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Improvement of Postharvest Grain Systems

Grain Storage, Processing and Marketing
Report No. 92
October 1983

ASSESSMENT OF EQUIPMENT, TRAINING AND INFRASTRUCTURE NEEDS FOR GRAIN STORAGE IN CAPE VERDE AND AN INITIAL ENVIRONMENTAL EXAMINATION

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REPORT SUMMARY

Title of Report/Publication: Assessment of Equipment, Training and Infrastructure Needs for Grain Storage in Cape Verde and an Initial Environmental Examination

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Period of Report/Publication: October 1983

Project Title: Improvement of Postharvest Grain Systems

Contract Number: AID/DSAN-CA-0256

Contractor: Food and Feed Grain Institute, Kansas State University, Manhattan, Kansas

SUMMARY STATEMENT

Kansas State University was requested to prepare a delayed Initial Environmental Examination (IEE) in conjunction with the PL 480, Title II, Section 206, Cape Verde Food For Development Project and to assess the equipment, training, and infrastructure needs for grain storage in Cape Verde.

EMPA, the organization responsible for storage of PL 480 commodities, has about 45,625 MT of covered storage capacity located throughout the islands. Of this amount, 53 percent is warehouse storage and 31 percent bulk silo storage suitable for safe storage of food grains. The other 16 percent is warehouse storage that could require significant improvement.

The five-member Cabinete Technico of EMPA has been trained by GTZ in grain warehousing and pest control. GTZ also conducted training in all of the islands for warehousemen in 1981. GTZ has also scheduled a practical type training for late November 1983. In this respect, no KSU training in Cape Verde is recommended immediately.

GTZ has also provided pesticides, application equipment, and safety equipment in the past. The pesticides supplied and recommended are not, in all cases, commensurate with USEPA registration. Fenitrothion, for example, is not registered by USEPA for direct application to grain or for use in grain storage facilities but is supplied and recommended by GTZ. FAO/WHO has, however, established a 10 ppm tolerance for fenitrothion on cereal grains and it is used in other countries. This issue should be resolved by GOCV (EMPA), USAID, and GTZ.

A new bulk storage silo (10,000 MT capacity) at Praia will be used for the first time in November 1983. The addition of this facility improves the safe storage capability of EMPA, however this constitutes a new method of storage at Praia and should be monitored carefully.

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Prepared by

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for the

AGENCY FOR INTERNATIONAL DEVELOPMENT
UNITED STATES DEPARTMENT OF STATE

AID/DSAN-CA-0256
Improvement of Postharvest Grain Systems

at the

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I. INTRODUCTION

A. Purpose

Kansas State University was requested through AID/Washington to prepare a delayed Initial Environmental Examination (IEE) in conjunction with the PL 480, Title II, Section 206 Cape Verde Food For Development Project and to assess the equipment, training and infrastructure needs for grain storage in Cape Verde.

B. Scope of Work

The stated scope of work was to include, but not be limited to:

1. Assessment of Empresa Publica de Abastecimento do Cape Verde (EMPA) personnel qualifications and requirements for training.
2. Determination of needs for ancillary application and safety equipment in the use of pesticides.
3. Comparison of specifications for all pesticides now in use by EMPA with United States Environmental Protection Agency (USEPA) specifications.
4. Assessment of other donor technical assistance related to grain storage.
5. Determination of the adequacy of the existing storage infrastructure.
6. Preparation of an IEE, including the risk/benefit analysis and recommendations for additional actions as appropriate.

C. Duration of TDY

Travel was requested as soon as possible for a two-week visit (maximum) by a Kansas State University representative. The visit was accomplished during the period October 2 through 12, 1983, and coincided with that of a PL 480 Food For Development (Title II, Section 206) evaluation team.

II. BACKGROUND

A. Situation

The Cape Verde Food For Development Program (PL 480, Title II, Section 206) prepared by AID/AFR/DR October 10, 1981 (revised April 10, 1982) represents a significant conceptual change. Rather than seeking justification for chronic or annual emergency food requirements, this proposal acknowledges Cape Verde's structural deficit in food production.

The program authorizes the use of revenues from the sale of food commodities for multi-year planning of selected agricultural and rural development activities to improve the production, protection and utilization of food resources. A small portion of the revenues, decreasing over time, are to be used to increase the effectiveness of food distribution and its availability.

B. Geography and Climate of Cape Verde

Topography. The Cape Verde Islands are a group of nine islands (and several islets) located in the Atlantic Ocean about 360 miles (600 km) west of mainland Africa between 15 and 16 degrees north latitude. The archipelago is of volcanic origin and includes one island (Fogo) with an active volcano. Collectively, the rocky barren islands include 4,000 sq km of land area spread over a square section of ocean roughly 240 km on a side. The islands are traditionally divided into two groups: the northern Ilhas de Banlavento (windward islands: Santo Antão, São Vicente, São Nicolau, Sal and Boa Vista), and the southern Ilhas de Sotavento (leeward islands: Brava, Fogo, Santiago and Maio). See Figure 1.

Rainfall. Cape Verde has an arid climate and is located at the western edge of the large arid, semi-arid belt which crosses North Africa. Both the regularity and amount of rainfall at particular locations on the islands depend strongly on elevation. Rainfall variability is relatively high everywhere

CAPE VERDE ISLANDS

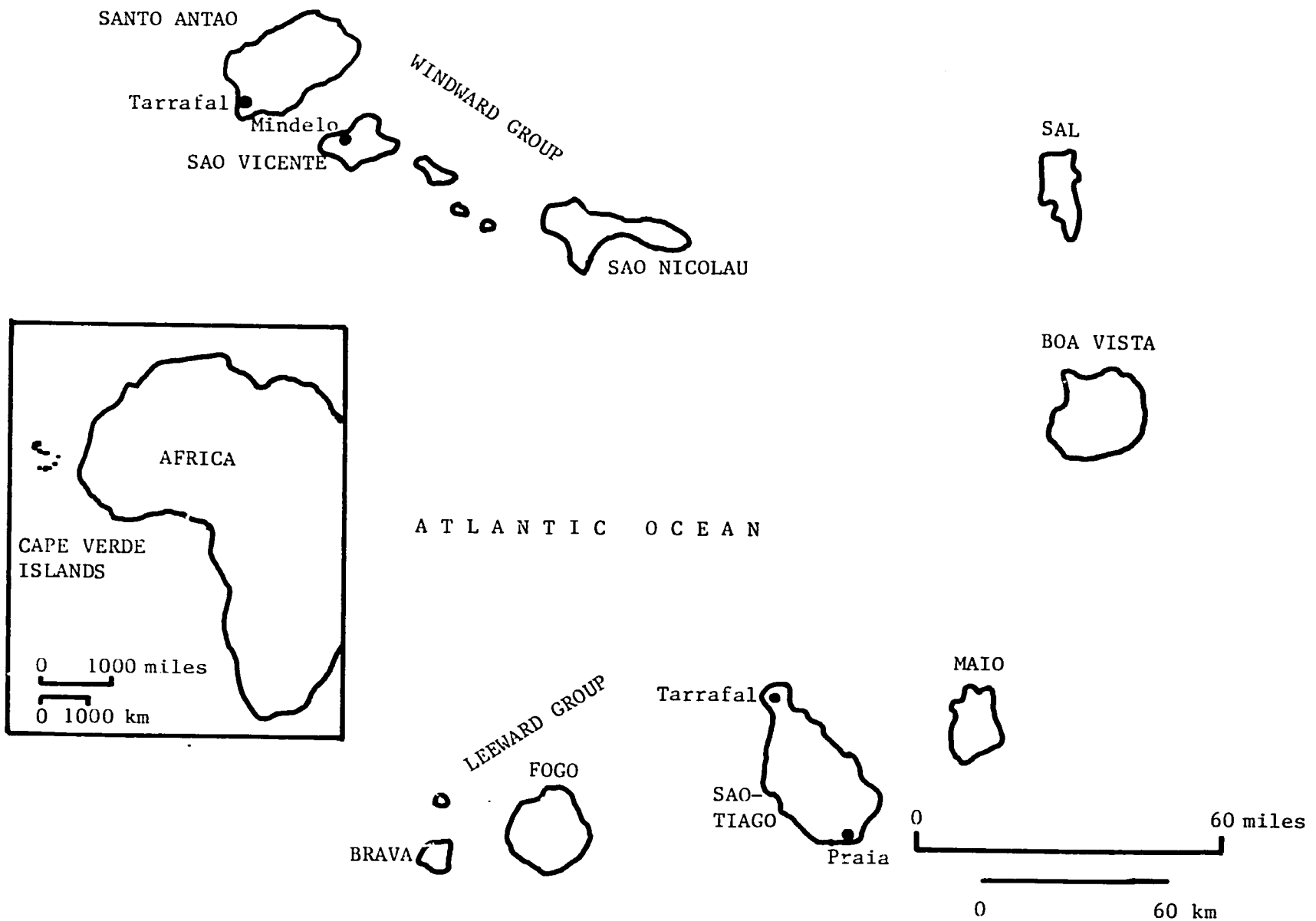

FIGURE 1

(35 to 60 percent), with the greatest variability in the lowest most arid regions. There are no permanent lakes or streams on the islands.

Most rain falls from July to October, when South Atlantic monsoon winds bring rainstorms from the west or southwest. During this period, half the year's rain may occur in a single erratic torrential storm. During the remainder of the year the islands are exposed to the generally drying effects of the northern tradewinds and the occasional hot and dry Harmattan winds from the east. The northeast tradewinds are humid, however, and condense to form mists from 400 to 1300 m on the more mountainous islands.

Temperatures. Temperatures are moderate throughout the islands and, like the rains, influenced by elevation. At Praia (elevation 27 m), monthly mean temperatures range from 22°C in February to 27°C in September (see Figure 2). Temperatures at higher elevations are cooler by 5.5°C per 1000 m and less variable. At intermediate elevations the annual range in monthly means is 3°C. Temperatures throughout the islands rarely exceed 30°C or fall below 13°C. The average maximum is 24.6° and the minimum 16°C.

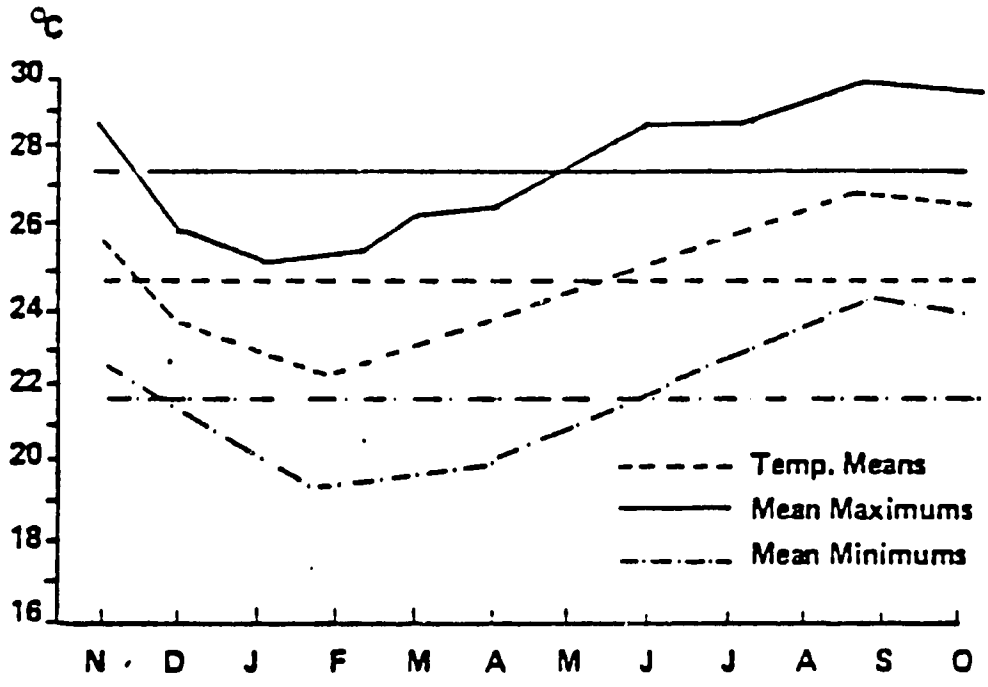

Figure 2. Mean monthly temperatures, Praia

TABLE 1

RELATIVE HUMIDITY (PERCENT), PRAIA, 1951-1960

Month	10:00 am	2:00 am[1]	10:00 pm
January	61.2	60.9	72.0
February	56.1	56.4	69.5
March	53.3	53.3	67.1
April	56.2	56.2	70.4
May	57.5	58.5	71.7
June	59.6	58.7	72.9
July	67.1	67.3	77.4
August	68.7	68.9	78.7
September	70.7	71.0	81.2
October	68.2	68.6	80.3
November	63.8	64.0	75.0
December	63.1	62.6	73.1

[1]Original document said 2 am but should probably read 2 pm.

Source: Freeman, 1978.

Winds and Humidity. Strong winds and high humidity are climatic constants on all of the islands. At Praia, north or northwest winds blow 78 percent of the time with calms only 7 percent of the time. On Santiago Island humidity is constantly high. In ten years of observation at Praia, relative humidity rarely fell below 55 percent (see Table 1).

C. Demand for Cereal Grains and Legumes

The Government of Cape Verde (GOCV) estimated a total demand for cereal grains and legumes at 73,000 MT for 1982. It seems reasonable to assume that the requirements for 1983 and subsequent years may be slightly higher based on expected population increases.

Cereal Grains. Referring to data supplied to FAO by EMPA and based on EMPA's 1981 food distribution data and on FAO's calculations based on World Food Programme (WFP) standards, it appears that 65,000 to 66,000 MT of cereal grains (corn, rice and wheat) are required to feed the Cape Verdian population, estimated in 1980 at approximately 300,000. Tables 2 and 3 reflect the GOCV and FAO estimates, respectively. Even though the GOCV and FAO do not agree on the annual requirements for rice or wheat, the requirement for corn and the total of all grains required do agree closely.

TABLE 2

CAPE VERDE FOOD REQUIREMENTS[1]

Corn	45,000 MT	=	150 kg/capita[2]
Wheat	12,000 MT	=	40 kg/capita
Rice	8,000 MT	=	27 kg/capita
Total	65,000 MT[3]	=	216.6 kg/capita

[1]Based on EMPA's 1981 food distribution data.

[2]Based on estimated 300,000 population.

[3]8,000 MT beans not included.

Peas and/or Beans. The government's 1982 estimates for food include 8,000 MT of beans in addition to that indicated in Table 2. This estimate is very cl~ ` to that estimated by FAO and shown in Table 3.

TABLE 3

FAO ESTIMATED CAPE VERDE FOOD REQUIREMENTS FOR 1982

Food	Urban and Semi-Urban Population (=110,000)		Rural Population (=190,000)		Total
	Requirements				
	kg/Capita	MT/Year	kg/Capita	MT/Year	MT/Year
Corn	73.0	8,030.0	155.125	29,473	37,503.75 (45,004.5)[1]
Rice	54.75	6,022.5	-	-	6,022.5
Wheat (Flour)	54.75	6,022.5	27.375	5,201.25	11,223.75 (14,965.0)[2]
Total (Cereals)	182.5	20,075.0	182.5	34,675.0	54,750.0 (65,992.0)[3]
Peas/Beans	16.425	1,806.75	32.85	6,241.5	8,048.25

[1]20% added for diversion to animal feed from cachupa.

[2]Wheat grain equivalent.

[3]Total adjusted for [1] and [2].

D. Production of Cereal Grains and Legumes

Since 1969, drought periods in Cape Verde have severely affected the country's agricultural productivity. The effects of the drought have led to a situation of chronic food deficit. The Cape Verde Food For Development Program proposal indicated that Cape Verde would always experience a deficit in cereal grain production. It indicated that domestic needs for corn were in the range of 48,000 MT and that production at maximum would only supply 20 percent of the current needs. During the dry crop year of 1981-82 production amounted to only 3,000 MT or approximately 6.7 percent of the current requirement.

Only 500 MT of the projected need of 8,000 MT or 6.3 percent of beans required were produced in 1981-82.

E. Imports and Food Aid

It is obvious that Cape Verde will, of necessity, continue to import cereal grains to satisfy the food needs of the population whether through purchases or donations in the form of food aid. Figure 3 (adapted from Annex 3 of the Cape Verde Food For Development Program proposal) indicates the relationship between the estimated needs, national production, donations and imports for corn and beans for the years 1977 through 1982. On the average between 25,000 and 40,000 MT of corn have been imported during this six-year period.

SUPPLY DATA FOR CORN AND BEANS: NEEDS, PRODUCTION, DONATIONS AND IMPORTS
1977-1981

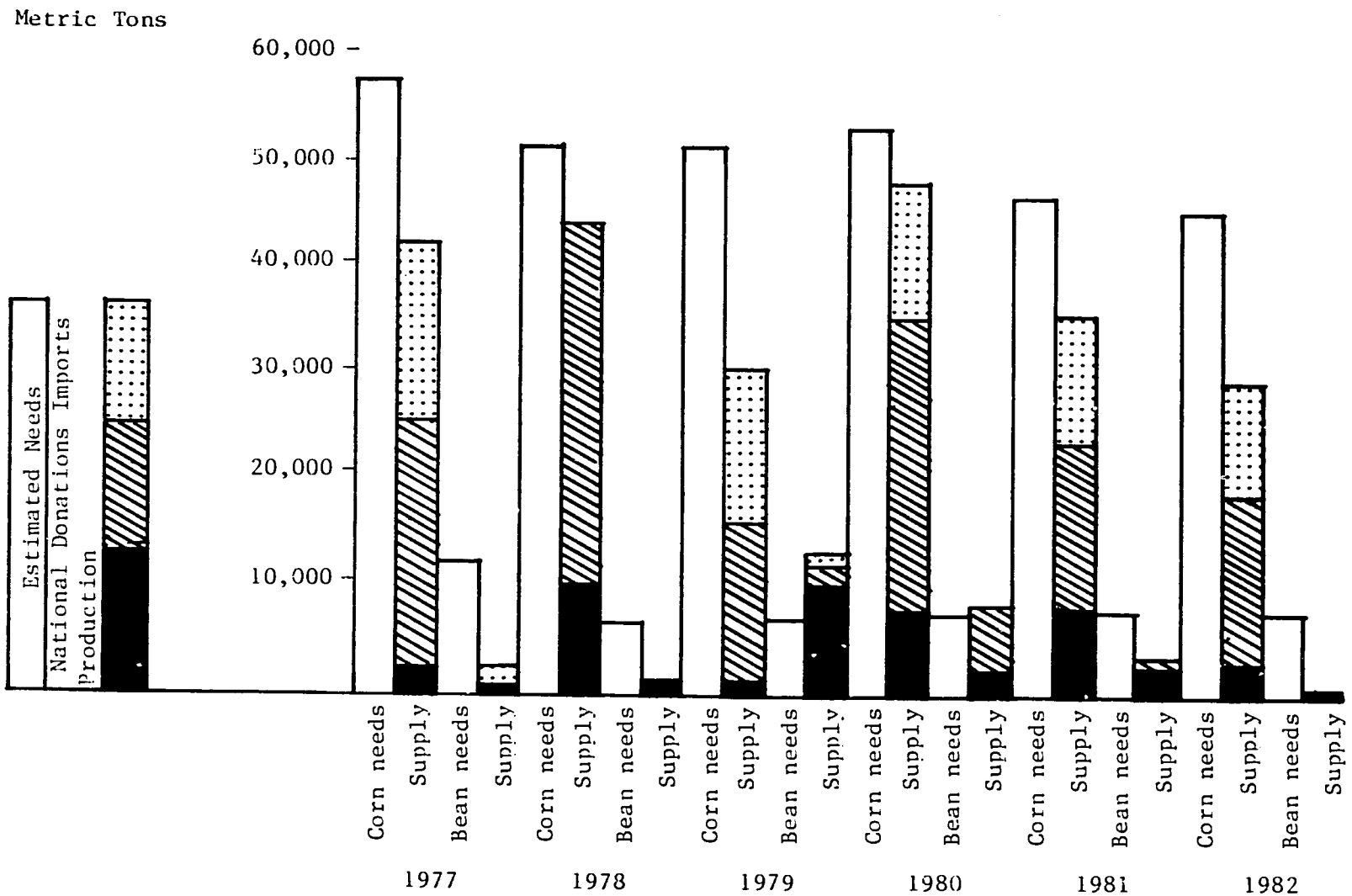

FIGURE 3

III. GRAIN STORAGE IN CAPE VERDE

A. Empresa Publica de Abastecimento (EMPA)

EMPA is the GOCV organization charged with the responsibility of importation, storage, wholesaling and some retailing of staple food commodities. Of these food commodities, corn comprises the greatest volume.

In addition to the above-stated functions, EMPA is also involved in recommending wholesale and retail prices for commodities through the Minister of Commerce. Prices are ultimately determined by a Council of Ministers. Four types of corn (listed below) are commonly found in the market.

Type	Price/kg (1980)	Source
Domestic	13-23 Escudo	Local production
No. 1	9.5	Argentina (purchase)
No. 2	6.5	U.S. PL 480 (grant)
No. 3	3.4	European (grant)

It should be noted that the price for No. 1 corn is approximately equal to the world price and that No. 3 corn is used primarily for animal feed.

B. EMPA Storage Capacity

As of 27 July 1983, EMPA's warehouse type and silo locations and capacities were reported as in Table 4. With the completion of the 10,000-MT silo in Praia scheduled for October 1983, EMPA should have enough covered storage for virtually the country's annual requirements for corn. Whether or not the location of warehouses is commensurate with the amounts of commodities to be distributed was not determined as a part of this investigation.

C. Types and Condition of Storage Facilities

Because of the relatively short duration of the visit to Cape Verde it was not possible to visit all of the individual warehouses nor each of the

various types. Observations on construction and conditions of type A, type B - B, an old warehouse and the new port silo at Praia were made and are briefly described.

1. Warehouse Facilities for Bag Storage

a. Type A Warehouse. Two type A warehouses were examined at Vila Tarrafal on Santiago Island. In general the warehouses were of sound construction. Walls and floors were smooth on the interior and the roofs were sound. Windows along the wall-roof juncture were unbroken and closed. Ventilators near the floor level were covered with fine mesh screen which in most cases was rusted and broken out. This can be remedied by using heavier gauge screen with openings about 1/4 inch. This type warehouse was also noted at Pedra Badejo but the two units there were not inspected. Each of the type A warehouses has an estimated storage capacity of 250 MT. This type warehouse can provide adequate storage for protection of food grain commodities. This general type warehouse is reported on Boa Vista, Maio, Sal, Brava and São Nicolau Islands but they were not observed.

b. Type B Warehouse. No type B warehouses were observed during this visit. They are said to have a capacity of 800 MT each.

c. Type B + B Warehouse. Four of this type warehouse exist at Praia (Santiago Island) and are said to have a storage capacity of 2,500 MT each. Two of this type warehouse were examined and found to have smooth walls and relatively smooth concrete floors. A few windows along the wall-roof juncture were broken but most were intact and closed. Ventilators near the floor level were protected by heavy mesh screen (1/4 inch square openings) and removable ventilator covers. The doors, two at each end of the warehouse, in most cases had openings at the center bottom which could admit small rodents. This type warehouse can provide adequate storage protection for food grain commodities.

TABLE 4

EMPRESA PUBLICA DE ABASTECIMENTO (EMPA) STORAGE CAPACITY AND LOCATION

Location	Standard Warehouses			Assorted Other Whses (MT)	Open Storage (MT)	Port Silos (MT)	Total Covered Storage (MT)	All Storage (MT)
	No.	Type	Capacity (MT)					
SANTIAGO								
Praia								
A. Grande	4	B + B	10,000	2,020	6,000		12,020	18,020
Z. Cais Velho				1,000	2,000	10,000	11,000	13,000
Sta. Catarina								
Assomada				2,400			2,400	2,400
Sta. Cruz								
Pedra Badejo	2	A	500	125			625	625
Tarrafal								
Vila Tarrafal	2	A	500	400			900	900
Calheta				500			500	500
BOA VISTA								
Sal Rei	1	A	250	100			350	350
MAIO								
Porto Ingles	1	A	250	150			400	400
SAL								
Palmeira	2	A	500		150		500	650
Espargos				250			250	
FOGO								
S. Filipe	2	B	1,600		380		1,600	1,980
Mostieros				100			100	100
BRAVA								
Nova Sintra	1	A	250	80	220		330	550
Subtotal			13,850	7,125	8,750	10,000	30,975	39,475

TABLE 4 (continued)

Location	Standard Warehouses			Assorted Other Whses (MT)	Open Storage (MT)	Port Silos (MT)	Total Covered Storage (MT)	All Storage (MT)
	No.	Type	Capacity (MT)					
SAO VICENTE								
Mindelo								
Italcabe		New	4,300				4,300	4,300
CC-2		Compartmented	1,000				1,000	1,000
CC-2					ca 3,500			3,500
Alfandega			400		1,000		400	1,400
Z. Cais						4,200	4,200	4,200
SANTO ANTAO								
P. Novo	1	New	3,000				3,000	3,000
Paul			300				300	300
P. Sol				300	250		300	550
Janela				100			100	100
SAO NICOLAU								
V. Ribiera Brava	1	A	250				250	250
Tarrafal	1	B	800		400		800	1,200
Subtotal			10,050	400	5,150	4,200	14,650	19,800
Grand Total			23,900	7,525	13,900	14,200	45,625	59,275

Source: Adapted from letter, Secretaria de Estado da Cooperagão e Planeamento, Praia, 27 July 1983.

Type A, B, B + B and newly-constructed warehouses at Mindelo (São Vicente) and P. Novo (Santo Antão) account for approximately 52.4 percent of EMPA's reported covered storage capacity.

d. Assorted Other Warehouses. Warehouses in this category were generally referred to by EMPA technical personnel as older warehouses. One warehouse in this category was examined at Calheta (Santiago). This warehouse was reported as having 500 MT storage capacity. The structure had one doorway which entered a central section which was used for sacked corn storage with additional sections at each end of the central area. One section was used for storage of vegetable oils, rice and other food items. The other section was very disorganized and didn't appear to be used for food commodity storage. The entry door did not fit tightly enough to exclude small rodents and was below ground level. Round openings along the upper part of the wall for ventilator had bars on them but were not protected to exclude birds or rain. The condition of this warehouse would not generally be considered adequate for proper protection of food grain commodities. Facilities in this category comprise about 16.5 percent of EMPA's reported covered storage capacity.

e. Open Storage. Hard surfaced areas are generally considered to be included in this category of storage. Storage of this type should only be considered for emergency use since no protection from pests or climatic conditions is provided. EMPA reported open storage space for 13,900 MT and in all cases this type space was at locations where covered storage was also available.

2. Port and Other Silos

a. Praia Port Silo. The new port silo at Praia is scheduled for completion in late October 1983. The total cost of the project is reported to be $3,050,250 under an FAO project with services of experts and consultants, contract for construction, provision of non-consumable equipment and training provided by the Netherlands.

The storage capacity is stated as 10,000 MT (bulk) with a receiving capacity of 120 MT per hour and discharge capacity of 60 MT per hour. Two sack filling scales are rated at 9 MT per hour each.

Aluminum phosphide fumigant applicators are provided on each of the silo filling conveyors and each silo is equipped with thermocouple cables to read grain temperatures in storage. Each silo can be ventilated by pulling air up through the grain from four ventilators in the hopper bottom and exhausted from one of two fan systems located on the bin top level.

A shipment of 6,500 MT of U.S. PL 480 corn is to be discharged in bulk at the Praia port silo in November.

b. Mindelo Port Silo. Time did not permit a visit to the silo located at Mindelo, Sao Vicente. It is said to be similar in construction to that being completed in Praia but of lesser capacity (4,200 MT). A shipment of 3,500 MT of PL 480 corn is to be discharged bulk at the Mindelo silo in November. This will be the first U.S. corn delivered in bulk to Cape Verde under the PL 480 Food For Development Program.

c. Moave Flour Mill Silo (Mindelo). Moave is a flour milling parastatal with a reported 2,000 MT bulk storage capacity. This facility was not visited.

d. Seed Storage Silos. The government received the components for constructing metal silos at S. Filipe, Fogo, in late 1981. These silos were to serve as storage of corn and bean seed in order to help farmers who do not have enough seed to sow their fields when the rains start. The Ministry of Rural Development (MDR) intends to subsequently build silos on every island for this purpose.

D. Storage Practices

1. EMPA Warehouses

a. Standard Warehouses. Visits were made to warehouses classified in Table 3 as "standard" warehouses in Tarrafal and Praia, Santiago. In general, bagged corn and other sacked commodities were neatly stored on pallets off the floor and away from the walls. In most instances, there was only minor spillage of grain in the stacks of bags and on the floors. This is consistent with observations reported by the AID Project Assistant on a visit to the new warehouse in Porto Novo, Santo Antão in August 1983.

There was an exception to the general cleanliness of the warehouses in one of the B + B units at A. Grande, Praia. A resacking operation appeared to be taking place and even though the warehouse was nearly empty many open sacks of corn and piles of corn were noted throughout the warehouse.

b. Assorted Other Warehouses. The only warehouse of this category was visited at Calheta, Santiago. Storage conditions at this warehouse were much more congested. While some of the sacked grains were neatly stored on pallets away from the walls there was one stack of bags which had fallen against the wall and some bags were stacked directly on the floor and against the wall. There was considerably more spillage of grain in the stacks and on the floor of this warehouse when compared to the standard warehouses. This was, in part, due to rodent-damaged sacks of corn.

2. EMPA Silos

The new silo at Praia is just being completed and will be tested on October 20 in preparation for receipt of the first bulk shipment in November. Grain will be off-loaded from the ship at the harbor quay using two clam-shell units each with 2 m^3 capacity. Grain will be placed in trucks and delivered to the silo receiving hopper (approximately 300-400 yard from the ship).

Grain will be elevated at the rate of 120 MT per hour and can be treated with aluminum phosphide pellets at the time of unloading or by turning the grain if it is determined that fumigation is necessary during storage. Grain can be turned at the rate of 60 MT per hour.

Each of the 15 silo units (670 MT capacity each) is equipped with a thermocouple cable which can be monitored in the central control room on a Foss Mini Scan unit. It is recommended that temperatures of grain in the silos be monitored weekly. Any increases in temperature in localized or isolated parts of the grain should be a signal that a problem exists and that steps should be taken immediately to determine the cause of the temperature increases, i.e., insects or molds developing in the grain.

Two sacking scales are provided for disposition of grain in sacks to warehouses. Each scale has a capacity of 9 MT per hour. A warehouse is provided as a part of the silo structure to facilitate accumulating truck load quantities of bagged grains.

The operation and storage practices of the silo at Mindelo are not known. Although no U.S. corn has previously been received at Mindelo in bulk, Argentine corn has been reported received in bulk.

IV. PESTS, CONTROL PRACTICES AND PESTICIDES

A. Pests

1. Insects. Of the warehouses visited during the time in Cape Verde the most serious pest was *Ephestia* and related moth species in all warehouses. Large numbers of adult moths were seen on the warehouse walls and on sacks of grain in storage stacks in Praia and Tarrafal.

In one of the B + B warehouses located at A. Grande, Praia, a large stack of corn from France was under fumigation with aluminum phosphide. Adjacent to this stack were several open sacks of the same corn with the grain heavily webbed by moth larvae. During a return visit a few days later, the fumigated corn had been uncovered and was subject to reinfestation from the infested sacks which remained in their same position.

In the small warehouse at Calheta, the moth infestation was lighter but there was an indication that the AID corn had been infested with *Sitophilus* spp. The corn probably had been fumigated since no live *Sitophilus* weevils were noted on the bags. A list of insect pests reported in various stored commodities was prepared in 1978 by the Direction de la Production et Protection des Végétaux. The list indicated the source of infestation, the degree of infestation and the insect species involved. The list is attached as Annex I of this report.

2. Rodents. No gross evidence of rodent activity was noted in the standard warehouses at Tarrafal or Praia. At the small warehouse in Calheta rodent-chewed bags were noted at a few locations in the stack of AID corn which had resulted in some spillage. Rodent-chewed kernels of corn and mouse droppings were also noted in the stack of corn.

3. Molds. No evidence of molded grains was noted in any of the storage observed. An unloading report for AID corn delivered to Mindelo in March 1983,

indicated evidence of minor sweating in three holds and later reported 58 sacks slightly stained but contents not altered.

Although the corn delivered under PL 480 Title II is No. 2 yellow corn (which indicates a possible 15.5 percent moisture content) AID personnel indicate this corn is delivered at 13.5 percent. When the corn is stored in sacks under the generally dry arid conditions in Cape Verde, moisture is generally lost from the grain. EMPA personnel indicated corn moisture contents in storage of 11.0 to 11.5 percent.

Storage of corn in bulk may alter the customary drying of corn in storage. In bulk, the corn is less likely to lose moisture to the atmosphere. If corn is delivered at moisture contents marginal for safe storage, i.e., 14.0 to 15.5 percent, molding of the grain could occur under the temperature conditions predominant in Cape Verde.

Provision is made to pull air up through the grain in the new silo constructed at Praia but the rated airflow is not known. It is possible that marginal moisture corn could be dried in the silos.

Moisture content of bulk stored corn is an item which should be monitored carefully until experience with bulk storage in Cape Verde is developed.

B. Pest Control Practices, Materials and Equipment

1. Control Practices

a. Insecticide Application. In the past, insecticides have been applied as emulsifiable concentrate dilutions on warehouse floors, walls, ceilings and as surface treatment of stacks of bags of stored grain. Insecticide dust has been used between layers of bags of grain as the stacks are formed. Smoke generated aerosol treatments have been used to control flying insects in warehouses.

b. Fumigant Application. The solid tablet form of fumigant has been used for fumigation of stacks of bags of grain under gastight tarpaulins sealed to warehouse floors by sand snakes.

2. Pest Control Materials

a. Insecticides. GTZ, under its project on postharvest problems in Cape Verde, has recommended the insecticide Folithion® (= fenitrothion) for use as an insecticide spray treatment for warehouse floors, walls, overhead areas and external treatment of stacks of bags of stored grain. A one percent concentration of spray solution was reported as being used.

A one percent Folithion dust was recommended for between layer treatment of sacks in stacks at initial storage of grain.

A five percent solution of Folithion in oil has been used as a smoke generated aerosol for flying insect control in warehouses.

"Mafu" (= dichlorvos) has also been used for this purpose but it was indicated that GTZ rescinded their recommendation for use of "Mafu."

Fenitrothion is not currently registered by USEPA either as a general use pesticide or a restricted use pesticide for the treatments described. Dichlorvos is registered as a general use pesticide in most states for ULD treatment of storage facilities.

GTZ is providing these insecticides as assistance to EMPA.

b. Fumigants. GTZ has recommended the use of aluminum phosphide for fumigation of stacks of bags of grain. Aluminum phosphide, on exposure to moisture in the air, generates hydrogen phosphide gas (= phosphine), an effective and widely-used fumigant for stored-product insect control. USEPA has registered aluminum phosphide under several trade names (including Phostoxin, Gastoxin, Detia EX-B, etc.) as a restricted use pesticide.

3. Application and Safety Equipment

GTZ has provided, as a part of their 1981 project on postharvest problems, insecticide and fumigant application equipment as well as safety equipment.

a. Application Equipment. GTZ supplied compression sprayers, motorized sprayers and dusters and Swingfog aerosol applicators for insecticide treatments. They also supplied aluminum phosphide pellet applicators for Praia and Mindelo silos as well as gastight tarpaulins to the EMPA "standard" warehouses.

b. Safety Equipment. Draeger or Auer full-face gas masks with chin-type canisters were supplied by GTZ. The specificity of the canisters was not confirmed, however EMPA personnel indicated they were for phosphine use.

c. Equipment Needs. All of the types of equipment needed for the applications of pesticides used in the current program were available. It was impossible to determine whether there were sufficient quantities of equipment and supplies without conducting an inventory at all locations. EMPA personnel did indicate that additional tarpaulins could be used because they now have to transport them from island to island occasionally. Sand snakes appeared to be of local fabrication and should not pose a problem.

Expendable items such as gas mask canisters could be in need, however the canisters and masks must be matched by manufacturer to assure proper safety in use. In the U.S. larger canisters than the chin-type are generally preferred for fumigation use. It should be determined whether the German suppliers of Auer and Draeger supply masks with chest-type canisters.

V. REQUIREMENTS FOR TRAINING AND QUALIFICATIONS OF EMPA PERSONNEL

A. Requirements for Training

1. GTZ Training Program. Discussion with the Director of the Integrated Pest Management Program in Cape Verde, Ms. Maria Luisa Lobo, confirmed that GTZ planned to conduct a training session for warehouse personnel. GTZ had indicated such an activity for October or November 1983 at the GASGA meeting in Cairo in June. There was no formal program prepared and available at the time of this visit, however Ms. Lobo provided a copy of the program for a seminar held in April 1981 (Annex II). Ms. Lobo also indicated that training had been provided at each of the islands in September of 1981.

Since it appears that GTZ will again be providing a training course in Cape Verde it seems inappropriate to suggest a parallel type of training on the part of the Kansas State University Food and Feed Grain Institute.

Dr. A. Laborius of GTZ will be contacted through Kansas State University's GASGA association to determine the type and extent of training to be provided and to explore the possibility of a future joint effort on training and recommendation of pesticides.

2. Kansas State University Training. In view of the GTZ apparent planned training, it is suggested that USAID/Praia should consider sending two participants to the annual AID Grain Storage and Marketing Short Course held each year at Kansas State University from mid-June until the last of July. Specific information regarding the short course will be sent to USAID/Praia for consideration and action.

In general the short course covers the basic fundamentals involved in storage of grains (kernel structure, moisture-humidity relationships, changes in storage, grain inspection and grading); identification and biology of pests (insects, molds, rodents, birds); engineering aspects of storage (storage

handling, drying, aeration, structures, maintenance, etc.); pest control (inspection, housekeeping, physical/mechanical methods, chemical-insecticides fumigants, rodenticides); economic aspects of grain storage (marketing, distribution, transportation, price policy, planning, feasibility analysis, etc.). Instruction is provided by means of lectures, laboratories, problem solving, demonstration and field trips.

It is suggested that one person from the EMPA Cabinete Technico would be a logical candidate and that an individual from the MDR engaged in pest control research at the São Jorges Center for Agrarian Studies (CAS) be sent to the short course. The person from CAS could later serve as a technical backup person on pesticide usage.

Before a KSU in-country training effort is proposed the content and outcome of the GTZ training needs to be assessed. The possibility of a joint GTZ/KSU training effort should also be considered.

3. Qualifications of EMPA Personnel. In my opinion, the EMPA personnel would benefit from additional technical expertise. The Cabinete Technico at EMPA consists of five trained persons: a chief, a technician and two assistant technicians in Praia and a technician in San Vicente. Members of the Cabinete seem to be quite knowledgeable in discussion of grain storage procedures for preserving quality. However, some of the conditions observed in the Praia warehouses tend to indicate a lack of application of the knowledge. The reasons for this were not fully apparent during this visit.

Warehousemen at the various storage locations, in general, seem to know the basic stacking and orderliness of commodity storage but would probably benefit from additional knowledge regarding pest control.

VI. OTHER DONOR TECHNICAL ASSISTANCE

A. FAO Silo Construction at Praia - 10,000 MT Capacity

The Netherlands has provided the services of experts and consultants, contracted for construction of the silos and provision of non-expendable equipment. According to the general contracting supervisor J. J. Ferrandis, training has been provided in Portugal for mechanical and electrical personnel at the silos. The head of the Cabinete Technico-EMPA indicated one person from his group would be given responsibility for pest control in the silos.

This project was started in 1982 with funds provided and disbursed in 1982 of $1,768,725. Total funds for the project, scheduled for completion in October 1983, were $3,050,250.

The silo facility is described in greater detail in an earlier part of this report, II.C.2.a. Praia Port Silo.

B. GTZ Project on Postharvest Problems

The GTZ efforts on pesticide and equipment supply and warehouse personnel training have been mentioned repeatedly in this report. However, no formal technical assistance document was reviewed or seen. This assistance will be further clarified by means of correspondence directly with Dr. A. Laborius, GTZ.

VII. INITIAL ENVIRONMENTAL EXAMINATION - CAPE VERDE PL 480, TITLE II, SECTION 206, FOOD FOR DEVELOPMENT PROGRAM

On the basis of observations and information gathered during this visit to Cape Verde, an Initial Environmental Examination was prepared and is included in this report as Annex III.

The preparation of this document is somewhat complicated in that the pesticides used are being supplied and recommended by another donor GTZ (Federal Republic of Germany) and not by USAID. The warehouses where the pesticides are used function as storage facilities for not only PL 480 Food For Development commodities but also for commodities from other donors.

The resolution of this problem should be discussed with the parties concerned--USAID, GTZ and the GOCV.

VIII. SUMMARY OF RECOMMENDATIONS

A. Condition of Warehouses

1. In general the type A, B, B + B and new warehouses are subject to the need for minor repair to make them less likely to be invaded by rodents. A survey of these warehouses should be made and repairs to doors be made and ventilator openings covered with heavy mesh screen with openings no larger than 1/4 inch (= 0.7 cm).
2. The condition of some of the older warehouses may cause them to be less than adequate for safe commodity storage. The "assorted other warehouse" category should be assessed to determine whether it is economical to bring them up to an "adequate" storage status.
3. Open storage should only be used for commodity storage in extreme emergencies.
4. The new port facility should be used to the maximum for longer term storage of commodities in bulk. Bulk storage in silos allows for maximum protection of grains and more effective use of pest control measures.

B. Pest Control

1. Steps should be taken to identify the initiation of moth infestations in warehouses so that appropriate control measures can be applied before populations reach the levels noted in warehouses. Pheromone traps may prove useful for this purpose.
2. The initial storage of bulk corn should be monitored very carefully to assure that molds do not develop as a result of high moisture in storage.

3. The selection of pesticides for use in EMPA warehouses and silos needs to be reviewed. USAID, GTZ and the GOCV need to resolve the issue of appropriate pesticides for use in the future. KSU can initiate an informal dialogue with GTZ regarding this situation.

4. EMPA should indicate their perceived needs for pest control materials, equipment and/or safety equipment.

C. Training

1. An immediate training course for warehousemen is not deemed appropriate at present because of the GTZ scheduled training.

2. It is recommended that one or two persons from Cape Verde attend the annual AID Grain Storage and Marketing Short Course next June-July. One person from EMPA and one from MDR would seem appropriate.

KSU can explore the possibility of a joint GTZ/KSU training effort in the future.

DIRECTION DE LA PRODUCTION ET PROTECTION DES VEGETAUX

Liste de Principaux Ravageurs de Produits Entreposés aux Iles du Cap-Vert

	1973
M 1 - Maïs (EMPA) importante infestation	- Sitophilus zeamais
M 2 - Maïs (EMPA) très importante infestation	- Tribolium castaneum
M 3 - Maïs (EMPA) infestation moins importante	- Dermestes maculatus
M 4 - Maïs (EMPA) infestation moins importante	- Alphitobius leavigatus
M 5 - Maïs (EMPA) infestation moins importante	- Ephestia cautella 1 Plodia interpunctella
M 6 - Maïs (EMPA) infestation moins importante	- Sitotroga cerealella
A 1 - Riz (EMPA) très importante infestation	- Sitophilus zeamais
A 2 - Riz (EMPA) très importante infestation	- Tribolium castaneum 1 Palorus subdepressus
A 3 - Riz (EMPA) très importante infestation	- Cryptolestes ferrugineus
T 1 - Blé (MOAVE) très importante infestation	- Sitophilus oryzae
T 2 - Blé (MOAVE) très importante infestation	- Sitophilus oryzae
T 3 - Blé (MOAVE) très importante infestation	- Tenebroides mauritanicus
T 4 - Blé (MOAVE) très importante infestation	- Alphitopius leavigatus
C 1 - Café (EMPA) infestation moins importante	- Não se trata duma praga de produtos armazenados
C 2 - Café (EMPA) infestation moins importante	- Não se trata duma praga de produtos armazenados

PROGRAMA DO SEMINARIO

Controle de Pragas nos Produtos Armazenados

28.3.81 (sábado)		Chegada dos referentes (Dr. Laborius, Harnisch) a Praia
29.3.81 (domingo)		Chegada dos participantes ao Seminário
30.3.81 (segunda)	8,00	Introdução Geral do Programa (MDA - Laborius)
	9,00	Pausa
	9,15	Principios de armazenamento e cuidados com os produtos
	11,00	Pausa
	11,15	Classificação e biologia dos pragas dos produtos armazenados
	12,30	Almoço
	14,30	Continuação (até 18 horas)
31.3.81 (terca)	8,00	Tipos de armazéns a detalhes técnicos da sus construção
	10,00	Pausa
	10,15	Continuação
	11,15	Pausa
	11,30	Técnicas de armazenamento e higiene
	12,30	Almoço
	14,30	Principios básicoa de controlo de ratos
		Informaçoes práticas de combata de ratos
1.4.81 (quarta)	8,00	Principios de aplicação com insecticidas e resultados com insecticidas
	10,00	Pausa
	10,15	Selecção de insecticidas para controlo de pragas de produtos armazenados
	12,30	Almoço
	14,30	Visita a armazéns (EMPA)

2.4.81 (quinta)	8,00	Demstracão dife tipo ap
	12,00	Almoço
	14,30	Aplicação prática de insecticidas
	16,15	Pausa
3.4.81 (sexta)	8,00	Métodos tradicionais de controlo de pragas nos armazéns
	10,00	Pausa
	10,15	Principios teóricos de utilização de fumigantes
	12,30	Almoço
	14,30	Continuação
	15,30	Aplicação prática de fumigantes
	19,30	Jantar com os participantes do Seminario
4.4.81 (sábado)		Discussão final com técnicos e autoridades MDR-EMPA-FAP

INITIAL ENVIRONMENTAL EXAMINATION - CAPE VERDE PL 480, SECTION 206, FOOD FOR DEVELOPMENT

1. Summary

Empresa Publica de Abastecimento (EMPA) is the Cape Verde government organization responsible for importation, storage, wholesaling and some retailing of staple food commodities. This includes storage and distribution of corn under PL 480, Title II, Section 206, Food For Development Project.

Under a project on postharvest problems, the Federal Republic of Germany, German Office of Technical Cooperation (GTZ) has provided EMPA recommendations for pesticide use and training in grain storage and pesticide application. Further, GTZ has supplied quantities of pesticides, application equipment, safety and monitoring equipment and gastight tarpaulins for grain fumigation to EMPA for use at warehouses and storage facilities throughout the nine principal islands of Cape Verde.

Whereas USAID/Praia will recommend the use of malathion, registered by the USEPA for unrestricted use in grain storage facility treatment and direct application to grain, GTZ has chosen to recommend and supply a pesticide, fenitrothion (Folithion, a registered trade name of Bayer), for storage facility treatment, exterior treatment of grain sacks and fogging of the space surrounding stored sacks of grain. Fenitrothion is not registered by the USEPA for the uses suggested by GTZ.

GTZ has also recommended the use of aluminum phosphide containing fumigants, specifically Phostoxin for fumigation of stored grains in EMPA storage facilities. USAID/Praia concurs in this recommendation. Phostoxin, and several other products containing aluminum phosphide, is registered by USEPA with a restriction based on user hazard, and must be used only by personnel trained in proper application methods and safety precautions.

Therefore, under Title 22 CFR, Part 216, Section 216.3 (b)(1)(i), (ii) ar (iii)(a), an evaluation of the economic, social and environmental risks ar benefits of the pesticides is required to determine whether the use may resul in significant environmental impact. The accompanying evaluation of risks ar

Evaluation of the Economic, Social and Environmental Risks and Benefits of the Use of Malathion, Fenitrothion (Folithion®) and Aluminum Phosphide (Phostoxin®) in Conjunction with PL 480, Title II, Section 206 Cape Verde Food For Development Program

A. The USEPA registration status of the requested pesticide(s)

Malathion (premium grade) is registered by the USEPA without restriction for the intended use. Fenitrothion is not registered for the same or similar uses by USEPA without restriction or for restricted use on the basis of user hazard. Aluminum phosphide (Phostoxin and others) is registered by the USEPA for the intended use, but carries a restriction based on user hazard, requiring adequate training for fumigation crews as well as adequate safety equipment.

B. The basis for selection of the requested pesticide(s)

Malathion (premium grade) and aluminum phosphide were selected on the basis of USEPA registration for use in protection of stored grain as well as being commonly used and accepted pesticides for stored grain. Fenitrothion is not a pesticide of choice, however it is being recommended and donated by the German (FRG) Office of Technical Cooperation (GTZ). Further, it has been used in other countries for the treatment of grain storage facilities and for direct application to grains.

C. The extent to which the proposed pesticides are part of an integrated pest management program

The proposed pesticides will be used to treat and protect bagged grain inside isolated warehouses and bulk grain in silos. Efforts to protect stored grains from deterioration due to insects and other pests have commonly stressed an integrated approach to pest management. Frequent and thorough cleaning of storage facilities reduces the necessity for frequent pesticide applications and makes the pesticides applied more effective. Preventive treatments by pesticide treatment of storage facilities reduces the necessity for use of the restricted use aluminum phosphide fumigants.

D. The proposed method or methods of application, including availability of appropriate application and safety equipment

Premium grade malathion is available as emulsifiable concentrate (EC) or dust formulations. EC formulations are diluted with water and then applied with backpack or pump-type sprayers to treat walls and floors of warehouses or silo storage facilities. Premium grade malathion EC and dust formulations are also registered for direct application to cereal grains. It is possible this form of treatment would be used when corn is received for storage in bulk in the new port silo in Praia. Application should be made according to label directions.

Fenitrothion is available as a 50 percent EC or 1 percent dust formulation. The EC formulation is diluted with water to provide a 2.5 percent solution for application to surfaces. The 1 percent dust formulation is dusted on bags between layers when sacked grains are first placed in storage.

Aluminum phosphide is a fumigant in solid form which, when exposed to moisture in the atmosphere, generates hydrogen phosphide (phosphine) gas. Aluminum phosphide fumigant formulations are available as pellets, tablets or in paper sachets. Each pellet contains 0.2 g of phosphine; each tablet 1 g and each sachet 11 g. Tablets or sachets are distributed over the surfaces of bags for fumigation of bags of grain in stacks. Gastight tarpaulins are placed over the stacks of bags as the tablets or sachets are dispensed. Sand snakes seal the tarpaulin to the floor to form a gastight chamber for 72 hours. After the exposure period tarpaulins are removed and the grain is aerated. Appropriate tarpaulins and safety equipment are available for fumigators including gas masks and canisters and gas detectors. Pellets will be applied by automatic applicator units in the new silo for bulk storage.

E. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such hazards

There are no known long-term toxicological hazards associated with the pesticides.

Malathion has low mammalian toxicity both orally and dermally and is one of the safest pesticides available.

Fenitrothion has slightly higher oral and dermal mammalian toxicity but in the manner proposed for use will have minimum direct contact with the food commodity.

Hydrogen phosphide gas is acutely toxic when inhaled, however, delayed generation of the gas during application and training in the use of safety equipment prevents exposure to toxic concentrations of the gas.

F. The effectiveness of the requested pesticide for the proposed use

The pesticides proposed for use have been shown to be effective for their intended use through research and acceptance of them for protection of stored grain.

G. Compatibility of the proposed pesticide(s) with target and non-target ecosystems

The proposed pesticides are compatible with the target pests, and no non-target pests or ecosystems are involved.

H. The conditions under which the pesticide(s) is to be used

The pesticides will be used inside grain warehouses and will not affect any flora, fauna, water courses, soil or other natural resources.

I. The availability and effectiveness of other pesticides or non-chemical control methods

The proposed pesticides are the most effective for the purposes, and no non-chemical control method is available for protection of bagged or bulk stored grains. Non-chemical means, such as housekeeping will be used to increase the effectiveness of the pesticides and minimize their use.

J. The requesting country's ability to regulate or control the distribution, storage, use and disposal of the requested pesticide

All pesticides used by EMPA are controlled by the chief of the technical group of EMPA. He is assisted by four technicians trained in handling pesticides.

Separate storage areas are provided at warehouse locations for storage of insecticides. Fumigants are stored at some warehouse locations but transported to other small warehouses as needed.

Insecticides used for treatment of warehouses are applied by warehousemen who have been trained and are provided instructions in their use by the chief of the technical group of EMPA.

Fumigations of grain are conducted only by a trained team from the EMPA main office in Praia.

K. The provisions made for training of users and applicators

The German Agency for Technical Cooperation (GTZ) which is supplying the pesticide and equipment for application and safety, conducted a training seminar in Praia in early 1981 and later in 1981 provided trainings at other warehouse locations in Cape Verde. Another training program is scheduled in Cape Verde for October/November 1983 by this same agency.

L. The provisions made for monitoring the use and effectiveness of the pesticides

Monitoring the use of pesticides is accomplished by the technical group of EMPA. Monitoring the effectiveness of the pesticides is determined by warehouse manager requests for additional treatment.

LIST OF REPORTS AND DOCUMENTS REVIEWED

Trip reports from Jerry Dom, PL 480 Project Assistant to Ted Kaminski, PL 480 Project Manager, Praia.

1. Survey trip to Porto Novo, St. Antão, 11 August 1983.
   Purpose: EMPA warehouse, treatment, storage, sales and distribution.

2. Survey trip to Mindelo, São Vicente, 12 August 1983.
   Purpose: Unloading, treatment, storage and distribution of bagged corn and next shipment in bulk.

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Silliman, James R. (1980) Draft Environmental Profile on Cape Verde. Prepared by the Arid Lands Information Center, Office of Arid Land Studies, Univ. of Arizona (Tucson). Funded by AID, Office of Science and Technology, SA/TOA 1-77, National Park Service Contract No. CX-0001-0-0003 in Cooperation with U.S. Man and the Biosphere Secretariat, Department of State, Washington, D.C., 50 p.

Plaisier, L. and J. J. vander Zee (1982) Strategy for Integrated Development of Santo Antao, Cabo Verde - Concept Report. Prepared by consultants from the Netherlands, 76 p.

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World Bank (1980) The Republic of Cape Verde - Economic Development in a Small Archipelago. Report No. 2730-CV. Volume I: Main Report, 100 p.