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REPORT TO USAID/W AND USAID/COSTA RICA ON A CONSULTING VISIT AND RELATED WORK

OCTOBER 1970

A. H. Boyd, Jr.

SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
STATE COLLEGE, MISSISSIPPI

Report Summary

Title: Report to AID/W and USAID/Costa Rica on a consulting visit and related work

No.: TA-71-10

Author: A. H. Boyd, Jr., Assistant Agronomist

Period of Report: 11 September - 18 September, 1971

Project Title: AID/W and MSU AID/csd 2976

Contractor: Mississippi State University

Investigator: A. H. Boyd, Jr.

Summary

1. The above named specialist visited Costa Rica to continue assistance to AID/Costa Rica and GOCR in development of their seed program.
2. Principal work concerned explanation and presentation of final plans for a seed and grain testing laboratory.
3. Conferences were held with Dr. Echandi (University of Costa Rica staff), the architect, and refrigeration engineer to explain the plans.
4. In continuation of services to Costa Rica, guidelines for construction of a seed germination room and a dehumidified cold storage room were prepared to present to AID/Costa Rica and the University of Costa Rica.
5. This project is continuing and need for future visits to Costa Rica is anticipated as work progresses.

Report to AID/W

and

USAID/Costa Rica

On A Consulting Visit

and

Related Work

11 September - 18 September 1971

INTRODUCTION

Assistance to the Government of Costa Rica began at the request of AID/Costa Rica under contract MSU-AID-W 607 for assistance to the seed improvement project (AID Loan 515-L-022). This visit was undertaken as a continuing part of this project under MSU contract AID/csd 2976. The first visit to evaluate the seed program and make preliminary recommendations was made in October 1970 by Dr. J. C. Delouche, director of Mississippi State University Seed Technology Laboratory. Subsequent visits were made by this consultant in December 1970 and March 1971. These visits were concerned chiefly with the plans for the seed processing facility at Bananca developed in collaboration with the STL staff and Consejo Nacional de Produccion.

The principal objective of this visit was to consult with personnel involved in the construction and operation of the seed testing and grain grading facility to be constructed at the University of Costa Rica, particularly to discuss problems and present ideas to the architect and refrigeration engineer on construction of the seed germination room and the environmentally controlled seed storage room to be incorporated in the facility.

MEETING WITH THE ARCHITECT

Dr. Ronald Echandi and this consultant met with Sr. Gutirez to discuss building methods available and to try to convey the idea of just what was necessary in a germination room. In addition the facility plans had the germination room and the cold storage sharing a wall. Possibilities for making some changes to correct this point of inevitable trouble caused by a warm, wet room adjacent to a cold dry room were discusses. As a result of these discussions and to further clarify the points, a set of comments on equipment and construction was presented and follows in this report.

GERMINATION ROOM
GRAIN AND SEED LABORATORY
UNIVERSITY OF COSTA RICA

Description and Comments on Equipment and Construction

1. Physical dimensions of the room.

Preliminary architects drawings the floor plan is 3 meters x 3 meters. This can be arranged satisfactorily, however, the usual size of a germinator tray is 19 inches x 20 inches, thus, a room 2.5 meters wide would be adequate for two rows of tray racks with a walkway between.

2. Construction features peculiar to high humidity application.

a. All material inside the germinator must be of moisture resistant materials.

b. Walls floor and ceiling should maintain a vapor barrier to retain moisture vapor inside the room. Since walls will be cement blocks a good grade of epoxy coating (2 coats) on the inside will help. A better solution would be waterproof plaster such as is used in athletic showers.

In view of the beautiful tile workmanship in Costa Rica the ideal solution would be to tile all inside walls. Particular attention should be paid the ceiling since the wood ceiling joists will decay rapidly if allowed to absorb water.

c. A drain should be placed in the center of the floor to aid in keeping the room clean.

d. Fluorescent light fixtures must not be installed inside the room. They have high working voltage and can give a fatal shock after some deterioration takes place in the constantly humid atmosphere. To have a timed lighting system glass or plexiglass panels must be sealed in the wall and the fluorescent lights installed outside the high humidity area. (A drawing showing a suggested method follows)

e. Incandescent lights installed in the celing must be of the weatherproof type.

ITEMS IN SPECIFICATIONS

Item 1. Water Pump

The water pump specified is a 3000 rpm magnetic impeller type. Two are specified since the water curtain inside will operate continuously. Small inexpensive pumps such as this cannot be expected to be extremely durable so one is a spare. These are readily available as replacements and substitutions of submersible pumps such as are found in water fountains, etc., can be made. Any pump that will deliver about 225 gallons per hour against a 9 foot head will suffice.

Item 2. Water heater

The chromalox heaters specified are standard hot water heater elements and are installed to heat the water in the reservoir which subsequently heats the room and maintains the relative humidity at a high level. These must be connected to a magnetic contactor since thermostats cannot carry the necessary current to run the heaters. Four are necessary with one extra specified for a spare.

Item 3: Water Reservoirs

The water reservoirs are to be locally constructed. They consist of two tanks alongside the walls behind the tray racks. Dimensions are about [illegible] cm deep by [illegible] cm wide and the length is as long as the room. They will be tied together at the bottom by a pipe of about 2.5 cm diameter to maintain equal water level in both. Construction may be of galvanized metal or they may be built in and waterproofed as the walls are constructed. Anywhere galvanized metal is used replacement in a few years must be expected. Good maintenance and painting will extend the life of galvanized components.

Item 4. Water Curtain

The water curtain should be a piece of plexiglas hung under the water distributor to protect seeds on the trays from direct splatter and allow more heat exchange between air and water. The panel must be clear since the light from the fluorescent fixtures must shine through.

Item 5. Water Distributor

The water distributor can be constructed by a sheet metal shop to specifications or consist of a piece of box gutter as used on the eaves of houses. This is available in aluminum or galvanized steel. This should be mounted with the top about 1[illegible] cm from the ceiling. A total of 24, 1/8 inch holes drilled in the bottom of a distributor mounted over a water curtain and reservoir will allow a flow of about 150 gallons per hour over each water curtain. As an alternative a total of 75, 1/16 inch holes should give equivalent flow and better water distribution, however, it will have to be kept clean to prevent plugging.

Item 6. Fluorescent light fixtures

Fluorescent fixtures are standard two tube 40 watt fixtures. 40 watt cool white tubes should be used.

Item 7. Cabinet for controls

This cabinet should be built after controls are installed. Any convenient location is satisfactory. This should cover thermostat, timer, and magnetic contactors.

Item 8. Thermostat

Honeywell thermostat with remote bulb. Any remote sensing thermostat with a temperature differential of 3° is satisfactory.

Item 9. Timer

The specified timer is to control the fluorescent lights in the germinator for proper application of light. It should be installed adjacent to the other controls so that a cabinet can be placed around them.

Item 10. Magnetic contactor.

Two four-pole contactors are specified. They should be wired so as to operate the four heaters. They must be placed inside a junction box inside the cabinet for protection of personnel. The thermostat is connected to the coils to control the heaters.

Item 11. Door

The Jamison plyfoam door specified is faced with galvanized metal. It must be kept painted to prolong the life. A locally constructed metal or plastic faced, gasketed door will be satisfactory. A wood door or a metal faced wood door without soldered seams will not be satisfactory. Uncovered wood door facings will not be satisfactory.

Germination trays and tray racks should be made of aluminum angle if possible. Fasterners must be of the same alloy as the angle or electrolysis will cause corrosion and collapse of the framework.

A walk-in germinator built from the above suggestions should perform satisfactorily with reasonable maintenance. Certain features such as more expensive pumps and extensive use of stainless steel or aluminum where galvanized is specified will minimize maintenance and greatly extend the life of components. It will also greatly increase the cost.

GERMINATION ROOM
GRAIN AND SEED LABORATORY
UNIVERSITY OF COSTA RICA

Item	Description	No. req.	Unit Cost	Est. Cost U. S. $
1	Water Pump			
	Teel magnetic drive mild chemical solution pump capable of 225 gal. per hr. delivery at 9' head 115 v. 60 cy. Grainger's stock No. 1P677 (2) Probable Vendor Index	2	31.00	62.00
2	Water Heater Chromalox 120 v. 1500 watt utility water heater with standard pipe threads Harry Alter Co., Inc. stock no. 25785 (1) probable vendor index	5	8.00	40.00
3	Water Resevoir			
	Locally fabricated, see description of construction and equipment			
4	Water curtain			
	Locally fabricated, see description of contruction and equipment			
5	Water Distributor			
	Locally fabricated, see description of construction and equipment			
6	Fluorescent Light Fixtures			
	Two lamp (40 watt each) rapid start fluorescent fixtures less lamps (2) Probable Vendor Index	6	10.00	60.00
	Fluorescent Tubes 40 watt, rapid start, cool white, fluorescent tube	12	1.35	16.00

Item	Description	No. Req.	Unit Cost	Est. Cost U. S. $
7	Cabinet for Controls			
	Locally fabricated, see description of construction and equipment			
8	Thermostat			
	Honeywell T 675 A remote bulb thermostat Temperature range 55-175°F Harry Alter Co. Stock No. 73652 (1) Probable Vendor Index	1	28.00	28.00
9	Timer			
	Dayton 24 hour dial time switch 125 v. SPST Grainger's stock no. 2E 021 (2) Probable Vendor Index	1	11.00	11.00
10	Magnetic Contactor			
	AC magnetic contactor RBM 30 amp 110 v. operating coil Harry Alter Co. Stock No. 48391 (1) Probable Vendor Index	2	18.50	37.00
11	Door			
	Jamison "plyfoam" door constructed of 20 gauge galvanized steel faced over foam core. 3'6" x 6'6" complete with facing and hardware. All seams soldered for high humidity application (3) Probable Vendor Index	1	395.00	395.00
	TOTAL PURCHASED ITEMS			649.00

Probable Vendor Index*

1. The Harry Alter Co., Inc.
   2399 S. Archer Ave.
   Chicago, Illinois 60616

2. W. W. Grainger, Inc.
   823 S. Congress Street
   Jackson, MS 39201

3. Jamison Door Co.
   P. O. Box 70
   Hagerstown, Maryland 21710

* Designation of probable vendor and/or brand name does not constitute a recommendation. Brand names are used only in aiding clarity in specification. Equivalent quality and performance are all that is necessary.

MEETING WITH THE REGRIGERATION ENGINEER

The next discussion with Dr. Echandi and Sr. Beiruta the expected refrigeration contractor for the Seed Laboratory and the adjacent Food Technology facility also concerned construction details and specific points of difference between a dehumidified facility and the normal "meat box" type installation. As with the seed germination room a set of guidelines to help the designer was developed and is made a part of this report.

GUIDELINES FOR REFRIGERATION ENGINEER AND ARCHITECT ON SPECIFICATIONS FOR DEHUMIDIFIED SEED STORAGE ROOM AT UNIVERSITY OF COSTA RICA SEED TESTING LABORATORY

General

The room is to be insulated and constructed with vapor barriers outside the insulation material. Extreme care should be taken to prevent moisture penetration.

Mechanical Equipment:

1. The refrigeration equipment must be designed to maintain a temperature of 40°F with the outside conditions at 90°F dry bulb and 85°F wet bulb and the following special conditions inside.

   1500/BTU hr. heat of condensation
   3500/BTU hr. added by electric heater

2. Evaporator coils must permit a temperature drop to 10°F across the coils to insure adequate dehumidification.

3. Fan behind the evaporator coil must run continuously because of the dehumidification function of the system.

Dehumidification:

1. The unit cooler will be equipped with four (4) finned strip electric heaters of 500 watt capacity each. The heaters are to be mounted across the face of the air cooling unit.

2. The heater system is to be controlled by a humidistat through on across-the-line type magnetic starter.

3. Individual switches will be provided for each 500 watt heater strip to allow switching them in or out of the heater system.

Note: This is desirable since there are so many variables in the climate as well as utilization of the storage facility. This feature will aid in balancing the system with the season and amount of traffic in the room, a schematic diagram of the feature is included.

ALTERNATE GUIDELINES USING A DESICCANT DEHUMIDIFIER

Mechanical Equipment:

The refrigeration equipment must be designed to maintain a temperature of 40°F with outside conditions at 90°F dry bulb and 85°F wet bulb and 8100 BTU/hr added inside by the dehumidifier.

Dehumidification:

1. The dehumidifier should be a Dryomatic Model R-150 or equivalent desiccant type dehumidifier. A humidistat should control the process air flow so that a relative humidity or 40-50% can be maintained.

2. This unit adds approx. 8100 BTU/hr to the heat load of the room when it is in operation.

3. The connected load of this model is 5 KW.

4. Installation should be under a protective shelter since the unit is not weather tight.

RECOMMENDATIONS

1. The architect should continue to develop plans for the facility using guidelines presented but utilizing local construction methods wherever he can obtain equal results.

2. The refrigeration engineer should consult with the architect and specify equipment that will meet the conditions outlined in his guidelines.

3. The guidelines presented should not be accepted as the only way but utilized for what they are-guidelines.

4. Future correspondence and visits to keep in contact with the project and give help as it progresses.

5. Final plans should be presented to the Seed Technology Staff for review before bids on construction are solicited.

The author wishes to express his appreciation to Mr. Milton Lau, R.D.O., Mr. Paul Holden and Dr. Ronald Echandi for their continued courtesy and cooperation.