 11-20 days for delivery. The cost is about 3.5 times more than by the Nigerian route.

About 80% of peanut exports (120,000 mt) is usually routed to Kano and from there via the Nigerian Railway to Lagos. Also carried on this route is 50,000 mt of import products. Most of the remaining external traffic goes through Benin under regulation by the Common Organization (Dahomey-Niger) (OCDN) formed by the two countries in

1959. OCDN operates the Parakou-Cotonou railway and has the exclusive right to charter road transport for evacuation of the portion of the peanut production routed through Benin. Traffic flows have become distorted over recent years by the effects of the drought and inadequate management of the Nigerian route.

A route that may be of value to western Niger (Niamey and Gaya) in accessing Port Harcourt is by way of the Niger River. The river is navigable for about 7 months out of the year from Port Harcourt to Gaya. The factors limiting the river navigability to Gaya are a low bridge linking Malanville to Gaya and severe rapids at La Tapoa (between Niamey and Gaya) which render the river impassable during periods of low water. Efforts to establish commercial navigation on the Niger River have failed so far. Much of the traffic during the drought period has therefore been carried through Cotonou.

Domestic Transportation

The existing domestic transportation network in Niger appears sufficiently extensive to access market centers in the southern portion of Niger from east to west borders. The system is road oriented as Niger has no railroads. Water transportation is seasonally limited from mid-December through March to the navigable section of the Niger River from Niamey to Gaya, Niger (298 km).

Niger's road network consists of about 7,500 km of roads and tracks. Most of the roads linking major markets in the more populous southern regions are all weather. Transportation routes are limited and subject to flooding in the sparsely populated north and central regions. However, the low volume of freight movement and short time of flooding fail to justify infrastructure development in these areas (20).

In the more populous southwestern region, a road that runs parallel to the Niger River and extends from the north border to the south border is of primary importance in serving domestic transport needs. The road intersects three market centers: Tillabery, Niamey, and Dosso. Most of this road has an asphalt surface. A hard-surfaced segment, suitable for year-round travel, extends 769 km along Niger's southern border from Dosso to Zinder passing through several major market areas.

A road extending 470 km from Zinder to the largest city in central Niger, Agadez, is in poor condition

**Table 35. Road Transportation Cost in Niger**

| From | To | Distance (km) | Estimated Transportation Cost[a] $/mt |
|---|---|---|---|
| Niamey | Tillabery | 120 | 11.04 |
| Niamey | Gaya | 298 | 17.47 |
| Niamey | Dosso | 140 | 10.19 |
| Niamey | Maradi | 672 | 25.75 |
| Zinder | Agadez | 470 | 28.54 |
| Zinder | Maradi | 237 | 15.76 |
| Maradi | Tahoua | 326 | 20.91 |

[a]Includes handling at $3.74/mt.

and may become impassable during the rainy season.

During the flood season, there do not appear to be any routes via southern Niger that do access Agadez. Imports must cross the Sahel--a long and expensive route. Transportation rates and distances to market centers in Niger are presented in table 35.

## ALTERNATE SUPPLY SCHEMES

Fertilizer consumption in Niger is very low--estimated to be 2,200 mt of material in 1976. For this reason, production of fertilizer at any level beyond the planned rock grinding cannot be recommended. The low use level also precludes consideration of semi-bulk imports or bulk blending.

The GON should proceed as quickly as possible to obtain suitable ground PR from domestic deposits for direct application.

In addition, the GON should place orders for required finished fertilizers in quantities as large as practical to take advantage of better prices.

Thirdly, the GON should begin negotiations with Nigeria to obtain a supply of SSP from the Kaduna plant at a competitive price.

## POTENTIAL PROJECTS

Niger has the land resources to achieve self-sufficiency in food production for its people. Only 7% of the potentially arable land is presently under cultivation. While not an easy process, new lands can be brought into production with time. In the short run, food production can be increased through greater yields on existing croplands. The use of improved production practices on currently cultivated land can significantly increase the productivity of Niger agriculture.

Transformation of subsistence farming into commercial agriculture is the key to meeting present and future food requirements. Essential to this process will be market development, more production incentives, new technology, improved transportation, and the increased availability of necessary farm supplies and equipment. A key input in such a development program will be fertilizer, currently only used in very limited quantities.

Niger has indigenous resources to produce some of the nutrients needed for expanded fertilizer use. Phosphate rock (PR) deposits exist to supply some of the $P_2O_5$ nutrient requirements. Other nutrients must be imported.

Adoption of fertilizer involves more than just the ability to accurately recommend and supply fertilizer. A stable price relationship between the value of yield gain and cost of fertilizer application must provide an economic incentive to the farmer. Even when this relationship appears to be economically favorable, the farmer may still be reluctant to adopt fertilizer. Extension education and fertilizer response demonstrations are important in assisting him to more accurately evaluate the benefits and risks of fertilizer use.

Project recommendations suggested to accelerate the use of fertilizer in Niger follow.

## Soil Fertility Project

A fertilizer trial and demonstration program is needed in Niger to obtain data and demonstrate response for major crops at various levels of on-farm management. Method of land preparation and tillage; varieties; plant population; timing of seeding, weeding, and harvesting; and soil type and moisture need to be correlated with crop response to fertilizer.

PR deposits exist in Niger, and at least that from Tahoua appears to be suitable for direct application. The effectiveness of these rocks in providing plant nutrients needs to be determined for the major crops under varying soil and moisture conditions. Phosphate rock should be tested in comparison with other standard PR and soluble phosphate fertilizers. Research findings can then be incorporated into an extension education and demonstration program which can advise farmers on new production practices.

IFDC recommends that an expatriate team of crop production specialists be assigned to Niger to work closely with existing research and extension organizations to obtain crop response data and demonstrate responses to farmers. Project team members would be responsible for agronomic and economic research on crop response and for training nationals in methods of agricultural research and extension education. The term of the project is 5 years. A detailed description of the proposed project is contained in appendix II.

## Public Policy Studies on Price Stabilization and Equalization

Fertilizer use is highly dependent upon the relationship between the cost of fertilizer and crop prices.

IFDC recommends that alternate public policies on price support and cost subsidization be studied to determine their effects on fertilizer adoption, food production, and overall economic development. IFDC recommends that one expatriate economist work with Nigerien economists from the appropriate planning organization to carry out the study. The term of this project is 6 months. See appendix II for additional details.

## Estimated Budgets

The estimated foreign exchange requirements for the budgets of the recommended projects are:

| Project | Period, Years | Budget |
|---|---|---|
| Soil Fertility | 5.0 | $1,590,000 |
| Public Policy | 0.5 | 31,000 |
| | | $1,621,000 |

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20. Sahel Transportation Paper, IBRD, West Africa Projects Department, 1975.

## APPENDIX I

### Fertilizer Raw Material Deposits and Literature References

| References | Composition of Samples | Location | Other Information |
|---|---|---|---|
| Reference 1 | Calcium phosphate 45%<br>Calcite 28%<br>Pyrite 14%<br>Silica 3% | Aschia<br>Tinamou | Composed of fishbones and pyrite cement.<br>There is water present-- said to contain $CaSO_4$. |
| | $P_2O_5$ ... 20%<br>C ... 12-1/2%<br>$Fe_2O_3$ ... 7-1/2%<br>CaO ... 42%<br>Ign. loss ... 6% | | |
| Reference 2 | $P_2O_5$ ... 30-33%<br>CaO ... 40-50%<br>$Fe_2O_3$ ... 2-11%<br>$Al_2O_3$ ... 2-10%<br>$SiO_2$ ... 2-9% | In Akker, 63 km from Tahoua | Because of the high $R_2O_3$, the rock is unsalable. Contact Mr. Sorry, geologist of Ministry of Hydrology and Mines. |
| | $P_2O_5$ ... 24-37%<br>CaO ... 7-10%<br>$Al_2O_3$ ... 19-30%<br>$Fe_2O_3$ ... 2-4%<br>$SiO_2$ ... 2-35% | Tamaguelelt | This is based on analyses for two samples only. |
| Private communications and Ref. 1, p. 417 | Phosphate rock and alunite, $Al_2(SO_4)_3.K_2SO_4.6H_2O$.<br><br>At Homodji the alunite contains 6.3% $K_2O$. | Adar and West | The phosphate rock deposit at West is said to be large. West is said to be 2°E and 12°N near Niamey. (This would put it on the borders with Upper Volta and Benin.) |

## Fertilizer Raw Material Deposits and Literature References (continued)

| References | Composition of Samples | Location | Other Information |
|---|---|---|---|
| Reference 2, p. 185 | Alunite containing $K_2O$, 9.2%; $Al_2O_3$, 38%; and $SO_3$, 37%. | Termit and Amelaoulaou | No quantities stated but several deposits exist. |
| Reference 2, p. 186 | A mixture of sulfates, carbonates, bicarbonates, and chlorides of Na. % NaCl 10-80% | Koramas, Manga | Also Mem. BRGM 1963, 512 1965, 564. Page 538 of first reference above gives an analysis showing mainly $Na_2SO_4$ and $Na_2CO_3$, few other ions. |
| Reference 2, p. 187 | Pyrites | Tegama | Small quantities |
| Reference 2, p. 178 | Bitumen | Digdiga, Senonien, Kao | Quantity unknown. No oil found up to now in spite of wide searches |
| Reference 1, p. 532 | $NH_4NO_3$ + $Na_2SO_4$ + $MgSO_4$ in solution | Dambouda | No quantities given. Analysis on p. 536 shows mainly AN with much $K_2O$, CaO, and $Na_2O$. Very few other anions. The solids are 5-15% soluble in water. |
| Mem. BRGM 1973 No. 82, p. 123 | A phosphatic iron ore containing 42-50% Fe and 3% $P_2O_5$. | Say | The reference says there is 100 mt proved and probably 700 mt. It continues to say the use of ore would give big quantities of good basic slag. |

## Fertilizer Raw Material Deposits and Literature References (continued)

| References | Composition of Samples | Location | Other Information |
|---|---|---|---|
| Industries et Travaux d'Outremer No. 262, 1975 pp. 721 and 737 | Coal. Overburden 40 m. Reserves 4.5 mt | Anou Araren | This is to be used on a new power plant furnishing energy to the uranium mines of Arlit and Akouta. Also perhaps for the new company formed by the Niger Government, the French Atomic Energy Authority, and Overseas Uranium Resources Development of Japan to build a uranium beneficiation plant (Akorita). |
| Reference No. 3 | Lignite and pyrite coal | Tanout Intedreft | |
| Private Information | Phosphate rock | Near Bilma in the east of Niger, close to Chad | |
| Private Information | Oil and bitumen | Near Djado and southeast of Joummo | |

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1. Faure, H. 1966. Reconnaissance Geologique des Formations Sedimentaires Post-Paleozoiques du Niger Oriental, Mem. No. 47, BRGM, 630 pages, figs., refs., col. geol. map. (In French) Phosphates, p. 167, 171, 531.

2. Greigert, J., and R. Pougnet. 1967. Essai de Description des Formations Geologiques de la Republique du Niger, Mem. No. 48, BRGM, 238 pages, figs., refs., maps. (In French) Phosphates, p. 178, 179.

3. Arnaud, M. G. 1945. Les Resources Minieres de l'Afrique Occidentale, Bull. No. 8, Dir. Mines Afr. Occid., 100 pages, figs., refs., maps. (In French) Phosphates, p. 61.

## APPENDIX II

### Recommended Projects

SOIL FERTILITY PROJECT IN NIGER

Fiscal year proposed for financing: FY 1979

Priority and Relevance

A goal of AID support in west Africa is to assist in increasing food production, particularly to restore balance between production and demand. Major emphasis is being placed on this goal by AID through support of Semi-Arid Food Grain Research and Development (SAFGRAD) and country and sectional crop production and/or integrated rural development projects. Specifically, AID is funding a national cereals production program. Other agencies are funding crop production projects, most of which involve some cereal production.

Requirements for millet and sorghum, primary food crops, are projected to increase 114,000 and 244,000 mt by 1980 and 1985 over 1975 food requirements. To help meet these needs, basic and applied research programs are being implemented to develop and distribute drought-tolerant varieties adapted to the soil and climatic conditions and to study cropping systems suitable to the area. These programs are much needed and are essential to bring about improved crop production. In addition, other measures are needed to improve crop yields and expand production.

Research on experiment stations has shown good cereal response to fertilizers, particularly N and P.

PR from Tahoua has been tested at Nigerien experiment stations for several years. Experiments at Tarna on P-responsive soils have shown 15-25 kg of millet produced/kg of $P_2O_5$ applied as Tahoua PR. On less-responsive soils Tahoua PR gave only about 50% as great response as TSP. Unfortunately, experimental design of past experiments has not been adequate to determine the relative value of PR in comparison with soluble P fertilizer. Additional data are needed, particularly under farmer conditions.

Farm-level information is scarce for cereal response to fertilizer. Limited data indicate on-farm response is quite variable. To maximize the response to fertilizer, improved production practices at the farm level must be implemented. Little is known about farmer attitudes toward acceptance of improved cultural practices. Efforts have been made to introduce changes without much success. The lack of widespread acceptance in many cases may be due to the lack of farmer knowledge, bottlenecks in the delivery system for inputs, limited availability of credit at economical interest rates, inadequate input/output price relationships, and unstable market demand.

Description of Project

This project would implement a soil fertility program in Niger consisting of two "action" components followed by a project evaluation. The term

of the project is 5 years. It would be implemented within the framework of existing institutions responsible for agricultural research and extension.

The objectives of the soil fertility project are:

1. To define the nature of response of food crops to fertilizer in various soil and climatic conditions at the farm level;

2. To quantify the value of Tahoua PR for food crop production in relation to soluble-P fertilizer and other widely used PR under varying soil and climatic conditions;

3. To train nationals in improved crop production practices, methods of conducting and analyzing trials and demonstrations, and using results with farmers;

4. To demonstrate to farmers the value of improved crop production practices; and

5. To relate levels of inputs of a crop production program to outputs, changes in attitudes, and changes in practices.

Crops and soils research is under the direction of INRAN with technical assistance from IRAT and USAID for food crop research. Their research includes soil fertility, crop breeding, variety testing and selection, rotations, residue management, soil preparation, etc. The Institute for Crop Research in the Semi-Arid Tropics (ICRISAT) has the responsibility for improving crop varieties and developing minimum input production packages for small farmers in the semi-arid tropics which includes Niger.

This project proposes that four crop production specialists be assigned to work in Niger. One of the persons would be assigned as coordinator for this component. Each crop specialist would have four assistants (nationals) who would be trained to carry on the work themselves. One or two additional assistants would be added each year.

Specialists would be assigned for 2 and 3 years, and rotation would be staggered to permit continuity. The first coordinator's term would be for 3 years. The specialists must have training and experience to conduct professional levels of work and must be able to effectively converse in French. Specialists should arrive in Niger January or February to give time for familiarization and planning before their first crop season. Upon arrival, the specialists would familiarize themselves with existing research data and projects and make detailed plans for the coming season in consultation with those staffs.

Each crop specialist would be responsible for conducting 30-40 crop production trials or demonstrations of a design suitable to measure the effect of individual plant nutrients, crop variety, plant population, timing of planting and harvesting, soil preparation, and incorporation of residue or manure application. Long-term experiments would be established to determine the effect of crop rotations and the value of residual fertilizer.

Individual trials with PR would be conducted for 3-5 years to determine the immediate as well as residual effect. The trials would include equivalent rates of $P_2O_5$ applied as TSP and PR and the lowest rates of PR with

supplemental TSP. In all trials and demonstrations, soil samples would be obtained and analyzed for attempts at correlation of yield response and levels of soil test P and possibly other characteristics. Arrangements would be made for proper analysis of samples at research station laboratories. Rainfall (quantity and distribution) would be recorded at or near each location.

The project leader would coordinate statistical and economic analyses of project results, develop practical farm budgets for various cropping and economic situations, and serve as field advisor for a graduate student conducting adoption studies of changes resulting from crop production program.

The study by the graduate student would include documenting at the village level such things as: kinds and number of farmer contacts; availability of credit and other inputs; input and output prices; price fluctuations; availability of markets; acceptance and implementation of new practices; and effect of these on production, labor requirements, and economic well-being. The study would attempt to define the relative importance of various inputs of a crop production program upon the diffusion, acceptance, and implementation of improved cropping practices.

Training sessions would be conducted with assistants covering how and why various things are done. In addition, training sessions would be held with each cooperating farmer before trials are established, during the growing season, during harvest, and after harvest.

## AID and Other Relevant Experiences

AID has funded many applied research, crop production, and extension training projects. The soil fertility project has particular relevance to the SAFGRAD project since it contains an action program to strengthen national institutions and to provide immediate benefits to Nigerian farmers.

## Beneficiary

Principal beneficiaries of the project are Nigerian farmers. Through better-defined crop response data and better-informed extension advisors, farmers are more likely to increase crop yields and produce more for the time spent on production.

## Feasibility Issues

Indications of cereal response to fertilizer are 7-16 kg of grain/kg of nutrient, with 40-50 kg of applied nutrient/ha. Present farmer price for 50 kg of each urea and DAP (55 kg of nutrients) in Niger is 2,750 F CFA. If a response of 10 kg of grain/kg of nutrient is obtained, the yield increase is 550 kg/ha. Using 25 F CFA/kg as the grain price, the value of the increased yield is 13,800 F CFA/ha or 11,050 F CFA/ha above fertilizer cost.

On the national basis, fertilizing 10,000 ha of millet or sorghum would require 400 mt of nutrients and result in 3,600 mt of additional grain. Estimated economic farm-gate value of sorghum based upon world prices, margins, and freight is 38,000 F CFA/mt which gives an economic farm-gate value of 136.8 million F CFA for the additional grain produced from 400 mt of nutrients. These nutrients supplied as urea and TSP would cost 64 million

F CFA delivered to Niamey (based upon estimated cost/mt in 1976). Using the same rate for domestic freight and margins as for grain, these add 1.2 million F CFA for a total cost of 65.2 million F CFA for the fertilizer delivered to farms. Therefore, each million F CFA on fertilizer can yield grain to replace 2.1 million F CFA in grain imports.

Other Donor Coordination

IBRD, FED, FAC, and AID are presently funding crop production projects and/or research and extension activities. The Federal Republic of Germany, Canadian International Development Association (CIDA), and Ford Foundation may be interested in funding of this type of project.

Financial Plan

The annual foreign exchange cost of the project is estimated to be $460,000 or $2.3 million for a 5-year period. In addition, the GON would be expected to supply the assistants and field hands for the work, as well as office space. It is estimated that about 60% of the salaries budgeted in the first year for technical services would be needed in the first year since they will not be in the field a full year in the first fiscal year. However, support costs will be highest the first year.

Estimated Foreign Exchange Support for Five-Year Project

| | |
|---|---|
| **Technical Services** | |
| Crop production specialists--4 at $45,000 x 5 | $ 900,000 |
| Support | 500,000 |
| | $1,400,000 |
| Graduate student stipend--1 at $3,000 x 2 | 6,000 |
| Support--$17,000 x 2 | 34,000 |
| Travel--$5,000 x 2 | 10,000 |
| | $ 50,000 |
| Commodities | 40,000 |
| Travel for specialists, workshops, printing and logistic support | 100,000 |
| Grand total | $1,590,000 |

Implementation Plan

A contractual agreement will be made with GON. The project would be administered by a project coordinator probably placed in the administration of INRAN in the Ministry of Rural Economy. Very close collaboration would be needed with the managements of projects and department administrations.

Project Development Schedule

| | |
|---|---|
| Departure, Project Design Team | January 1, 1979 |
| Project Committee Review, Project Paper | April 1, 1979 |
| Review/Approval of Project Paper | June 1, 1979 |
| Project Staff Arrive in Niger | January 1, 1980 |

## STUDY OF PUBLIC POLICIES ON PRICE STABILIZATION AND EQUALIZATION

Fiscal year proposed for financing: 1979

### Priority and Relevance

Fertilizer-use level is highly dependent upon the cost-price relationship between fertilizer and a crop although other factors influence fertilizer use. Farmers tend to maximize net returns and do not use fertilizer if returns do not cover the cost plus risks involved.

Generally, a kilogram of nutrient can be expected to give 8-10 kg of cereal grain. At current world prices for grain and fertilizer nutrients, imports of grain would cost 1.9-2.3 times the cost of fertilizer to produce the grain in Niger. An in-depth analysis would require consideration of many other factors.

### Description of Project

This study would describe alternative public policies on price stabilization and equalization; subsidies for crops, fertilizer, and other related inputs; their implementation; effects upon fertilizer use; and the effects on the economy of the country sectors and regions. It would furnish guidelines for establishing policies related to fertilizer use which could effectively meet government goals. The study would require one expatriate economist working with one or more economists from the national planning agency. The study would be completed in 6 months.

### AID and Other Relevant Experiences

The nature of other studies in this area financed by AID is unknown.

### Beneficiary

Agricultural development would benefit rural and urban sectors. Increasing self-sufficiency in food through appropriate agricultural price and incentive policies would substantially strengthen Niger's international positions by helping to correct current balance-of-payment problems.

### Feasibility Issues

Establishing favorable fertilizer product prices could result in increased fertilizer use and increased food crop production provided other inputs are available for favorable response of crops to fertilizer. Given the varying cost:price ratios over the years, it would seem worthy of establishing guidelines.

### Other Donor Coordination

Unknown.

## Financial Plan

The foreign exchange cost of the study is estimated to be $31,000. In addition, the local government would be expected to supply one or two local economists to work on the project.

### Estimated Foreign Exchange Support for the Study

| Technical Services | |
|---|---|
| Economist--1 at $30,000 x 0.5 | $15,000 |
| Support | 10,000 |
| Travel | 5,000 |
| Publication | 1,000 |
| | $31,000 |

## Implementation Plan

A contractual agreement would be made with the local government. The study would be undertaken with the national planning agency. It would require cooperation and assistance from the Ministry of Rural Economy, Office of Price Regulation, and UNCC.

## Project Development Schedule

| | |
|---|---|
| Visit to the country for project negotiation | January 1, 1979 |
| Visit to the field for data gathering (2 months) | April 1, 1979 |
| Completion of study | September 1, 1979 |