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REPORT TO:

TA 77-05

REGIONAL BUREAU AFR/RA/PSA
USAID/CDO/GUINEA BISSAU

PROJECT PAPER (PP) REVIEW FOR SEED LABORATORY-SEED STORAGE-PLANT PATHOLOGY IN GUINEA BISSAU

Services Rendered Under The Agreement Between AID/W and MSU AID/ta-C-1218

SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI

Report to the

Regional Bureau AFR/RA/PSA
and
USAID/CDO/Guinea Bissau
and
AID/W

on the
Project Paper Review
For
Seed Laboratory, Seed Storage and Plant Pathology
In
Guinea Bissau

Services Rendered
Under the Contract
between
AID/W and MSU
AID/TA-C-1219

Seed Technology Laboratory
Mississippi State University
Mississippi State, Mississippi

August, 1977

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REPORT SUMMARY

TITLE: Project Paper Review for Seed Laboratory, Seed Storage and Plant Plant Pathology for Guinea Bissau

CONTRACT: Services under AID/TA-C-1219

CONSULTANT: C. Hunter Andrews, Seed Technology Laboratory, Mississippi State University

PERIOD OF CONSULTATION: July 6-18, 1977

Summary

1. The AID African Bureau of Regional Affairs requested the services of one seed specialist to work cooperatively with a designated working team in reviewing the Project Paper for Agricultural Development in Guinea Bissau. The AID/MSU Contract Project Manager approved a 15 day assignment.

2. The specific terms of reference were to make a careful review of the seed program (seed testing laboratory and seed storage) and plant pathology components of the project. This included preparing an implementation plan, list of equipment and specifications, determining training and technical assistance requirements, and making revised cost estimates. Also, the qualifications and scope of work for a technical assistant in Seed Program Development was prepared.

3. The working team consisted of the CDO for Guinea Bissau, a civil engineer in Land Reclamation, an AID/TDY agricultural officer and a seed specialist The team thoroughly reviewed the PP, contacted GOBG officials and subsequently made appropriate revisions as deemed advisable.

4. The appendices in this report provide the details concerning the equipment and specifications for the seed laboratory and plant pathology laboratory, time frame schedules, budget revisions and qualifications and scope of work for a technical assistant in the seed program.

ACKNOWLEDGEMENTS

The author expresses his sincere appreciation to Mr. James O' D. Maher, USAID/CDO/Guinea Bissau, for his thorough briefing and advice both before and during the period of this consultation. His opinions and experience provided valuable guidance in analyzing the situation and in determining a sound approach towards implementing this project. His professional approach and sincere dedication to the mission of assisting people in less developed countries under AID projects is outstanding. His friendship is valuable.

The briefing in AID/W with Mr. Charles Sanders, African Bureau of Regional Affairs and Mr. Angel Diaz, Officer In Charge, AFR/RA/PSA provided valuable guidance in developing a sound approach in this assignment. In addition, Mr. Diaz was always extremely helpful during the prepratory stages of this assignment.

The author is grateful to Mr. Merril Assay, AID/TDY to Guinea Bissau, for his valuable council and suggestions during this assignment. In addition, the author wishes to express his appreciation to the entire team who participated in the revision of this project, James Maher, Merril Asay and George Thompson, for their congenial attitude and constructive suggestions.

The author certainly appreciates the cordial reception extended by the Commissariat of Agriculture in Guinea Bissau, C. A. Avito da Silva and by the Director General of International Cooperation, Ing. Inacio Semedo. Appreciation is extended to Sr. Augusto Nalete Maria for his guidance during the field trip to the rice project at Contuboel. A cordial reception was also extended by Ing. Carlos da Silva, Rice Section Chief.

Sincere appreciation is extended to the U.S. Embassy staff in Guinea Bissau for their assistance and advice.

Respectfully,

C. Hunter Andrews
Professor
Mississippi State University

CHA:scc

Report to
Regional Bureau AFR/RA/PSA,
USAID/CDO/Guinea Bissau,
and AID/W on the Project
Paper Review for the Seed Laboratory,
Seed Storage and Plant Pathology
in Guinea Bissau

I. BACKGROUND

A Project Paper (PP) was developed for Guinea Bissau by a Project Development Team in June, 1976 in which four components were identified for the Agricultural Development Project: (1) Seed Improvement, (2) Plant Pathology, (3) Land Reclamation, and (4) Agricultural Planning. Subsequently, a Grant Agreement between the United States of America and the Republic of Guinea-Bissau for Agricultural Development was developed and signed by appropriate officials.

Although implementation of the project was anticipated in the Fall of 1976 following the timely signing of the Grant Agreement, to date little if any progress in evident in either of the four areas identified in the PP.

Thus, the AID African Bureau of Regional Affairs assembled a working team to travel to Guinea-Bissau to discuss with GOGB officials implementation matters and develop necessary information to prepare PP revision on the Agricultural Development Project. The working group consisted of Mr. James Maher, CDO-Guinea Bissau; Mr. Merril Asay, Agricultural Officer AID; Mr. George Thompson, Civil Engineer; and Dr. C. Hunter Andrews, MSU Seed Specialist.

II. TERMS OF REFERENCE

In May, 1977, AID/W African Bureau of Regional Affairs (AFR/RA/PSA) requested services of one seed specialist from MSU to participate as one member of a working group to discuss implementation matters and PP re-

vision for the Agricultural Development Project for Guinea-Bissau. Dr. C. H. Andrews, Seed Technology Laboratory, Mississippi State University was nominated for this assignment, and the AID/TAB project officer approved this nomination under the auspices of the contract between AID/W and MSU, AID/TA-C-1219. The consultant departed MSU on July 6 for a briefing in AID/W after which he proceeded to Guinea-Bissau on July 8. He returned on July 18, 1977.

The purpose of this team assignment was to work with the Country Development Officer and the other technicians in reviewing the various components of the Agricultural Development Project (657-0002) for Guinea-Bissau in order to: (1) make appropriate revisions in the existing Project Paper and (2) to develop a feasible plan of action to expedite project implementation.

The specific objectives were:

1. Make a careful review of two of the four components of the Agricultural Development Project:

   (a) Seed Improvement
   (B) Plant Pathology

2. Develop a step by step implementation plan. In addition prepare a list of equipment and specifications, determine training and technical assistance requirements, and determine revised cost estimates.

3. Outline a scope of work for a technical assistant seed specialist including qualifications.

4. To the extent feasible, advise AID on the Plant Pathology Laboratory Project Component to include equipment, staff and training requirements.

III. CURRENT SITUATION AND BASES FOR RECOMMENDATIONS

The Project Paper (657-0002) prepared in 1976 describes subsistence agriculture as typically characterizing the principal economic activity in Guinea Bissau. Thus, the Government of Guinea Bissau has designated

agriculture as one priority sector for development assistance.

The Project Paper describes AID's initial assistance in the agricultural sector as that of increasing agricultural production including seed improvement, control of plant diseases and land reclamation. This is in accordance with Bissau's national agricultural policy to supply directly to the farmer seeds, fertilizer, and other materials necessary for the control of insects and plant diseases.

Seed Program development is identified in the areas of seed testing and seed storage. Specifically, the PP proposes development in the area of seed testing to consist of establishing a testing laboratory within the facilities of the Commissariat of Agriculture (CA) for the purpose of conducting basic investigations in seed germination, varietal characteristics, seed storage, etc. An existing building at the Granja Pessebe Experimental Station is to be renovated for laboratory space, and an appropriate list of equipment and specifications are to be provided so that the laboratory can function by testing and evaluating the quality of planting seed for the country.

The Project Paper indicates that the GOGB has assumed a critical role in the distribution of seed throughout the country and that the central collection point for seed will be in Bissau for both imported and domestic seed. Thus, the proposed project proposes the construction of two new 300 MT storage warehouses at the Granja Pessebe Station. In addition, existing facilities in outlying regions will be renovated to provide the capability of storing 1000 MT.

To compliment the seed program component, assistance will be provided in the area of plant pathology (plant protection) so that disease and insects can be identified and control measures recommended. A plant

pathology laboratory will be constructed and equipment will be provided for its operation.

In both the seed program and the plant pathology program, the project provides for technical assistance in the form of in-country training and training in other countries for those persons who will be responsible for each component. The project also provides for technical assistance, possibly in the form of a technical advisor, in order to set up the laboratories, provide training and plan the future program.

With this background information provided in the Project Paper, the specific objectives of this assignment as set forth in the Terms of Reference are presented in a series of appendices in this report. It is assumed that the base data upon which the Project Paper was developed is fairly correct and presents a realistic overview. This consultant did not identify any production figures for seeds upon which to base storage requirements, nor did he identify potential technicians for the separate components of the program. It should also be pointed out that the Plant Pathology component of this assignment presented a more difficult task since very little information was available. The equipment list provided in this report merely supplements the one prepared initially by the FAO project.

It will be noted that the seed storage component was altered slightly to include a small conditioned storage space in one of the 300 MT units at the Granja Pessebe Experimental Station. This is necessary to maintain the experimental seed stocks of cooperating agencies for extended periods of time.

The designs for the seed testing laboratory and the new storage

units will require some additional time to prepare but should be available by September 1 which fits the time frame as discussed with members of the working group.

Note: Appendices I and J were prepared by Mr. James Beck of the Seed Technology Laboratory staff for the storage component. Design drawings for both the seed testing lab and the storage facilities will be completed by Mr. Beck in the near future. Appreciation is extended to Mr. Beck for his assistance in this project.

APPENDIX A

Itinerary and Principal Contacts

July 6	PM	Depart MSU
July 7	AM	AID Washington - briefing with:
		Mr. Charles Sanders, African Bureau of Regional Affairs
		Mr. Angel Diaz, Officer In Charge AFR/RA/PSA
		Mr. Merril Asay, USAID TDY Team Member
July 8	AM	Arrive - Guinea Bissau
	PM	Initial contact with Mr. Avito da Silva, Commissariat of Agriculture (CA)
July 9	AM	Consultation with Mr. Avito da Silva and visit Seed Lab site location at Granja Pessebe Experimental Station
		Consultation with Mr. Carlos da Silva, Rice Section Chief
	PM	Free Time
July 10	AM	Field trip to Mansaba with
	PM	Mr. James Maher and Merril Asay
July 11	AM	Met with Mr. Augusto Nalete Maria, corn seed specialist and visited Granja Pessebe Station for further evaluation of seed lab and seed storage facilities.
	PM	Accompanied by Mr. Augusto Nalete Maria to a near-by experimental station to observe citrus, banana, corn experiments.
July 12	AM&	Field trip to Contuboel to visit the FAO Rice Seed
	PM	multiplication project.
July 13	AM	U.S. Embassy and USAID office for necessary documentation and orientation:

		Mr. Dean Curran, Charge de Affairs
		Mr. Bob Kile, General Services Officer
	PM	(1) USAID Office to assemble necessary information for PP revision.
		(2) Confer with Mr. Avito da Silva on land reclamation and pathology prospects and visit land reclamation project.
July 14	AM	(1) USAID Office to discuss project with team members, Jim Maher, Merril Asay and George Thompson
		(2) Visit UNDP official
	PM	USAID office to continue work on project revision, equipment lists and implementation plan.
July 15	AM	(1) USAID office to complete project revision recommendations.
		(2) Contact Ingr. Inacio Semedo, Director General International Cooperation
	PM	Finalize team discussions and plan departure
July 16	AM	Depart Guinea-Bissau
		Arrive Dakar, Senegal
	PM	Lay-over in Dakar
July 17	AM	Lay-over in Dakar
	PM	Depart Dakar
		Arrive New York
July 18	PM	Arrive MSU

APPENDIX B

Equipment List and Specifications
for
SEED TESTING LABORATORY
GRANJA PESSEBE EXPERIMENT STATION
BISSAU, GUINEA-BISSAU

Item No.	Cat. No.	Quantity	Probable Vendor	Description	Approx. cost US $ Unit	Total
1	135	6	Burrows	Purity Work Board, illuminated (diaphanoscope), wood construction, work area of opal glass, overall dimensions approx. 22" x 11" x 4", 1 drawer - 220 v. 50 cy.	67.50	405.00
2	1-349A	1	Burrows	Gamet precision divider for seed and grain, 200 v.-50 cy., all wearing parts of heavy brass or copper, chrome plated throughout	436.50	436.50
3	1-0344	1	Burrows	Boerner divider with two pans.	219.00	219.00
4	1-1760	4	Burrows	Fluorescent lamp with magnifier dazor type, pedestal base, 220 v. 50 cy., with tube.	79.75	319.00
		8	Burrows	Extra 22 watt tubes for fluorescent lamp No. 1-1760 220 v., 60 cy.	--	--
5	DWM2-1	2	Burrows	Torsion Balance scale, capacity 120 g; dial 1g.x .01 g; small dial adds 9 g.x 1g. increments, accuracy 5 mg. with polished steel scoop	300.00	600.00
6	TM-140	2	Burrows	Weight set for DWM 2-1 torsion balance scale (50 g., 30 g., 20 g., 10 g.)	6.50	13.00
7	1-1332	2	Burrows	Metric seed scale, capacity 2120 g.; sensitivity .01 g., front beam 10 x 0.1 g.; center beam 100 x 10 g.; rear beam 100 x 10 g.; with scoop and including one set each of 500 g. and 1000 g. attaching weights.	83.00	166.00
8	59	6	Seedburo	Forceps, nickel plated, 5 1/2" long, medium serrated point.	1.75	10.50
9	00B	6	Seedburo	Forceps, nickel plated 5" long, fine smooth point.	1.85	11.10
10	9-1915	6	Burrows	Counter brush 9"	2.65	15.90
11	9-1721	2	Burrows	Flat bottom scoop	2.60	5.20

Item No.	Cat. No.	Quantity	Probable Vendor	Description	Approx. cost US $ Unit	Total
12	51M	1	Seedburo	Boerner weight per bushel tester; beam graduations in kilos per hectoliters	600.00	600.00
13	PT2-B	1	Seedburo	Steinlite moisture tester, model PT2-B peanut tester with complete set of charts, operable on 220 v. 50 cy.	657.00 add $10 for 220 v.	657.00 10.00
14	95076-17	1	Seedburo	Cenco, stainless steel constant temperature oven, gravity type, temp. range to 245°C, with 3 adjustable shelves and a 0 to 300° C thermometer operable on 220 v, 50 cy.	684.00	684.00
15	T-2050-A	6	Scientific Products	Thermometers, general testing, glass mercury filled, readings with yellow back, range -20 to 105°C, 1° divisions, total immersion, 305 mm. long	5.00	30.00
16	1-1853	1	Burrows	Seed germinator, model 1853, stainless steel, one compartment with 14 trays and 4 fluorescent tubes, temperature range from 32°F to 110°F, to operate on 220 v., 50 cy. NOTE: order 8 spare fluorescent tubes.	2195.00 (plus cost for spare tubes)	2195.00
17	4S12E20	1	Seedburo	System 400/stereo microscope model 4S12E20, ocular 10 x WF, objectives 1 x, total mag. 10 x, operable on 220 v., 50 cy.	246.00	246.00
18	1-0512	2	Burrows	12" seed trier, nickel plated steel, 1" outside diameter at large end, leather shield.	10.30	20.60
19	1-0560	2	Burrows	66" aluminum trier, 11 openings, no partitions	69.05	138.10
20	1-0536	1	Burrows	39" bag probe, nickel plated, 7/8" diameter, 6 openings, no partition	28.95	28.95
21	1-0301	4	Burrows	Sample pan (1 1/2 qt.)	10.00	40.00
22	1-0304	6	Burrows	Triangle pan, heavy tin, dark blue, 10" x 10" x 1 1/2"	4.10	24.60
23	1-0341	6	Burrows	Sample pan, round tinplate, 2 qt. capacity, 8 3/4" dia. x 2 3/4" deep	.82	4.92

Item No.	Cat. No.	Quantity	Probable Vendor	Description	Approx. cost US $ Unit	Total
24	70925	2	Harry Alter	Bacharach Sling psychrometer-range 30° to 110°F	app. 15.00	30.00
		2		Bacharach replacement thermometers for No. 70925		
25	1-6215	44	Burrows	9" x 9" hand testing screens Round Holes (64th) 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24 Round Holes (fraction) 1/24, 1/22, 1/20, 1/18, 1/16, 1/14, 1/12 Oblong Holes (64ths) 5 x 3/4, 6 x 3/4, 7 x 3/4, 8 x 3/4, 9 x 3/4, 10 x 3/4, 12 x 3/4, 14 x 3/4, 16 x 3/4, 18 x 3/4, 20 x 3/4, 22 x 3/4 Oblong Holes (fractions) 1/24 x 1/2, 1/22 x 1/2, 1/20 x 1/2, 1/18 x 1/2, 1/16 x 1/2, 1/14 x 1/2, 1/12 x 1/2	9.85	433.00
26	1-62113	4	Burrows	9" x 9" Bottom Pan	9.85	39.40
27	1-7000	2	Burrows	Testing screen rack for 9" x 9" screens	24.20	48.40
28		10,000 sheets	Anchor	Seed Germination paper towels, regular weight, cut 10" x 15" sheets		100.00
29		5,000	Anchor	Seed Germination blotters, blue cut 6" x 12"		125.00
30			Heinrich	Spear Envelopes for grain		
		1,000		4 ounce	50/M	50.00
		1,000		8 ounce	60/M	60.00
		1,000		12 ounce	75/M	75.00
31	365	3 doz.	Burrows	Plastic grain sample box, 2 3/4" dia., 5/8" depth	1.50/doz.	4.50
						$7,846.37

List of Probable Vendors

Burrows Equipment Company
1316 Sherman Avenue
Evanston, Illinois 60204

Seedburo Equipment Company
618-628 West Jackson Blvd.
Chicago, Illinois 60606

Heinrich Envelope Company
925 Zone Avenue No.
Minneapolis, Minnesota 55422

Anchor Paper Company
350 Sexton Building
Minneapolis, Minnesota 55415

The Harry Alter Co., Inc.
695 Stewart Ave., S.W.
Atlanta, GA 30310

Scientific Products
Export Division
Flushing 58
Long Island, New York

APPENDIX C

Equipment Items for Seed Laboratory Operation

Item No.	Quantity	Description	Approx. cost US $ Unit	Total
1	2	Air conditioners, operable on 220 v., 50 cy. for laboratory	app. 500.00	1,000.00
2	1	Land rover, long chassis, 10 passenger diesel motor, model 109 Spare parts	8,500.00	8,500.00
		(10% of total price)	850.00	850.00
3	1	Typewriter, standard manual operation		300.00
			TOTAL	$10,650.00

NOTE: These items are considered essential to the total operational concept of a seed program. The seed laboratory will be capable of functioning without these items; however, if the personnel are to extend their work effectively to the entire country, then above items will be advisable. The Land Rover is considered essential in order to travel to out-lying storage facilities and the FAO rice seed project at Contuboel in order to inspect seed storage, production and sampling.

APPENDIX D

BUDGET
SEED PROGRAM/PRODUCTION

I. SEED LABORATORY		
1. Renovation Costs	10,000.00	
2. Basic equipment and supplies	7,846.37	
3. Two air conditioners	1,000.00	
4. Land Rover and spare parts	9,350.00	
5. Typewriter	300.00	
	$28,496.37	28,496.37
II. SEED STORAGE		
1. Construct two new seed storage rooms 300 MT capacity each	78,000.00	
2. Conditioned storage for approx. one-third of one of the 300 MT storage rooms:		
(a) 2 air conditioners	1,000.00	
(b) 1 dehumidifier	2,500.00	
(c) Install vapor barrier and asphalt on conditioned storage section	1,500.00	
	$83,000.00	83,000.00
III. TRAINING		
1. Two (2) trainees within 6 months sent for 2 month short course (probably to Brazil)		Cost supplied by AID/W ——
2. Four (4) trainees within 12 months sent for 2 month short course (probably Brazil)		Cost supplied by AID/W ——
3. Two (2) trainees within 22 months sent for BS degree in U.S.		Cost supplied by AID/W ——
IV. TECHNICAL ASSISTANCE		
1. One (1) technical advisor for duration of project (estimated 12 months)		Cost supplied by AID/W ——
2. One (1) Mississippi State (MSU contract) consultant for 2 weeks. After lab renovation, equipment and technical advisor arrival (estimated after 12 months)		Cost supplied by AID/W ——
3. Two (2) MSU contract consultants after 18 months to present a 2 week training course in-country.		Cost supplied by AID/W ——
GRAND TOTAL		

APPENDIX E

General Time-Frame Schedule of Activities

		Month
I. First Year		
1.	Revision of PP (assumed Sept. 1, 1977)	0
2.	Develop equipment list and specifications for seed laboratory	1
3.	Develop design for seed laboratory renovation including office space and storage	1
4.	Develop design for seed storage units - two 300 MT with conditioned storage designed for 1/3 of one of the 300 MT units.	1
5.	Order seed laboratory and seed storage equipment	1
6.	Identify two trainees	2
7.	Initiate renovation of seed laboratory	2
8.	Initiate construction of two 300 MT storage units	2
9.	Monitor renovation and construction progress by CDO	1-8
10.	Initiate search for technical advisor	4
11.	Two trainees depart for training, possibly Brazil in view of common language.	5
12.	Seed laboratory renovation completed	8
13.	Seed storage construction completed	8
14.	Seed laboratory equipment arrives (about Feb. 1978)	8
15.	Conditioned seed storage equipment arrives	8
16.	Technical advisor arrives	8
17.	Two trainees return	8
18.	Equipment installation and check out	10
19.	Seed laboratory and storage units become operational	12
II. Second Year		
1.	Schedule one week consultation by MSU seed specialist	13
2.	Identify four trainees for 2 month training (probably Brazil)	13

II. Second Year cont.	Month
3. Trainees depart for training	14
4. Technical advisor conducts in-country training, coordinates with FAO rice seed project at Contuboel, monitors out-lying seed storage units	12-24
5. Trainees return	16
6. Technical advisor assists in establishing laboratory routines and overall seed testing program.	16-24
7. Two week in-country training course by two MSU contract consultants.	18
8. Two trainees identified for BS degree in U.S. (English required)	22

APPENDIX F

Qualifications and Scope of Work
Technical Assistance Advisor
Seeds

The end result of the grant agreement between the U.S.A (AID) and the republic of Guinea-Bissau will be a seed testing and quality control laboratory, two new seed storage units, 300 MT each (1/3 of one to be conditioned storage for experimental seed stocks) and a total of 1000 MT renovated storage strategically located throughout GB (from the existing PP it is understood that 10 individual storage units are to be renovated).

For these components to become integrated into one complete seed program, a technical assistance advisor is required for a period of at least 12 months. His arrival in Guinea-Bissau should coincide with the anticipated target date set for the arrival of equipment, renovation of the seed laboratory, construction of the two new seed storage units and renovation of as many of the out-lying seed storage warehouses as possible.

It is also advisable that at least two trainees from Guinea-Bissau be identified, one being designated the Seed Division (Section) Chief, and sent for training in Brazil (language facility) so that they will be available as counterpart staff during the organization and development of the seed program.

Qualifications

1. Portuguese language capability - FSI rating of 2.0.

2. BS or MS degree in Seed Technology or Agronomy Crops.

3. Working knowledge and concepts of seed testing routine and techniques to include purity and germination procedures and seed quality evaluation techniques.

4. Have a working knowledge of all general types of equipment found in a seed testing laboratory.

5. Possess a basic knowledge of seed storage principles and relationships among environmental factors and their effects on seeds.

6. Possess a basic understanding of controlled seed storage structures and equipment to include air conditioners and dehumidifiers.

7. Understand basic requirements for seed production and quality control procedures.

8. Basic research capability in seed testing and quality evaluation.

9. Preferably some experience in the field of seed technology in developing countries, especially in those with tropical climates.

10. Desirable to have some teaching experience in the field of seed technology coupled with the ability to impart knowledge to personnel with all levels of training and experience, including small farmers.

11. Possess ability to adapt to and work effectively within the conditions found in a developing seed program in a developing country.

12. Willingness to travel throughout the country.

13. Ability to adapt to the life style and living conditions found in Guinea-Bissau.

14. Good health to withstand the rigors of working in the tropics.

Scope of Work

1. The technical advisor's arrival in Guinea-Bissau should coincide with the arrival of the seed testing and storage equipment. He will be responsible for unpacking, setting up the equipment and checking it for functional capability. This phase should be coordinated with the two trainees previously identified in the time-frame plan.

2. The TA should initially establish two distinct seed testing procedures, purity analysis section and germination section. Within each routine, procedures, record keeping and reporting must be established.

3. He should provide assistance in setting up a simple administrative section for records, personnel and reporting.

4. He should be capable of verifying the operational capacity of the conditioned seed storage rooms, mainly the air conditioners and the dehumidifier. He should provide guidance in maintenance and up-keep of this equipment.

5. He should travel periodically to the out-lying seed storage warehouses to advise on proper storage, cleanliness and take samples of seed for quality evaluation.

6. He should coordinate and cooperate with the FAO rice seed multiplication project at Contuboel by sampling and testing their seed.

7. He should advise in setting up seed demonstrations at the village level. This could be coordinated with available extension-type personnel.

8. If possible he should assist in developing simple posters (literature) on the benefits of using improved seed in order to reduce planting rates and ensure adequate stands.

9. He should initiate attempts to determine the present seed supply situation in rice, peanuts, corn and sorghum and project future requirements. He may be able to obtain assistance in this area from economists, marketing advisors and crop production specialists.

10. He should conduct a continuous in-country training program, especially with counter-part personnel, and he should coordinate third-country training programs (assist in evaluating and selecting trainees).

11. Determine basic research needs and capacilities for short range (2-5 years) and long range (5-10 years).

APPENDIX G

Suggested Equipment for Pathology Laboratory
(List is supplemental to original list submitted in FAO Project)

	Item	Approx. Cost US $
1.	Binocular research microscope 4x, 10x, 45x, 100x Ao microstar Model xL 10BJ-QW (operable on 220 v, 50 cy.)	$1700.00
2.	Stereoscopic Microscope variable zoom 7x - 30x B & L Model AVB-73 plus lamp (operable on 220 v, 50 cy.)	700.00
3.	Sterilizer, steam pressure, electric Market Forge Sterilmatic 16" x 26" chamber dimensions (operable on 220v, 50cy)	2000.00
4.	Oven, hot air sterilizer (operable on 220 v, 50 cy.)	250.00
5.	Oven, gravity connection Thelco Model 17 (operable on 220 v, 50 cy)	600.00
6.	Refrigerator with separate freezing unit (operable on 220 v, 50 cy)	450.00
7.	Isolation chamber Dust hood (Air control, Inc.) (operable on 220 v, 50 cy)	600.00
8.	Incubator, low temp. 0° to 50°C, 15 cu. ft. (operable on 220 v, 50 cy)	750.00
9.	Balance, Analytical sensitivity 1/10 mg., 200 gm capacity	400.00
10.	Balance, torsion 2000 gm capacity 1/10 gm. sensitivity	275.00
11.	Water still, 1 gal./hr. with low water cut-off (operable on 200 v, 50 cy)	700.00
12.	Distilled water storage tank 10 gal. capacity	400.00
13.	Air pump, pressure/vacuum	120.00
	TOTAL	$8945.00
14.	Expendable items (attached list)	2055.00
		$11000.00

Expendable Items for Plant Pathology

1.	400 glass petri dishes 100 x 10 mm	400.00
2.	12, Twelve plate copper petri dish holders for sterilization	200.00
3.	Beakers	200.00
4.	Erlemmeyer flasks	300.00
5.	Test tubes	
6.	Vials	
7.	Bottles	
8.	Funnels	
9.	Burners	
10.	Alcohol lamps	
11.	Transfer needles	
12.	Scalpels	
13.	Probes	
14.	Scissors	
15.	Cylinders	
16.	Chemicals	
17.	Media and Agar	
18.	Sieves	
19.	Blender	

APPENDIX H

Possible Time-Frame Schedule for Plant Pathology

1. Revision of PP
2. Equipment list and specifications
3. Plant pathology laboratory design
4. Identify three trainees
5. Order laboratory equipment
6. Initiate renovation (or construction) of laboratory
7. Monitor renovation and/or construction.
8. Three trainees depart for training (suggested IITA)
9. Initiate search for Technical Advisor
10. Laboratory renovation/construction completed
11. Technical advisor arrives
12. Three trainees return
13. Equipment arrives
14. Equipment installation and check-out
15. Laboratory becomes operational
16. Possible pathological consultant-one week
17. Additional trainees identified for BS degree training

Appendix I

Proposed Design and General Considerations for a 300 Ton Bagged Seed Storage Building for Guinea-Bissau

1. Basic building size and configuration

   1.1 300 ton is a convenient minimum basic size of standard store module. Suitable dimensions are 15 m X 30 m X 4 m to eave.

   1.2 These basic dimensions will allow stacks of 6 m X 8 m of approximately 30 tons per meter of height. This size stack is convenient for fumigation and allows adequate space for gangways between stacks

   1.3 This basic size building can be modified to provide a conditioned storage area. Sheet 2 of the attached drawings show one-third of the area provided with a ceiling and walls that have been vapor-proofed and insulated to control the temperature and prevent infiltration of moisture vapor into the area. This area will accomodate two 6 m X 8 m stacks that will have a capacity of approximately 120 metric tons.

2. Siting of Store

   2.1 Consider soil load-bearing capacity

   2.2 Avoid excessively wet areas. Choose a location that is well drained and can be kept dry all year round.

   2.3 Avoid sloping sites, if not avoidable make one or more drainage tren (cut-off drains) across the slopes uphill from the store to convey drained water around and away from the foundation of the store.

   2.4 If possible orient the long axis of the store east-west to minimize heat absorption from the sun.

   2.5 Consider carefully disposal of rain water collected by the roof. Let the rain run off the roof on to a wide concrete or stone path.

2.6 Consider access by vehicles

(1) To site

(2) Around store to doors or loading ramps. Ensure adequate widths for large trucks, on roads, turning circles and concrete "aprons" in front of doors.

2.7 Electric power is required for airconditioners in the controlled temperature storage area and is desirable for lights in the entire building.

2.8 Take into account future expansion or development of the site.

3. General Specifications

3.1 General arrangement - see sheet 1 of attached drawings. Several door locations are shown, some of which will not be required. After the building site has been decided, give careful consideration to the number and location of the doors. Doors are also important for ventilation and lighting.

3.2 Dimensions of basic store building - Builders tendering for the design, fabrication and supply of the structure, may wish to make minor modification to these dimensions to suit their own stock building size. The nominal dimensions shown are:

(1) Span 15 meters

(2) Length 30 m

(3) Height 4 m from floor level to underside of stanchions (pillars) giving 4 m working headroom.

(4) Roof pitch approximately 17-20 degrees.

(5) Eaves overhang 1 m along length except overdoor where the overhang is 3 m.

(6) Roof overhang at gables 1 m

(7) End door awning 3 m

3.3 Materials

3.1 Frame: Reinforced concrete stanchions (columns) connected at the top by a continuous beam of the same material

Alternate - Mild steel universal section columns and portal rafters with pressed steel or cold rolled purlins, angle eaves rails, wind struts, side rails, etc.

3.2 Roof and awnings: Structural framework of treated timber covered with baked brick tiles.

Alternate - covered with corrugated sheeting of galvanized steel or aluminum. End lap minimum 0.2 m side lap 0.15 m.

3.3 Doors: Double-leaf wood sliding door clad with galvanized steel or aluminum, giving a clear opening approximately 4 m X 3 m. All doors to run outside the building and be supplied complete with all track and door gear. Rodent guard-door about 1.0 m high should be fitted across the door width, hinged at the main door posts, clad with smooth metal sheet with a 1.5-2.0 cm overhang (outward) at the top. These rodent door should be hinged halfway along its width so that it "breaks" upon opening and hence will not collide with a nearby stack.

3.4 Ventilators: Louver type construction, not less than 0.5 m deep may be fitted at the top of the side walls. The openings should be covered with a fine wire mesh.

Alternate - Ventilators of galvanized steel frame and cladding, each giving an opening not less than 1 m high X 2 m wide, should be located in each gable.

3.5 Walls: Local concrete cavity block. Steel reinforcing bars inside block work to 1.5 - 2 m above floor level.

3.6 Floor and foundation: Local concrete

4. Construction of foundations, floor and walls

4.1 Preparation of site: It is extremely important to have a firm base for foundations and floor. A loosely compacted base will settle over time and will crack, cracks harbor insect infestations.

4.2 Foundations: The weight of the roof is transmitted to the ground by the columns, supported on concrete foundations. The manufacturer of the structural steel framework (if this type structure is used) should give recommendations for foundations for their steel framwork as related to local soil load-bearing characteristics.

4.3 Reinforcing: Mild steel reinforcing will be needed for walls, floor and foundations. Professional guidance should be given on reinforcing requirements to suit local conditions.

4.4 Walls: Should be built from hollow, dense concrete blocks, reinforced from foundations to 1-2 m above floor level. Good workmanship is essential. Blocks must be correctly bedded, using correct mixes. Correct bonding is important to ensure: that vertical joints are staggered, that hollows to be filled are placed accurately one above the other, that steel reinforcement is overlapped and that concrete used to fill the hollows is well compacted all the way. Metal rods, through the columns, built into the horizontal mortor layers between block will provide lateral support.

4.5 Wall finishes: Plaster inside surfaces but not exterior surface, which require a good cement wash followed by a white or light colored bituminous paint or other approved damp proofing treatment.

4.6 Floor: Design final floor level to be higher than adjacent roadway and ground levels which should be sloped away from the floor and walls. Arrange an outfall slope to doors of 50 mm in 3 m for the final floor surface. A damp proof course of thick plastic or other approved vapor-moisture barriers may be laid immediately below or in the center of the floor concrete. Thickness of the floor concrete should be at least 150 mm. Concrete mixture should be made up with as little water as possible. Lay the concrete in convenient width bays (say 3 m) and consolidate it thoroughly. Freshly laid concrete should be prevented from drying rapidly and kept damp from 7-10 days by covering with polythene sheeting or bituminous felt. Keep all traffic off setting concrete for 14 days at least. When concrete has dried firm it will have shrunk slightly and openings at joints between concrete masses must be filled up with flexible filler such as bituminous based mastic. Mastic should also be forced into all small openings where steel meets masonry.

Appendix

Proposed Modifications to Basic 300 Ton Seed Storage Warehouse to Provide Conditioned Seed Storage Area

1. Basic size and configuration of conditioned area.

1.1 One-third of the warehouse, an area 15 m X 10 m, preferrably the east end, to be provided with a ceiling and walls that are vapor proofed and insulated.

1.2 Two airconditioners to be mounted through the outside walls. See sheet 2 of attached drawings for suggested locations.

2. General Specifications

2.1 General arrangement - see sheet 2 of attached drawings. Locations are shown for two walk-in type refrigerator doors, which permits entrance from the outside as well as from the other portion of the warehouse.

2.2 Materials

2.2.1 Walls : Block walls to be provided with 2 x 6 nailers to which two layers of rigid insulation is attached (all joints staggered) after a vapor barrier (hot tar or 6 mil polyethylene) is applied.

2.2.2 Ceiling: Wooden joists supported by the walls and braced rigidly to the roof framework to be covered with T & G or plywood ceiling. Two layers of rigid insulation (all joints staggered) to be applied to ceiling after applying a vapor barrier (hot tar or 6 mil polyethylene).

2.2.3 Floor: The entire slab of the warehouse to be poured over a 6 mil polyethene vapor barrier. An additional vapor barrier (hot tar) should be applied under the wearing flow inside the conditioned storage area.

2.3 Equipment and Supplies

2.3.1 Vapor barrier - 6 mil polyethene
(800 m^2 needed)

2.3.2 Insulation - 5 cm polystyrene
(700 m^2 needed for two layers)

2.3.3 Refrigeration-type doors, framing & hardware
(Two needed)

2.3.4 Airconditioners - 28,000 BTU/hr
(Three needed, including one spare)
Connected load - two units - 8.0 KVA

2.3.5 Dehumidifier - desicant type
(One needed; moisture removal capacity - 12.0 lbs./hr. with inlet condition of 50 grains at 75°F.)
Connected load - 12.0 KVA