Proj 6770020 (2)
PD-AAC-133-B1

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Project Title: RURAL FAMILY GRAIN-STORAGE PROJECT
Project Location: REPUBLIC OF CHAD (TCHAD)
PVO Name and Location: CARE-Chad, B.P. 106, N'Djamena, Chad
Central Headquarters: CARE, Inc., 660 First Ave. New York, New York 10016
Contact Persons: Leo Pastore or Ralph Devone at Central Headquarters
Date of Submission to A.I.D.:

Total USAID Request: 28p. US$ 466,000 during the period FY 76-79

do you mean acacia?

I. Project Purpose and Description

The purpose of this project is to establish a replicable system of low-cost grain-storage facilities (Silos) at the village level. The project is designed to promote and make maximum use of existing village-level construction technology, with indicated improvements to the footings and platforms to assure that the facilities will last 15 years or longer with only a minimum of maintenance. At the end of this period a new silo can be built on the same base, which is made of cement and reinforcement rods, and is permanent.

The significance of the family silo cannot be overemphasized. It is the family food supply and the family bank.

The project will benefit small farm families by providing them with more grain storage capacity, durable in nature, which will:

a) Protect their stored crops from insects, birds and rodents, and reduce losses, equivalent of up to 20% of the entire crop yield.
b) Increase the food supply available to each participating rural family by up to 20%.
c) Increase the food supply of the village and adjacent areas by the amount saved from destruction by insects, which is not sold elsewhere or consumed by the family itself.
d) Increase the income of the rural family participating in the project by a percentage which will vary in accordance with seasonal price fluctuations, the length of time the grain is stored, and the amount of grain which is sold.
e) Encourage villagers to apply their existing technology to produce a semi-permanent grain storage facility.

Initially, all of the silos will be built using the construction methods pictured in section IV of this proposal. However, during the life of the project different designs and adaptations will be used in those villages where the silo pictured is not fully accepted, or when new methods of construction become more expedient. In all cases where a different design is used, the capacity of the silo built will remain the same.

The selection of the beneficiaries will be made jointly by CARE and the Ministry of Territorial Management, attempting always to select recipients currently without silos.

The targets for the project are as follows:

TOTAL FOR ALL FOUR YEARS

Construction of 800 Silos benefitting 3,200 rural families each with an average of 6 members, or a total of 19,200 people. The total storage capacity of all 800 Silos is 6,400,000 kilos or 6,400 metric tons.

FY 1976

Construction of 200 rural family grain-storage silos, each with a capacity of 8 metric tons or 80 sacks (220 pounds) and benefitting four families of an average size of 6 members, or a total of 4,800 people.

FY 1977

Construction of 200 rural family grain-storage silos, each with a capacity of 8 metric tons or 80 sacks (220 pounds) and benefitting four families of an average size of 6 members, or a total of 4,800 people.

FY 1978

Construction of 200 rural family grain-storage silos, each with a capacity of 8 metric tons or 80 sacks (220 pounds) and benefitting four families of an average size of 6 members, or a total of 4,800 people.

FY 1979

Construction of 200 rural family grain-storage silos, each with a capacity of 8 metric tons or 80 sacks (220 pounds) and benefitting four families of an average size of 6 members, or a total of 4,800 people.

THE PROBLEM

A recent FAO estimate of annual worldwide crop loss, expressed as a percentage of the market value of the crop, puts the loss from insect damage at 13.8% (for Africa the figure is more than 23%), from diseases at 11.6% and from weeds at 9.5%. The annual regional losses, in percentage of crop market value, are estimated as follows:

North and Central America, 28.7%
South America, 33%
Europe, 25%
Africa, 41.6%
Asia, 43.3%
Oceania, 29.7%

Annual losses, in millions of tons, for various crops are estimated as follows:

Cereals, 506
Potatoes, 129
Sugar Beets and Sugar cane, 636
Vegetables, 78
Fruit Crops, 56
Oil Crops, 42

Food waste is hard to document. Issue 19 of the TAICH News (Technical Assistance Information Clearing House, NYC) discussed the problem:

"The FAO's War on Waste may, at first glance, seem insignificant. The following random estimates should indicate the actual importance of this war against, mainly, spoilage, rats, bats, insects, and birds. At least one-fifth of all the food produced is wasted; were waste of the world's production of cereal grains reduced by half, the FAO calculates that nine million tons of protein would be saved; and roughly enough grain to feed 55 million Africans is lost yearly on that continent because of waste.

About 25 million tons of food are lost every year to the depredations of rats; in the Phillipines records kept in Cotabato Province have shown that ten percent of anticipated rice crops have been consumed by them."

"The destruction by insects is another sparsely documented but recognized cause of food losses; one controlled test reported by AID revealed that half of the stored sorghum in the Congo was ruined by insects in one year.

No insects are more spectacular for their annihilation of all in their path than locusts. Although the misery caused by locusts has been documented since man began recording his history, it is only very lately that he has begun to form the alliances necessary to check them. Desert locusts - the most elusive species, and therefore the greatest challenge - may range over 11 million square miles, 20 percent of the world's land, and they conduct their manoeuvres without regard for national frontiers.

Another campaign in this war is being waged against birds, particularly in Africa against the Quelea. Africa's quelea or weaver finch, is reputed to be the most destructive fowl on earth; a starling size bird with a red beak, it erupts annually in dense flocks from its nesting grounds in the southern Sudan and settles on grain fields over a broad belt of savanna land south of the Sahara. The quelea's rapacity has caused farmers to abandon attempts to cultivate sorghum, millet and other cereal grains in some African countries and has led to local famines.

Rodents destroy upwards of 50 percent of the food crops in some parts of the world. India, in particular, suffers substantial grain losses from their depredations. One source estimates that India's rats devour or spoil about 10 million tons of grain a year - enough to fill a railroad train almost 3,000 miles long. Damage to rice and other crops by rodents has long been a major agricultural problem in the Philippines. In the "rice bowls" of Central Luzon and Cotabato, rats consume up to 20 percent of the expected yield, or more than the annual consumption of a million people."

Volume V, No. X of the publication "War on Hunger" contained an excellent article by Joseph L. Ranft called "Waste, Hunger's Ally": "Waste not, want not" - there is still plenty of truth in that old adage. Experts on world agriculture claim that if the huge annual crop losses due to waste and spoilage were suddenly to be eliminated,

none of the poorer nations would want for food to fill its people's stomachs.

Nobody expects such a miracle, of course. A certain degree of waste, by the very nature of things, seems to be inherent in the agricultural production and marketing cycle. But even a modest cut in the loss rate would be economically significant for some food-deficit nations now obliged to spend scarce foreign exchange on imports to feed their people.

Dr. H.A.B. Parpia, head of India's prestigious Central Food Technological Research Centre at Mysore, has spoken of the need to create "a new conciousness among all nations, especially the developing ones, for the prevention of food losses as a means to economic progress and nutritional self-sufficiency."

Citing food production figures of the less developed countries, Dr. Parpia maintains that "there should not be a serious gap of protein or even calories in their diets." Nevertheless, malnutrition is pandemic in the Third World - a condition which the Indian scientist ascribes mainly to "the waste of food at various stages, right from production to consumption."

Waste thieves away the substance of the farmer, keeps food prices high for the consumer, and cuts into the businessman's legitimate profit.

Even in the United States, with its technology-intensive agriculture and vast storage capacity, losses of cereal grains in the fields between sowing and harvest range between five and ten percent, and in storage between three and seven percent. But in the countries of Asia, Africa, and Latin America, which can afford it least, food loss by wastage is considerably more than in the developed world. The United Nations Food and Agriculture Organization estimates that crop losses before and during harvest, handling, transportation, and storage may be as high as 60 percent in the less developed countries."

Speaking about the food supply in the Sahel, the January - March 1975 World Food Programme News reported:
"Despite the construction of some warehouses in 1974, the mission found that the better harvest put considerable strain on the

storage capacity of the region, which urgently needed additional facilities.

The desire of all the Sahelian Governments to build up a security stock of cereals as soon as possible highlights the need to complete the warehouse construction programme as a matter of urgency, the mission states in its report which advocates storage facilities both in main centres and in villages."

The food supply problems of the developed and underdeveloped countries are radically different. In the advanced countries, where the food production increases at 2.9% and the population at 1.1%, the problem is one of "supply management".

In the 64 principal developing countries the food production increase has averaged less than the 2% population growth rate. The FAO in discussing the world food supply in 1974 reports, "food production in developing countries is now even slightly below the level of the base period 1961-65. Only one region, the Near East, was able to increase per capita production. Hardest hit is the Far East, where per capita supplies dropped by 6% to a level of 3% below the 1961-65 average. If one compounds the annual growth from the base period 1961-65 through 1972, the annual rate drops to 2.5% as compared to a 2.6% population increase in developing countries. These figures demonstrate the precarious balance which exists between population growth and rising food production."

While the Gross National Product of the developing countries grew at an annual rate of 2% during the 1960s, the poorest and most undernourished of the population groups have often not benefitted from their countries' income growth. They are usually unable to buy food commercially and therefore must store a year's supply of grain from each harvest.

In 1985, simply to cover the expected population increases and modest increases in purchasing power in these 64 countries, the food supply will have to increase 142% over the 1962-level.

It is, therefore, essential that losses of existing crop production in the developing countries from insects, birds and rodents be minimized.

One essential approach to increasing food supplies is to cut down the wastage that occurs from improper storage. Storage losses are notorious. The US reports three to seven percent grain losses from improper storage, but in Africa the percentage is above 20 percent, almost all of it occurring from insects, birds and rodents.

II. Project Background

Chad's poverty is rooted in the low productivity of the agricultural sector, partly caused by poor soil and the climate. This sector contains the bulk of the population and produces 32% of the GDP. Accordingly, Chad's development efforts should be concentrated on raising rural productivity to alleviate poverty, and more particularly, on making full use of the under-employed labor force.

The country's foremost staple crops are millet and sorghum, the basis of the cereal diet of both cultivators and nomads. Grown principally for subsistence use, these two crops in 1970 occupied an estimated 15 to 20% of all cultivated agricultural land and contributed at least 12% of the gross domestic product (GDP). Millet is grown everywhere outside the desert zone, which has been encroaching south of 16°N, and is also cultivated on the oases within the northern desert zone.

The two cereals are always lumped together in the statistics, and the terms millet and sorghum are sometimes used interchangeably for certain varieties, so that it is difficult to make a clear distinction. Fine pennisetum millet is cultivated north of 12°N wherever there are light sandy soils and an annual rainfall of between 11 and 13 inches. It is the principal crop in the Sahelian zone. In fact, it is the only crop that can be grown in areas with less than 17 inches of rainfall. It is also grown in the south, wherever soils are too light for good sorghum yields. Bottom-land sorghum, known locally as berbéré, is grown in the dry season between 11°N and 13°N on clay soils that have been flooded during the rainy season. Red and white sorghums (also known as coarse millet) are grown in the rainy season in association with cotton cultures as far north as 12°N. In parts

of Mayo-Kebbi they were alternated with cotton without fallow, but elsewhere they are usually planted second or third in rotation with cotton. They require at least 27 inches of rainfall.

Statistical data on millet and sorghum production are rough estimates since no attempt has been made to undertake a sample survey of acreage in the northern, central or eastern regions. Surveys in the five southernmost prefectures reveal that earlier estimates had been on the high side. This may have been one factor in the apparent decline in millet and sorghum production since the mid-1950s. It was thought, however, that subsistence food crop production actually has declined somewhat. Among other factors, official programs for increased production of industrial crops, such as cotton and peanuts, may have cut into food crop production since the area that could be cultivated by any one family is quite limited.

Millet and sorghum are essentially subsistence crops, used for the home preparation of boule, the stiff gruel that forms the base of most meals. It is prepared with peanut oil and served two or three times a day with milk or with a sauce of vegetables and meat. Millet is also used in the brewing of several varieties of beer. One government source estimates that about one-third of the annual crop is used for beer, and one-third is sold or exchanged. Sedentary cultivators often exchange a portion of their crop with the nomads for salt or animal products. The internal demand is usually so strong that no price-support measures are necessary.

Millet and sorghum are not only the preferred diet of most of the population but they are nutritionally superior to most alternative cereal grains, notably rice. They require a drier environment than either rice or wheat, however, and are therefore not suitable for the area where heavy investment is being made in increased production of rice, wheat and corn.

The average per capita consumption of millet and sorghum is estimated at 260 kilograms a year, in food and beer. At this rate it is calculated that the requirement for the country as a whole should increase by about 15,000 metric tons a year.

Millet and sorghum producing in 1969/1970 was officially estimated at some 651,000 tons, most of which was consumed by producers and the rest marketed. Output is believed to have exceeded this level in good rainfall years. In the drought year 1970/71, output fell to 610,000 tons and in 1971/72 to 600,000 tons. Supplies were inadequate for domestic needs and foreign aid agencies shipped in grain. Small quantities of wheat (about 6,000 tons) are produced in the Bol polder area of Lake Chad, most of which is exported illegally across the Lake into Nigeria, in view of the low purchase price in Chad compared with the high cost of overland transportation to N'Djamena.

The market for millet is fragmented and disorganized. The small merchants who dominate the trade give credit on unfavorable terms to farmers to purchase necessities during the year. At the time of harvest, farmers receive extremely low prices, from 50 francs CFA per kilo in good crop years to 30 francs CFA in bad. On the other hand the consumer price in N'Djamena ranges from CFAF 20 to CFAF 80 per kilo. As producing zones are relatively isolated by lack of transport and communication, there are wide disparities between grain prices in different regions.

The per capita GNP was estimated at US$80 in 1971, including non-monetary subsistence income which accounts for 35% of the total. Income is poorly distributed. It is hoped that the beneficiaries reached will be able to increase their annual income by storing the food until the market price is higher. The improvement in income levels of the beneficiaries directly involved will in turn have a positive effect on the economy of the entire village. Similarly, it is hoped that the example set will encourage other small farmers to construct silos.

The current average cereal yield for a field is 750 kilos per hectar. At a savings of 20% through the provision of better storage facilities, each hectar would, in effect, supply 150 kilos of additional grain. This additional grain will allow one person to receive a ration of cereals per year (150 kilos), amounting to 69% of the average energy supply of 2,170 calories per day for the entire year.

In short, every hectar now under cultivation could provide the basic dietary needs of an additional person.

At the end of the project when all 800 silos have been built, each unit with a capacity of 800 sacks, a total of up to 1,280,000 kilos of grain could be saved each year from destruction by insects, giving 8,533 people the ration outlined above. These calculations are based upon the assumption that the facilities are used to full capacity. In actual practice, the figures will be smaller.

III. Project Analysis

Millet and sorghum are grown mainly for subsistence and are produced throughout the Sahelian zone as well as in the south. The market for these crops is fragmented and disorganized, and prices vary widely throughout the year, with the farmer receiving low prices at harvest, and merchants benefitting from the scarcity of supplies during the dry season. The problem lies partly in the fact that producing zones are isolated by lack of transportation. There would be substantial benefits to producers and consumers from an effort to increase local storage capacity, raise average production prices and thereby reduce exorbitant trade margins and market prices.

While a majority of the population is engaged in small-scale subsistence production, there is no significant element of the population that does not participate directly or indirectly in cash transactions or trade of some kind. As mentioned earlier, the principal subsistence food crops are millet, sorghum and groundnuts. It is estimated that three-fourths of all crop production in Chad is for subsistence use.

Because of low yields, inadequate storage facilities, losses from insect infestation of stored crops, and the burden of taxes or usury, many farmers do not produce, or keep for their own consumption, an adequate surplus of grain to tide them over the last two or three months before the next harvest. In poor crop years, during this period of almost universal shortage known as the soudure, entire villages occasionally go hungry, and grain prices in the towns are often prohibitive for the poor. In most

of the south and central regions the soudure comes during the season of heaviest rains. In areas where the government has encouraged the production of commercial crops, as in the southern cotton belt, the shortage of food crops tends to be correspondingly more severe, and in some areas the villagers subsist on starchy cassava root for much of the year. Elsewhere the farmers simply refuse to market such crops as peanuts or wheat through the prescribed government channels, and they enter the subsistence economy instead. One of the major benefits of this project will be to increase the family village food supply by making it possible for farmers to store more grain. This should help ease the food shortage during the soudure.

The food price mechanism in Chad does not function well, so that food supplies are often diverted from those areas or population groups where they are most needed. Unscrupulous traders are a frequent problem. Transport facilities are inadequate, and areas of the country are cut off by floods for months at a time. Prescribed legal prices to the producer at the time of harvest are sometimes radically lower than the price exacted from urban or other consumers at times of seasonal shortage, and in general do not offer much incentive to the farmer to plant crops assigned priority by the agricultural authorities or to deliver prescribed quantities to the state trading agencies. Legal trade channels for foodstuffs consequently have a tendency to break down, but the illicit trade network appears well developed. No doubt the desire to evade taxes also plays a part in this phenomenon.

Many of these problems might be mitigated if food production, which generally stagnated during the 1960s, could be expanded more rapidly than the population growth. Chad is thought to have considerable potential for the development of crop production. Resources in arable land per capita should be adequate, and traditional tenure patterns do not appear to constitute a very serious obstacle to progress.

Techniques of cotton culture have caused some soil depletion in the south, and many fields nearest the villages had to be abandoned in favor of more distant plots. In the grazing areas of the north-central region, widespread destruction of bush and

pasture have caused the arid semi-desert to encroach yearly farther south, and years of drought have reduced the area suitable for grazing. Nevertheless, the country still has adequate areas of both arable and grazing land to permit a far higher level of production than has been attained thus far.

Because so little is known about the predominating subsistence economy, official statistics on production are largely guesswork. Acreage under wheat can be estimated with some degree of accuracy, but production of subsistence crops such as millet and cassava are generally extrapolated from estimates of population and average consumption requirements. Both Agriculture and Planning officials concur, however, that the expansion of acreage under cultivation of food grains and peanuts has been declining. While food production has stagnated, the country's population has been growing at an estimated rate of 1.4 percent a year.

The population of Chad is about 3.9 million. Densities and settlement patterns are determined primarily by the level of precipitation. The southernmost prefectures of Logone Occidental, Logone Oriental, Mayo-Kebbi, Moyen-Chari and Tandjile, and the adjacent areas of Chari-Baguirmi receive enough rainfall to encourage a lush savanna vegetation and a variety of agricultural crops. Approximately 2.1 million people, almost 45 percent of the population, live in this area of about 50,000 square miles (roughly 10 percent of the country). The population density is about 34 per square mile in these southern prefectures.

The Sahelian central zone of about 96,000 square miles includes Lac, northern Chari-Baguirmi, Guera, Salamat and Ouaddai prefectures, and adjacent areas of Batha and Biltine prefectures. About 2.3 million people live in this semi-arid zone, at an average density of 20 persons per square mile. Densities in this zone vary widely.

The sparsely settled northern deserts and the northern part of the semi-arid central zone — Borkou-Ennedi-Tibesti and Kanem prefectures and the majority of Batha and Biltine prefectures — cover some 350,000 square miles. This area has not been included in the demographic fieldwork so estimates are based upon projections. It is thought that 500,000 people live in this area,

most below the 16°N. Borkou-Ennedi-Tibesti Prefecture, with nearly half of Chad's land surface, contains fewer than 100,000 persons, or less than 2.5 percent of the total population.

It is very important to know that there are more than 9,000 villages in Chad, with an average of 260 people per village. Nearly two-thirds of the population live in villages of less than 200 people, and less than one-third live in villages ranging from 200 to 1,000 residents. Only 4 percent of the people in the southernmost prefectures and less than 1 percent of those in the central prefectures live in settlements of more than 1,000 people.

In the south, typical village locations are in or near flood plains of rivers, just above the level of the average annual flood. Many are surrounded or partially surrounded by stagnant swamps during the dry months. Two internal village arrangements are common: a loose grouping of huts on ground above the average level of floods; or a linear unit consisting of a single or double row of closely spaced huts along a road or stream. Some loosely grouped villages are built around at least three sides of a plaza or market area. In the moslem areas, some villages are built in a rough circle around a mosque. In other areas — for example, in Moyen-Chari Prefecture — some family compounds include several huts surrounded by a fence woven from reeds, and villages are simply clusters of such compounds. Linear villages sometimes adjoin others end-to-end, particularly in the more densely populated southern prefectures. In the semi-arid central prefectures, villages average less than half the size of those in the south.

The standard of living of the poor depends upon raising per capita real incomes, preferably at least partly in terms of disposable money income. Fundamentally, income growth which can benefit the masses must depend upon productivity increases in agriculture.

One method of improving the real income level is to help rural farmers protect the grain they grow from destruction by insects, thereby giving them more to eat and sell.

IV. Project Design and Implementation

The design and implementation components of this project have been selected considering the following factors:

1. The characteristics of the farmers to be served and the nature of their needs.
2. The resources available to these farmers.
3. The extent to which various infrastructures exist -- Agricultural Extension Agents, input supplies, transportation, etc.
4. Current food storage practices.
5. Kinds and degrees of crop losses -- insects, birds, rodents.
6. State of development of the area and level of construction skills at village level.

In reviewing the information gathered on the six points listed above, it has been concluded that agricultural extension services have been most successful in Chad when the extension workers have a clear picture of their objectives, priorities and daily tasks. In short, they have been successful when associated with well-managed integrated projects where the agents have specific tasks to perform.

In the past there has been a tendency on the part of the individual extension workers and the whole extension service system in Chad to concentrate on the bigger and more progressive farmers, who can expand production most quickly. These more affluent farmers do not always require the help of an extension agent to adopt an attractive new technology, accompanied by incentives and other favorable conditions.

Therefore, it is more to the point to focus extension efforts on the less affluent but progressive small farmers who really do need the help.

This project creates a management structure in which the Chadian extension agents can function efficiently, reaching the smaller farmers. It is a project which offers encouragement, direction and material assistance to small progressive farmers.

Implementation Schedule

August/September/October

Select beneficiaries for the coming year based upon selection criteria which is related to levels of crop production. The 800 farmers must be selected during this period when their crop is available for assessing. This work will be conducted by Chadian Agriculture Extension Agents and CARE personnel.

November through June

Construction of the 200 silos: purchase and transportation of all materials to the construction sites, organization of the work teams for the cement work and for the clay work, gathering of the correct clay soil, straw and binding chemical.

The overall silo dimensions are two meters circumference and 2.5 meters in height. The legs are sunk 80 centimeters into the ground and 40 centimeters above the ground. They are 20 centimeters wide and 20 centimeters deep. The base plate is 10 centimeters thick and contains reinforcement rods.

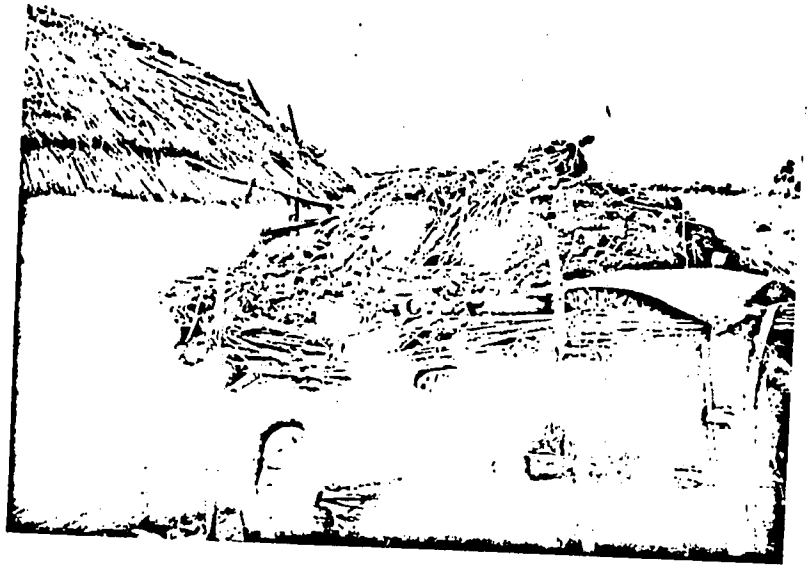
While the primary goal of this project is to increase the food supply by reducing losses from damage by insects, birds and rodents, the economics of food storage must be explored, particularly to determine whether the silos are relicable. The materials and labor that go into a silo cost US$350. Using 74/75 crop year prices the 8 tons of grain in September, 1974 would have sold for US$850. This same grain would have sold for US$1,440 if held until May, 1975. Because farmers tend to borrow money during the year which must be paid back by turning over a percentage of the crop at depressed prices, it is unlikely that the farmers will be able to take full advantage of the economics involved in storing grain for the full period of 7 or 8 months. In short, the project is economically viable, particularly if the silos are used correctly.

Logical Framework Matrix

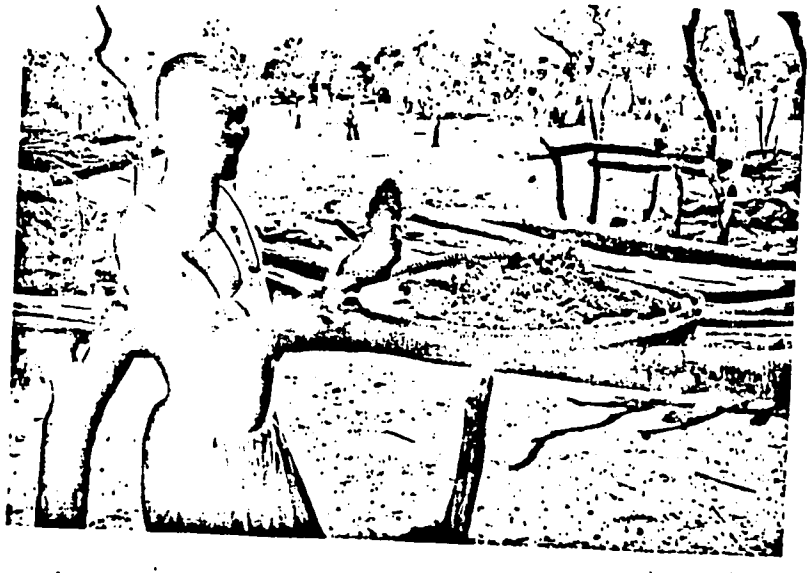
Summary	Objectively Verifiable Indicators	Important Assumptions
A.1. GOAL - Increase food supply - Increase rural farmer income	A.2. - There will be an increase in the available food supply in those areas where the project is located. - There will be an increase in income to those farmers participating in the project	A.3. - The Chadian Government policy will continue to be directed toward these goals
B.1. PURPOSE - Establish a relicable system of food storage facilities at the village level	B.2. - Farmers have understood the need for better storage facilities and show willingness to build them on their own. - The GOC has understood the value of improved village-level food storage	B.3. - An integrated replicable low-cost technological package can be adapted to increase food supply and increase income of rural farmers.
C.1. OUTPUTS - The number of silos built - The number of farmers participating in the project	C.2. - 800 silos, each with a capacity for 80 sacks of 100 kilos each - 3,200 farmers	C.3. - Fuel and materials will be available as required. - Agreed upon working arrangements with the GOC are not altered. - Farmer interest at high level can be maintained.
D.1. INPUTS - USAID - Materials and Equipment as well as Personnel and Operations and PL 480 (if available) - CARE - Personnel and Operations, and general support, as well as privately donated food commodities - GOC - Personnel, vehicles, support	D.2. - See Section V.	D.3. - PL 480 Support can be integrated into this project

2000

Current Practices, Construction Methods and Related Problems

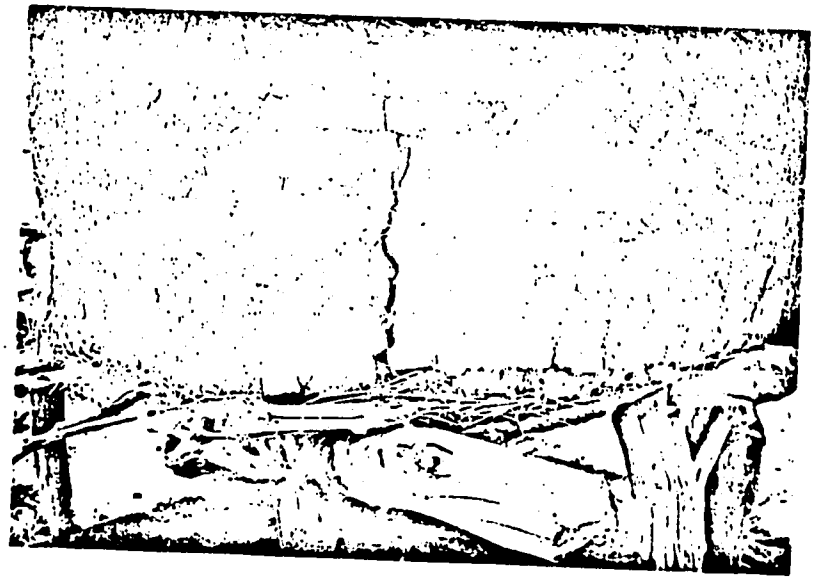


Most grain in Chad is not stored in silos. It is stored in the open air in easy reach of insects, birds and rodents. The sorghum in this picture was harvested in September, 1974, and the picture was taken in July, 1975. Upon inspection, about 30% of the grain had been eaten. It is interesting to note that the rains had already begun and mold was found inside the stack.



Sorghum is stored in Chad unthrashed until it is ready to be eaten.

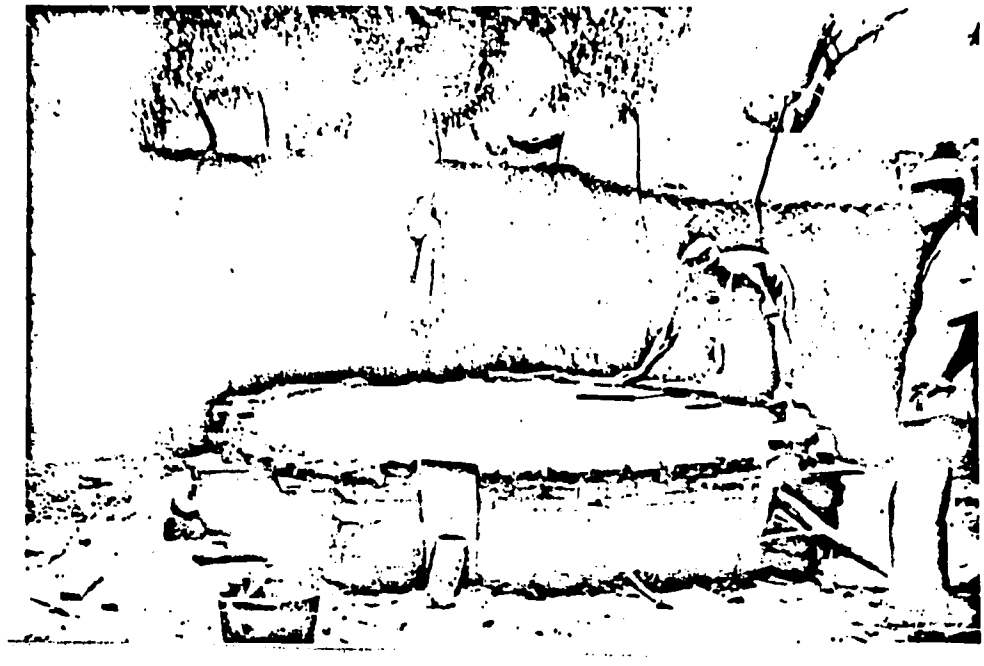
Sorghum heads are neatly stacked inside the silo.



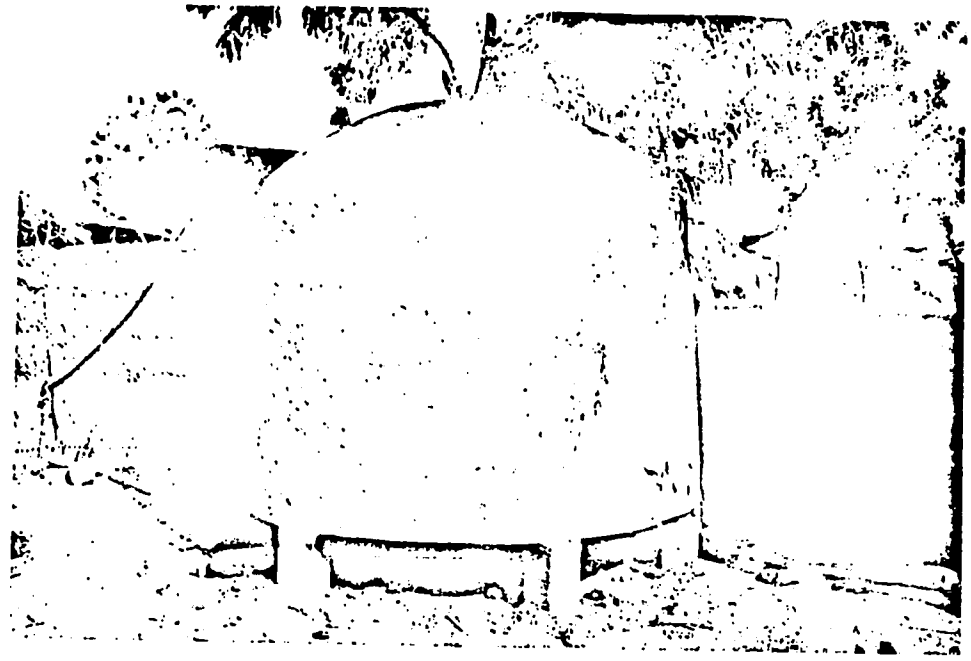
Silos built without the reinforced concrete base are not very durable because termites eat out the base and the silo cracks. The footing to the far left is eaten out by termites and the termite nests can be seen on the center footings and cross bar (log). In short, it is necessary to build a stronger base, of concrete, in order for the silo to last more than a year to 18 months.

Proposed Improved Construction Methods

The primary improvement to the existing method of construction is the cement footings and platform. Reinforcement rods are used.

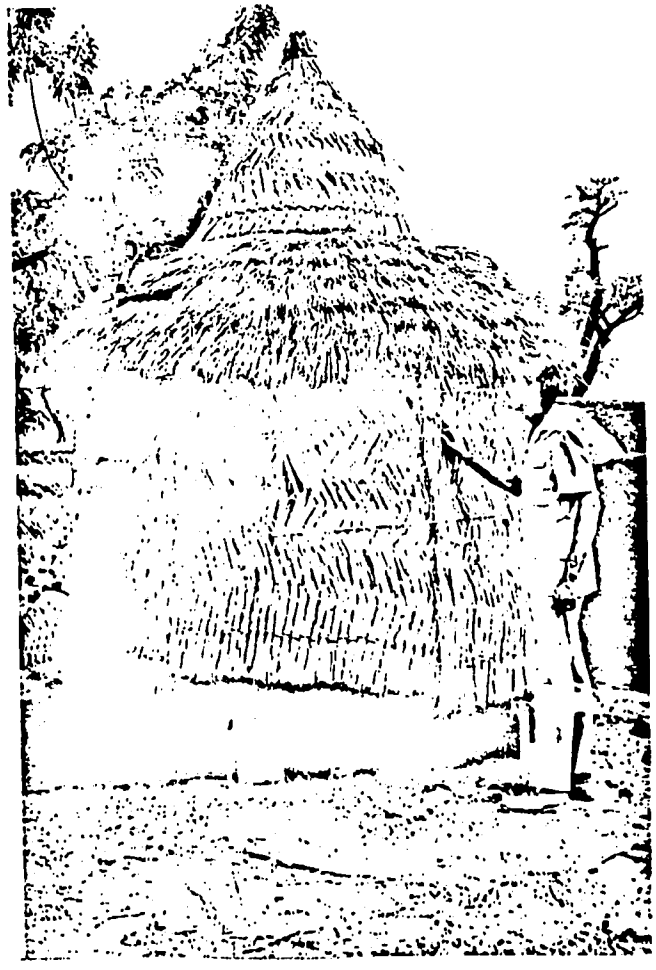


Mud and clay are mixed and formed into rounded strips which are moulded into place.



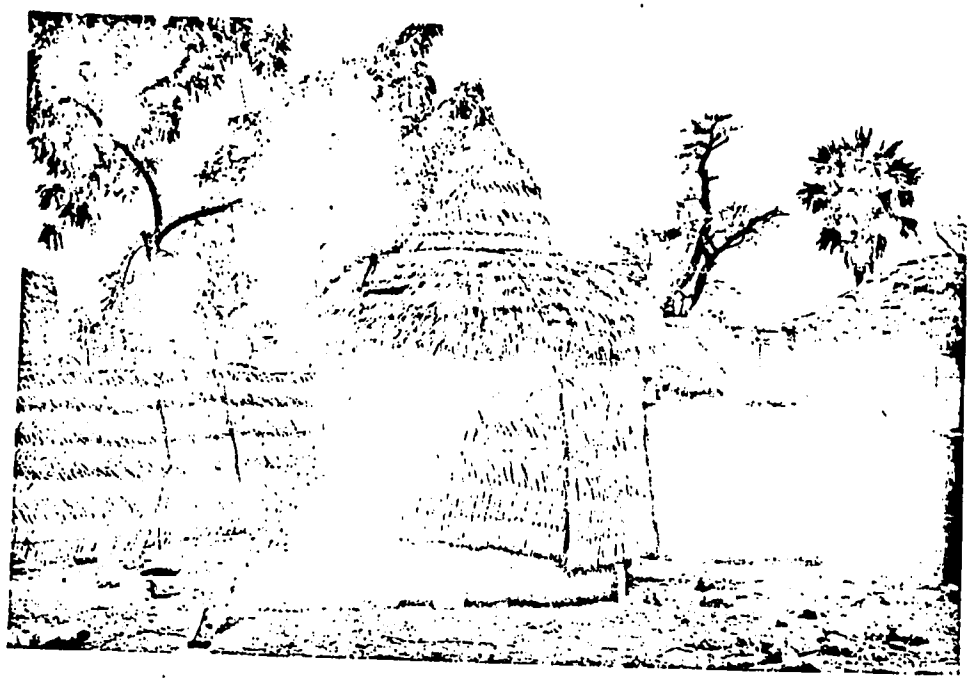
Silo is completed and plastered to height of 2 meters.

Lip is moulded at the top. Note that one can walk on top of the silo when it is dry.



Upper picture is of termites which eat the grain.

The picture on the left is of the skirt, roof and hat made wit treated straw (agains termites). This stra covering protects the silo from rain damage



Completed silo with 8 M.T. capacity. (The tree is the typical Chadian ladder).

V. Financial Plan

1. Personnel Costs: (See Annexes I, II and III for breakdowns)

a. US Technicians

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	$ 9,596	$ 9,660	0	$19,256
1977	10,557	10,626	0	21,183
1978	11,611	11,688	0	23,299
1979	12,777	12,857	0	25,634
Totals	$44,541	$44,831	0	$89,372

b. Third Country Personnel

None.

c. Local Personnel

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	$13,719	$ 2,532	$ 2,100	$18,351
1977	15,091	2,785	2,310	20,186
1978	16,600	3,064	2,541	22,205
1979	18,260	3,368	2,795	24,423
Totals	$63,670	$11,749	$ 9,746	$85,165

2. Training Costs:

None per se.

3. Commodity Costs:

a. US Procured

None

b. Third Country Procured

None.

c. Locally Procured

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	$ 38,750	0	0	$ 38,750
1977	42,625	0	0	42,625
1978	46,817	0	0	46,817
1979	51,607	0	0	51,607
Totals	$179,799	0	0	$179,799

4. Other Costs: (See Annexes I, II and III for breakdowns)

a. Cost of office, stationery, printed forms, duplicating facilities, utilities, equipment, etc. (includes Headquarters' Administration)

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	$ 6,999	$ 2,200	$ 700	$ 9,899
1977	7,699	2,420	770	10,889
1978	8,462	2,662	847	11,971
1979	9,318	2,928	932	13,178
Totals	$32,478	$10,210	$ 3,249	$45,937

b. Fuel

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	$ 5,250	0	$ 800	$ 6,050
1977	5,776	0	880	6,656
1978	6,400	0	968	7,368
1979	7,000	0	1,065	8,065
Totals	$24,426	0	$3,713	$28,139

c. Transportation Costs (including vehicle purchases)

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	0	$2,000	$ 979	$ 2,979
1977	0	2,200	1,077	3,277
1978	0	2,420	1,285	3,705
1979	0	2,662	1,414	4,076
Totals	0	$9,282	$4,755	$14,037

d. Other Spport Costs (Specialized Labor)

Fiscal Year	USAID Funded	CARE GENERATED North American CARE Donors	GOC Funded	Total
1976	$ 26,000	0	$ 1,050	$ 27,050
1977	28,600	0	1,155	29,755
1978	31,400	0	1,271	32,671
1979	35,086	0	1,398	36,484
Totals	$121,086	0	$ 4,874	$125,960
GRAND TOTAL for Items 1 to 4	$466,000	$76,072	$26,337	$568,409

Cost Benefit Ratios

a) Total Cost of Project from all Funding Sources:
$568,409

b) Inputs and Percentages of Inputs
USAID - $466,000 - 82%
CARE - 76,072 - 13%
GOC - 26,337 - 5%

c) Cost per Kilo
800 silos with a capacity of 6,400 M.T.
Total Cost $568,409
Cost per Silo $710

d) Cost Per Direct Beneficiary
3,200 farmers — Cost Per Farmer $177
16,000 dependents
19,200 — Cost Per Beneficiary $30

VI. Conditions

1. The project has been endorsed by the Chadian Government through its Ministry of Territorial Management and the Environment. A photocopy of this letter of endorsement is attached as Annex IV. The English translation of this letter is as follows:

"Ministry of Territorial Management

No. 109/M.ATHE/CAB July 24, 1975

Mr. Peter Reitz
Director CARE-Chad,
N'Djamena.

In the fight against the drought, the project for the construction of silos at the family level presents a definite interest to the Government of Chad. The realisation of this project would permit the rural population to save a portion of their crop for family consumption during the hungry season.

We would like CARE-Chad to continue to look for a donor to finance this project. In the event that you find the necessary funds the Ministry of Territorial Management agrees to assign a person to work with you in selecting the villagers who will participate in the project.

Battalion Chief Roasngar M'Baindoloumal
(Minister of Territorial Management and the Environment)"

2. CARE's input is guaranteed.