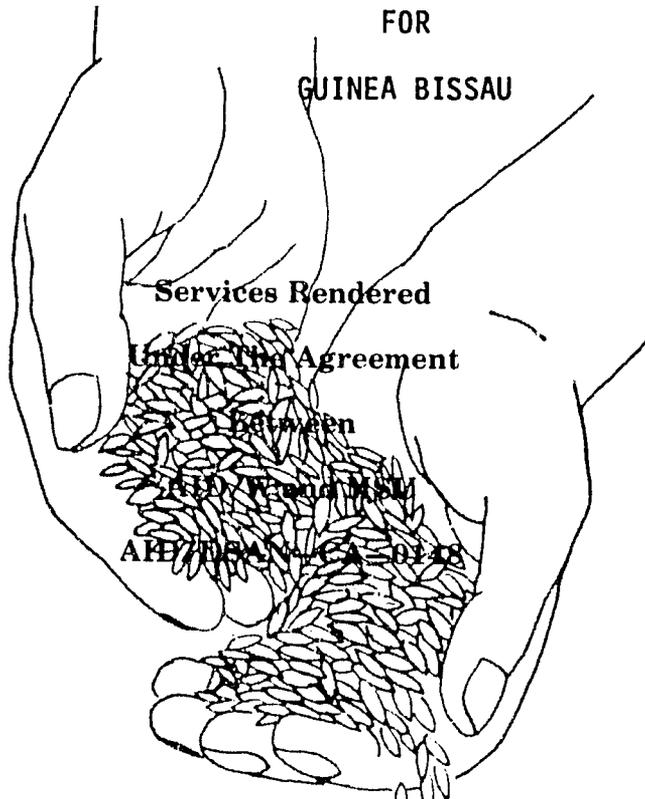


AID/W  
USAID/Guinea-Bissau  
Govt. of Guinea Bissau

REVIEW OF SEED PROGRAM,  
SEED TESTING LABORATORY  
AND SEED PATHOLOGY LABORATORY

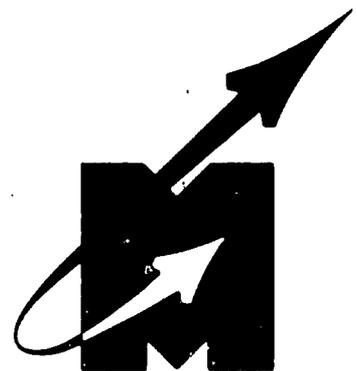
FOR  
GUINEA BISSAU



Services Rendered  
Under The Agreement  
Between  
AID/W and USAID

000805

SEED TECHNOLOGY LABORATORY  
MISSISSIPPI STATE UNIVERSITY  
MISSISSIPPI STATE, MISSISSIPPI



Report To  
AID/W, USAID/GUINEA BISSAU  
and GOGB

ON  
REVIEW OF SEED PROGRAM  
SEED TESTING LABORATORY  
SEED PATHOLOGY LABORATORY  
FOR  
GUINEA BISSAU

April 27 - May 7, 1985

Services Rendered  
Under the Agreement  
between  
AID/W and MSU  
Contract AID/DSAN-CA-0148

SEED TECHNOLOGY LABORATORY  
Mississippi Agricultural and Forestry Experiment Station  
Mississippi State University  
Mississippi State, MS

May, 1985

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### Acknowledgements

I acknowledge with appreciation the assistance provided by the USAID/GB staff who provided resources and logistical support. Mr. Gussie Daniels, AID Representative to GB was quite helpful and intent in analyzing and choosing the best alternatives to problems which must be resolved prior to the end of the project (Dec., 1985). In addition, appreciation is extended to Mr. Tim Rosche and all of the USAID staff for their cordial acceptance during my brief visit.

Respectfully,

---

C. Hunter Andrews

## REPORT SUMMARY

TITLE: Review of Seed Program, Seed Testing Laboratory and Seed Pathology Laboratory for Guinea Bissau

CONTRACT: MSU/AID/DSAN-CA-0148

CONSULTANT: C. H. Andrews, Seed Technology Laboratory

PERIOD OF CONSULTATION: April 27 - May 7, 1985

## Summary

In 1977 this consultant traveled to Guinea Bissau to evaluate the initial project, specifically the seed component, and to prepare equipment specifications for seed testing and seed pathology. The seed testing lab, begun in 1980, was completed in 1982. A technical consultant (Mike Maxey) was assigned to the project for two years during which the seed lab equipment was received, installed and became functional.

Mrs. Nharebat Intchasso completed her MS degree at Mississippi State in Seed Technology, and five Bissauan technicians received four weeks training at MSU and 6 months training in Brazil. The laboratory is complete and the personnel are now in place to begin work.

This assignment consisted of preparing a supplementary equipment and supplies list for seed testing and to re-confirm the basic needs for seed pathology. In addition alternatives for a National Seed Program are explored together with some considerations for a national program of seed control and certification.

## TERMS OF REFERENCE

The terms of reference were outlined in a cable from USAID/GB (Bissau 0817 April 1985) as follows:

1. Advise and assist GOGB seed department in establishing a seed quality control and certification program.
2. Advise and assist in establishing guidelines for National Seed Policy.
3. Prepare equipment specifications and recommend supplies for seed testing laboratory.
4. Advise on equipment and supplies for a seed pathology laboratory which is under construction.

## SUMMARY OF RECOMMENDATIONS

1. Recommend immediate action to prepare PIO/C for appropriate equipment and supplies to supplement the operational needs of the seed testing laboratory. (See Appendix D).
2. Recommend immediate action to prepare PIO/C for appropriate equipment and supplies for basic needs in seed pathology (see Appendix H).
3. Consideration be given to request of Seed Lab Director, Mrs. Nharebat Intchasso, for non-technical equipment to assist in routine laboratory functions.
4. Follow through with plans to send participant (Alcilia Monteiro) for academic training in Seed Pathology to U.S.
5. Identify one additional participant for non-degree training -laboratory techniques and procedures - in seed pathology and send to appropriate institution in U.S.
6. Send two (three) lab technicians for additional training in seed testing, control and certification - probably in Brazil, Portugal, or U.S.
7. Request two Seed Specialists from MSU/AID contract to conduct in-country training course in seed technology in October/November 1985. Course should coincide with anticipated follow-up trip of MSU seed specialist after equipment and supplies arrive.

8. Recommend follow-up action to send Mrs . Nharebat Intchasso (seed lab director) to U.S. for one month Management Training Course. A 2-3 day visit to MSU Seed Technology Lab after termination of course will be advisable if time permits. This will allow summarization of her program and planning for course in Guinea-Bissau in October.
9. Recommend that GOGB administration (Ministry of Agriculture) give immediate consideration to National Seed Program planning, authorization and structure.
10. Complete seed pathology laboratory as discussed and coordinate its functions with the seed testing laboratory.

SUMMARY OF COST APPROXIMATIONS

I. Equipment/Supplies for Seed Lab and Seed Pathology:

1. Equipment/Supplies for Seed Lab	\$ 8,151.30
2. Non-technical Equipment for Seed Lab	6,850.00
3. Equipment/Supplies for Seed Pathology Lab	10,559.43
4. Taxonomic References	<u>500.00</u>
Sub Total	\$26,060.73

II. Training Costs

	<u>Approx. Cost</u>
1. One participant in Seed Pathology for degree training.	\$60,000
2. One participant in Seed Pathology for laboratory technical training.	10,000
3. Two-three seed lab technicians trained in Brazil/Portugal/U.S. for one month.	5,000
4. Management Training for Mrs. Nharebat Intchasso	3,000
5. MSU contract training course in October/November.	-----
Sub Total	<u>\$78,000</u>

III. Additional Vehicles

1. Possibly two all-purpose vehicles for Seed Lab.	20,000	
Sub Total	<u>\$20,000</u>	Total: \$124,060.73

- NOTE: (1) Costs estimates for equipment and supplies are current catalogue quotations. Allowances have not been made for crating and shipping costs.
- (2) Training costs based on allowances of \$20,000 per year for Academic training.
- (3) Vehicle costs are merely estimates.

REPORT TO  
USAID/GUINEA BISSAU AND AID/W  
ON REVIEW OF  
NACIONAL SEED LABORATORY AND  
SEED PATHOLOGY LABORATORY  
GUINEA BISSAU

I. BACKGROUND

In 1976 a project was developed for Guinea Bissau in which seed improvement was identified as one component for the development project. In July 1977 Dr. C. H. Andrews, (MSU/AID contract) provided technical assistance to the project by analyzing the project status and providing recommendations for seed laboratory equipment for the seed testing laboratory at Granja Pessebe. In addition, discussions were conducted concerning the development of a plant pathology laboratory which would eventually become involved in seed pathology work. A suggested equipment list for plant pathology was prepared which was based upon previous suggestions submitted by FAO.

Construction on a new seed testing laboratory began in 1980 and was completed in 1982. The equipment was ordered and received during the time when a Technical Assistance Advisor (Mike Maxey) was in country. The laboratory equipment was set up and became operational prior to the departure of the Technical Advisor. Four Bissauan technicians were trained for 6 months in Brazil and 4 weeks in the fundamental operational concepts of seed testing at the Seed Technology Laboratory at Mississippi State University. In addition, Mrs. Nharehat Intchasso completed

her Master of Science degree in Seed Technology at Mississippi State and returned to Guinea-Bissau in December 1984 to assume the responsibilities of directing the seed laboratory.

Thus, the facilities, equipment and personnel are in place to begin the essential tasks of establishing a sound seed improvement program for Guinea Bissau. The next logical step in advancing seed improvement is to establish a NATIONAL SEED PROGRAM, define its role and objectives and establish the relationship of the National Seed Laboratory within the Ministry of Agriculture. This will be essential to the continued functioning and productivity of the laboratory and will establish its role in relation to other agencies.

## II. CURRENT SITUATION

The Central (National) Seed Laboratory is now completed, equipped and staffed. It began testing seed in 1982 and reached a maximum output of 536 samples in 1983 (see Appendix A for yearly totals).

A typical yearly schedule for the laboratory is as follows:

<u>Time Period</u>	<u>Function</u>
January - April	Visit every seed storage house to collect seed samples from previous crop production cycle.

Return samples to Seed Lab for testing and quality evaluation (purity & germination).

Each sample receives a lab number, divided into typical working sample and receives a purity and germination test.

April - May

Results of purity and germination tests are recorded. Three copies of results are made-

1 copy remains at lab

1 copy goes to MAG

1 copy is returned to origin (-producer or project).

The rainy season begins in May - June maybe continuing sporadically through August or September.

May - June

Seed which were tested during January - April are now planted during rainy season. Crop is produced and harvested in August -December, depending upon planting date.

August - December	Seed lab now samples seed storage houses once again for seed just produced.
November - December	Germination and purity results are available on recent crop seed just prior to going into storage. The seed are then stored the following year for 2 to 4 months.
January - April	Seed laboratory once again visits every storage unit and takes seed samples for testing prior to planting the next crop to verify quality of seed during storage.

**\*\* NOTE:** If the laboratory results indicate poor quality seed (low germination), then the originator (Project) may select other seed instead. However, this "new seed" may not be tested through the previous sequence. Also, if no other "seed" is available, then these "poor seed" may be used. Sometimes, if farmers receive this "poor seed", they complain to the storage-distribution center, and confidence in the system is compromised.

The organizational and staffing pattern of the Central Laboratory in Bissau is shown in Appendix B. Recommendations for additional equipment and supplies for this laboratory are in Appendix

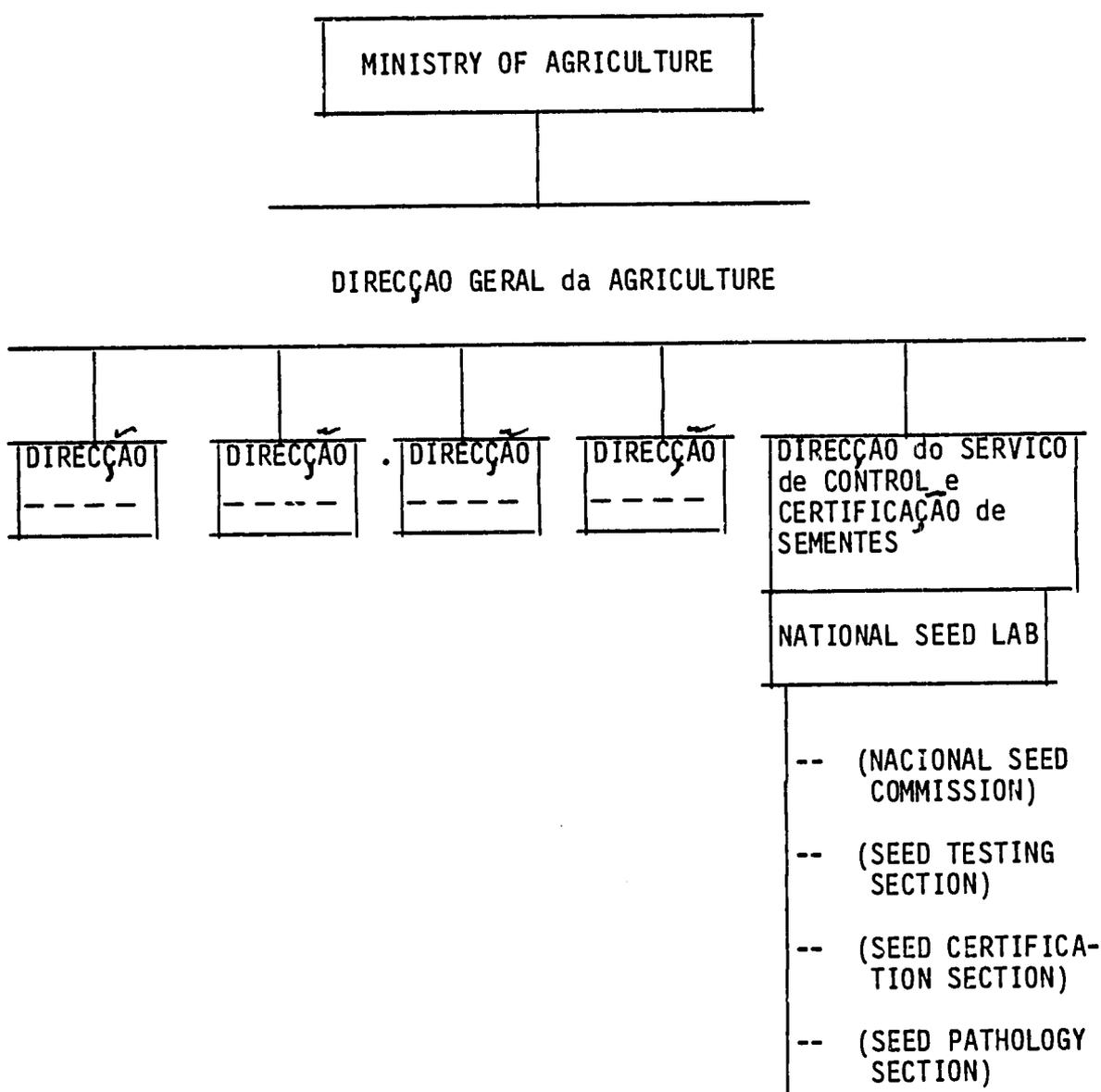
C. (Note: Appendix D project items of non-technical nature).

There are three other "seed" laboratories in strategic locations in Guinea-Bissau. These are associated specifically in separate regions (maybe with different or specific functions) usually related to a specific project in a region. One lab at Contuboel, supported by FAO project, is designed to operate within the confines of the FAO experimental station (or project). Another lab at Bafata (FAO Project) and one at Cabochanque (FRENCH Project) are also associated with "projects". It is not clear at this time as to the role these labs will play in a National Seed Program, if in fact, a National Program is mobilized. However, these labs could play a significant role in assisting the objectives of a National Seed Program. In addition, they could continue to conduct research with experimental seeds of their particular projects, which appears to be the major emphasis at the present time.

### III. NATIONAL SEED PROGRAM

It appears that the Government of Guinea-Bissau (GOGB) is anticipating some immediate action to set up, establish or designate a National Seed Program with the Central Laboratory in Bissau as the National Lab to guide and coordinate the entire program. Discussions have been conducted at the administrative level, and it appears that maybe two possible versions of a national program are emerging.

One concept seems to result in an organigrama where the central lab in Bissau appears rather lost or obscure in the lower echelons without apparent status or necessary recognition to function properly. Another concept, a result of recent discussions of a seminar at Contuboe1, seems to favor establishing a NEW Direcção Direcção do Serviço de Controle e Certificacao de Sementes equal in status with the other existing four Direcçao. This proposal is considerably more acceptable and in line with similar National Seed Programs in countries which are developing National Seed Programs similar to Guinea-Bissau. In this concept the Central, hence National Seed Laboratory in Bissau, will assume the distinction and designation as the Control and Certification Agency for seeds under the direct designation of the Direcçao Geral da Agriculture (organigrama of the Ministry of Agriculture). Thus, a possible abbreviated flow chart (organigrama) could appear as follows:



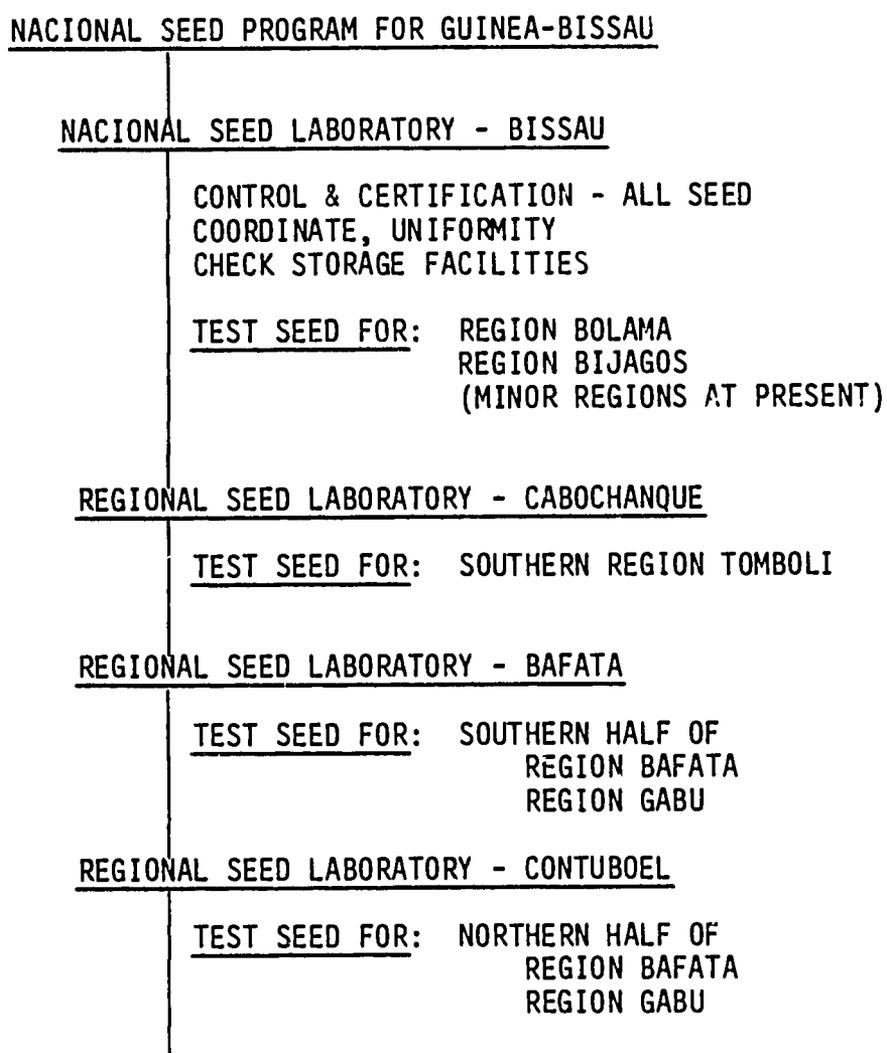
To further add the necessary cohesiveness to a National Program, the relationship between the Central Laboratory in Bissau and the outlying "regional" laboratories must be established in the near future so that each facility will know its purpose and responsibilities within the "new" National Seed Program Concept. At the present there appears to be two main directions (or responsibilities) for seed

improvement work in Guinea-Bissau. There is a definite need for seed research as one area and then a need for seed testing, control and certification as a second area. To sort out who will do these tasks, to coordinate the efforts, and to standardize the program will be a major and important task.

The three project laboratories (regional) may be designated to conduct primarily research with seeds within their existing programs. It appears, however, that the seeds from these projects actually do get into the so-called "commercial channels" (to land owners or farmers); hence, they should then be subject to national control and certification. Therefore, the Central (National) Seed Lab must have some association with these programs if a successful National Seed Program is to develop in Guinea-Bissau.

One concept which appeared feasible and which works in similar developing programs was proposed and discussed in detail with Mrs. Nharebat Intchasso who is the Director of the Central Laboratory. This concept involves establishing the Central Lab in Bissau as the National Lab with coordinating control for testing and certifying seeds for the entire country. Then, the regional labs could test seeds for germination within their specific region of responsibility, provide the Central lab with their results, and then the Central Lab could proceed with the certification process. This would mean some official response from the GOGB (Ministry of Agriculture) to notify these labs of their "new" responsibilities.

A possible organization along such guidelines would be as follows:



This proposal does not include any services for Regions Cacheu or Oio (western sector). Future development plans could include establishing fundamental seed testing services, similar to the other regional labs, at either Catchunga or Bissora. Otherwise, the Central (Nacional) lab at Bissau will have to assume this responsibility. See map of Guinea-Bissau (Appendix D) for proposed regional labs and responsibilities.

This approach to a National Seed Program provides an advantage of relieving the Central lab in Bissau of the extreme difficulties in communicating and transporting seed samples from far-out regions back to Bissau. The regional labs could maintain closer contact within smaller areas and probably serve the National program to a better degree. The Central lab would, of course, maintain close contact with each regional lab, making periodic checks and visits to the labs and to the out-lying storage centers and production areas. A centralized program such as this with regional labs and a closely coordinated program would establish credibility to the program at the farmer level and should tend to promote even the research programs at the regional project laboratories.

This approach may not be an acceptable alternative to the long-range planning programs in Guinea-Bissau. There remains doubt that the regional project labs can be brought into a National Program due to their regional identity or specific Project program or support. However, it is well to advise the danger of allowing regional labs to become entrenched and develop a completely separate "seed Program", entirely separate and outside of the National Program. Thus, at some early date, the relationship among the regional-Project labs and the Central (National) lab in Bissau must be clearly defined.

An alternative plan would be to designate the Central Laboratory in Bissau as the National Lab with direct control for quality evaluation and certification of all seed in Guinea-Bissau. This is an approach the Laboratory may be attempting to accomplish at the

present. It has been pointed out that the lab tested 536 samples of seed in 1983 and continued to sample and test seed in 1984 and currently in 1985. If this laboratory is to maintain its pace, which will probably accelerate under the new concept of National Seed Program status, it must receive additional and continued outside (donor) support similar to the other Project laboratories (Contubœl for instance). At present the lab is without essential supplies for effective operation. Anticipated problems with transportation to out-lying regions for seed sampling, storage inspections and general coordination of such a National program create a dim outlook and cause confusion and uncertainty.

Granted, the laboratory has probably been too long in construction and completion. This problem is unfortunately repeated in many similar situations in other countries. However, considerable investments have been made in personnel and facilities - an infrastructure now is in place upon which to build a more successful program. It appears essential that such an investment and opportunity should be adequately supported, at least until confidence in the program is adequately established.

#### IV. SEED PATHOLOGY LABORATORY

The concept of a Plant Pathology Laboratory was included in the scope of work in the 1977 visit to Guinea-Bissau. Apparently, earlier suggestions by FAO instilled the idea of the necessity of this

area of work, and a revised suggested equipment/supplies list was submitted in the 1977 report (TA 77-05 Seed Technology Laboratory, Miss. State University).

In this current assignment, it appears that the concept of a Plant Pathology Laboratory has now been converted to an idea of a Seed Pathology Laboratory. At the present an existing building adjacent to the seed lab is being remodeled for seed pathology work. I will hasten to suggest that in-depth seed pathological work could hardly serve a real useful purpose in Guinea-Bissau considering the urgent needs just in the seed quality control and certification programs. Just an initial outlay of approximately \$10,000 will be necessary to begin even the most basic pathology work. However, in view of current commitments and considering that joint work between seeds and pathology may prove to be beneficial, minimum expenditures in this area are advised.

Since the building is already in mid-stage of renovation and the overall designed has been reduced in scope, its completion is considered advisable. The building should provide some support to the existing seed lab in that it will have an air conditioned storage room which can jointly be used for pathology and seed testing (storage). In addition, the laboratory in this building should be useful in joint efforts by both areas.

The type of seed pathology work envisioned for this laboratory should begin on rather a basic and practical scale. First, imported seeds, both crop and vegetable, could be evaluated for diseases. The

difficulty of this, however, is trying to decide what to do in case the seeds may be contaminated. First, the diseases must be identified as harmful (unwanted), and then decisions as to what action to take must be made. Nevertheless, seed pathological work can provide information on diseases present, those on imported seeds, and possibly how to treat or control the pathogens.

One possible service from such a lab will be to provide the research project labs information on the disease status of their experimental varieties - resistance or susceptibility to certain seed pathogens. Such information could be useful in breeding programs.

In attempting to suggest necessary equipment and supplies for a Seed Pathology Laboratory, it is advisable to keep in mind that some of the equipment is refined and requires adequate (continued) maintenance. Additionally, seed pathology work requires large (and expensive) quantities of expendable supplies for reliable results. These requirements could impose additional stress upon a program that is already suffering from inadequate support.

An updated and fundamental list of equipment and supplies are provided in Appendix H. These suggestions were provided with help from the Plant Pathology Department at Mississippi State which does involve itself in Seed Pathology work. This list is quite similar to the initial list submitted in the 1977 report and bears out the fact that basic seed pathology work requires somewhat uniform equipment and supplies.

## V. SEED TECHNOLOGY TRAINING

The Central Seed Laboratory has a basic core of qualified personnel to conduct the routine assignments of the lab. This laboratory is fortunate in having Mrs. Nharebat Intchasso as its director, since she has received broad training in all aspects of seed technology. She returned to Guinea-Bissau in December 1984, having completed her Master of Science Degree in Agronomy-Seed Technology at Mississippi State University. She is the only well trained and qualified Seed Specialist in Guinea-Bissau.

In addition, the seed lab staff consists of 16 technicians who have received some basic instruction in seed testing work. Three of these people received 6 months training in Brazil and also 4 weeks at the Seed Technology Laboratory in Mississippi. Thus, the lab does have the foundation of persons qualified to accomplish the tasks which lie ahead.

Time permitting, however, some additional training would be advisable. Assuming that the seed pathology laboratory gets established, then at least two (2) persons should be trained in this area. It appears that one lady has already been identified for a three year academic program; thus, one additional person would be advisable -even if this training is not degree training but rather practical laboratory training in pathological techniques and procedures.

It would also be advisable to send two or three laboratory technicians for additional training either in Brazil (Portugal) or the U.S. Brazil has the advantage of language, while the U.S. probably has an advantage of a broader range of techniques and experiences. U.S. training would, of course, require a translator.

Another approach utilized by a number of countries has been to conduct in-country training course. The MSU/AID Contract continually provides two instructors for usually a two week course which covers fundamental concepts and utilizes practical exercises and indigenous supplies and materials for seed improvement work. Here again, translations would be necessary, but with the trained people already in Guinea-Bissau this should be no problem.

This concept might be coordinated with the projected return visit of an MSU seed specialist in October/November 1985 for installation and check-out of any new equipment and materials. A prime consideration along these lines would be in-country logistics for both the instructors and the participants.

One other training area which would be advisable is the idea proposed by USAID. In view of the fact that Mrs. Nharebat Intchasso is the Director of the Seed Laboratory and since she already has and will have additional responsibilities under the new National Seed Program, it appears to be appropriate to send her to a selected Management Training Course in the U.S. These programs are numerous, and the time, scope and course duration will probably be a deciding factor.

## APPENDIX A

ITINERARY AND CONTACTS

April 27	AM	Depart MSU
	PM	Depart USA
April 28	AM	Lay-over-Portugal
	PM	Lay-over-Portugal
April 29	AM	Depart Portugal
	PM	Arrive Guinea-Bissau
		USAID Briefing - Mr. Tim Rosche
		Assistant to Agricultural Development Office
		Mr. Gussie L. Daniels AID Representative
April 30	AM	Visit Seed Laboratory Granje-Pessebe Exp. Station Mrs. Nharebat Intchasso, Director
	PM	Visit Seed Laboratory Advise on Eqpt. Specifications Seed Pathology Laboratory
May 1	AM	Visit FAO Project & Laboratory Contuboel Travel with Tim Rosche'
	PM	Visit FAO - Contuboel
May 2	AM	Seed Laboratory - Granja Pessebe Mrs. Nharebat Intchasso Mr. Tim Rosche" Review Seed Pathology Laboratory Status
	PM	USAID Report Writing
May 3	AM	USAID Report Writing
	PM	USAID Report Writing
May 4		Saturday - Conclude Report

May 5		Sunday - Free Time
May 6	AM	USAID Briefing - Submit Report Mr. Gussie Daniels Mr. Tim Rosche'
	PM	Depart Guinea-Bissau
May 7	AM	In Route to MSU
	PM	Arrive at MSU

## APPENDIX B

## NUMBER OF SAMPLES TESTED BY THE SEED LABORATORY DURING 1982-1985

ESPECIES/ANOS	1982	1983	1984	1985	TOTAL
ARROZ	193	175	120	80	568
MANCARRA	64	18	79	47	208
MILHO	13	22	2		37
SORGO	6	16	4	4	30
MILHETE	5	8	3		16
FEIJAO	5	15	6		26
PIMENTO	3	5	3		11
PIMENTO - PICANTE	3	-	-	2	5
PEPINO	3	13	3	1	20
TOMATE	3	15	9	5	32
REPOLHO	3	10	10		23
ALFACE	3	10	10		23
QUIABO	3	1	2		6
ABOBORA	3	17	3		23

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ESPECIES/ANOS	1982	1983	1984	1985	TOTAL
COUVE TRONCHUBA	3	-	3		6
CEBOLA	3	6	4		13
MELANCIA	3	3	4		10
COUVE FLOR	2	1	3		6
COENTRO	2	1	1		4
CENOURA	2	5	6	1	14
MELAO	2	3	2		7
SALSA	2	-	5	1	8
NABO	2	4	-		6
BERINGELA	1	1	2	1	5
COUVE LOMBARDA	1	3	2		6
RABANETE	1	9	4		14
BETERABA	-	2	1		3
ERVILHA	-	8	-		8
ESPINAFRE	-	5	3		8
MOSTARDA	-	2	2		4

ESPECIES/ANOS	1982	1983	1984	1985	TOTAL
CAFE	-	1	-		1
TABACO	-	2	-		2
ASPARGO	-	1	-		1
BADIANA	-	1	1		2
BORRAGEM	-	1	1		2
BROCOLO	-	1	2		3
ALCRAVIA	-	1	-		1
AIPO	-	1	-		1
CEBOLINHA	-	1	1		2
AGRIAIO	-	1	-		1
ENDRO	-	1	1		2
ENDIVA	-	3	2		5
FUNCHO	-	1	1		2
ALFAGGMA	-	1	-		1
CHERIVIA	-	1	-		1
RUTABAGA	-	1	-		1

ESPECIES/ANOS	1982	1983	1984	1985	TOTAL
SALVIE	-	1	1		2
COLLARIOS	-	1	-		1
SEGURELHA	-	1	-		1
MANJERICAS	-	3	-		3
FLORES	-	131	-		131
GIRASSOL	-	2	1		3
ALGODAO	-	-	5	8	13
TOMILHO	-	-	1		1
TOTAL/ANO	334	536	313	150	1334

## APPENDIX C

## SEED LABORATORY STAFFING PATTERN

- 1) Nharebat Nancaia Intchasso - Directora do Servico de Controle e  
Certificacao de Sementes
- 2) Alcilia Monteiro - Directora - adjunto
- 3) Malam Sane' - Responsavel Tecnico do laboratorio
- 4) Alexandre Sanha - Responsavel da Germinacao
- 5) Alfredo Quemoda - Responsavel de Pureza
- 6) Armando Bora' - Responsavel do armazem
- 7) Mario Dama - Analista
- 8) Armando N'Bana - Jornaleiro
- 9) Clode N'Tode - Jornaleiro
- 10) Qeretugue Clute - Jornaleiro
- 11) Laia Cabi - Jornaleiro
- 12) Sana Nhasse - Jornaleiro
- 13) Maria Caetano - servente
- 14) Cima Na Suma - servente
- 15) Joaquim Mota - Dactilografo
- 16) Amido Balde' - Conductor

APPENDIX D  
EQUIPMENT LIST AND RECOMMENDED SUPPLIES  
FOR  
NATIONAL SEED TESTING LABORATORY  
GRANJA PESSEBE EXPERIMENT STATION  
BISSAU, GUINEA-BISSAU

ITEM NO.	CAT. NO.	QUANTITY	PROBABLE VENDOR	DESCRIPTION	APPROX. COST US	
					UNIT	TOTAL
1	Model 919	1	Seedburo Eqpt. Co.	Motomco 919 Moisture Tester complete with set of standard grain conversion charts - operation on 220 V, 50 cycle	\$ 640.00	\$ 640.00
2	No. 118	3	Seedburo Eqpt. Co.	Seedburo Magnifiers	27.50	82.50
3		1	Stults Scientific	Stults Model D-4 Dry Germinator No Water Curtain - Unit Capacity 22 Trays at 2" Spacing - To Operate on 220V, 50 cycle	3000.00	3000.00
4	No. 620	5,000	Seedburo Eqpt. Co.	Polyethylene Sample Bags N. 620 - 8" X 26" X .003 w/pockets	0.13M	650.00
5	SD3815	50,000	Anchor Paper Company	Germination Towels, Cut 10 inches X 15 inches, regular weight	18.85M	942.50
6		10,000	Anchor Paper Company	Germination Blotters, Cut 6" X 12" (basic 19 X 24) blue-gray	72.88M	728.80
7		10,000	Anchor Paper Company	Standard Filter Paper to Fit Disposable plastic Petri Dishes 100X15mm		700.00

8-757-12	4 cases	Fischer Scientific Co.	Petri Dishes, Sterilized, Disposable Plastic, 100 X 15mm 500/case, cat. #8-757-12	49.40	197.
No. 59	12	Seedburo Eqpt. Co.	Seedburo Forceps No. 59, 5" Long, Blunt Point, Nickle plated	4.10	49.
No. mm	12	Seedburo Eqpt. Co.	Seedburo Forceps No. mm 5-1/4" Med. Sharp, Nickle plated	4.10	49.
No. PB-B	5	Seedburo Eqpt. Co.	Replacement Batteries 9 volt, for Dole 400 Moisture Tester	2.00	10.
No. 103126	(100grn)	Seedburo Eqpt. Co.	Tetrazdium Powder 2-50grn pkg.	72.40	144.
	1,000	Spear Envelope Company	4-oz. Spear Envelopes	80.00	80.
	1,000	Spear Envelope Company	8-oz. Spear Envelopes	100.00/m	100.
	2,000	Spear Envelope Company	12-oz. spear Envelopes	125.00/m	250.
No. 8500	50	Seedburo Eqpt. Co.	N. 8500 3M Mask	8.35/ct	417.
No. 6308	10	Seedburo Eqpt. Co.	Counter & Bench Brush, 8" brush 14" overall length	5.25	52.
No. 10114	5	Seedburo Eqpt. Co.	All Tampico Fiber Floor Brush - No. 10114, 14" brush	11.40	57.

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TOTAL                      \$8,151.

## APPENDIX E

NON-TECHNICAL EQUIPMENT  
REQUESTED BY NATIONAL SEED  
LABORATORY FOR EFFECTIVE  
AND EFFICIENT OPERATION

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	<u>APPROXIMATE COST</u>
PHOTOCOPY MACHINE	\$5,000.00
MANUAL TYPEWRITER	500.00
SMALL HAND CALCULATORS (2)	100.00
ELECTR'C CALCULATOR	100.00
REFRIGERATOR	1,000.00
VOLTAGE REGULATOR	<u>500.00</u>
TOTAL	\$6,850.00

1/ Note: These items are requested by the staff of the seed laboratory to expedite operational techniques and procedures. Since they are not considered technical in nature, they are listed separately from Appendix C, Equipment and Supplies.

## APPENDIX F

ADDRESSES OF PROBABLE VENDORS

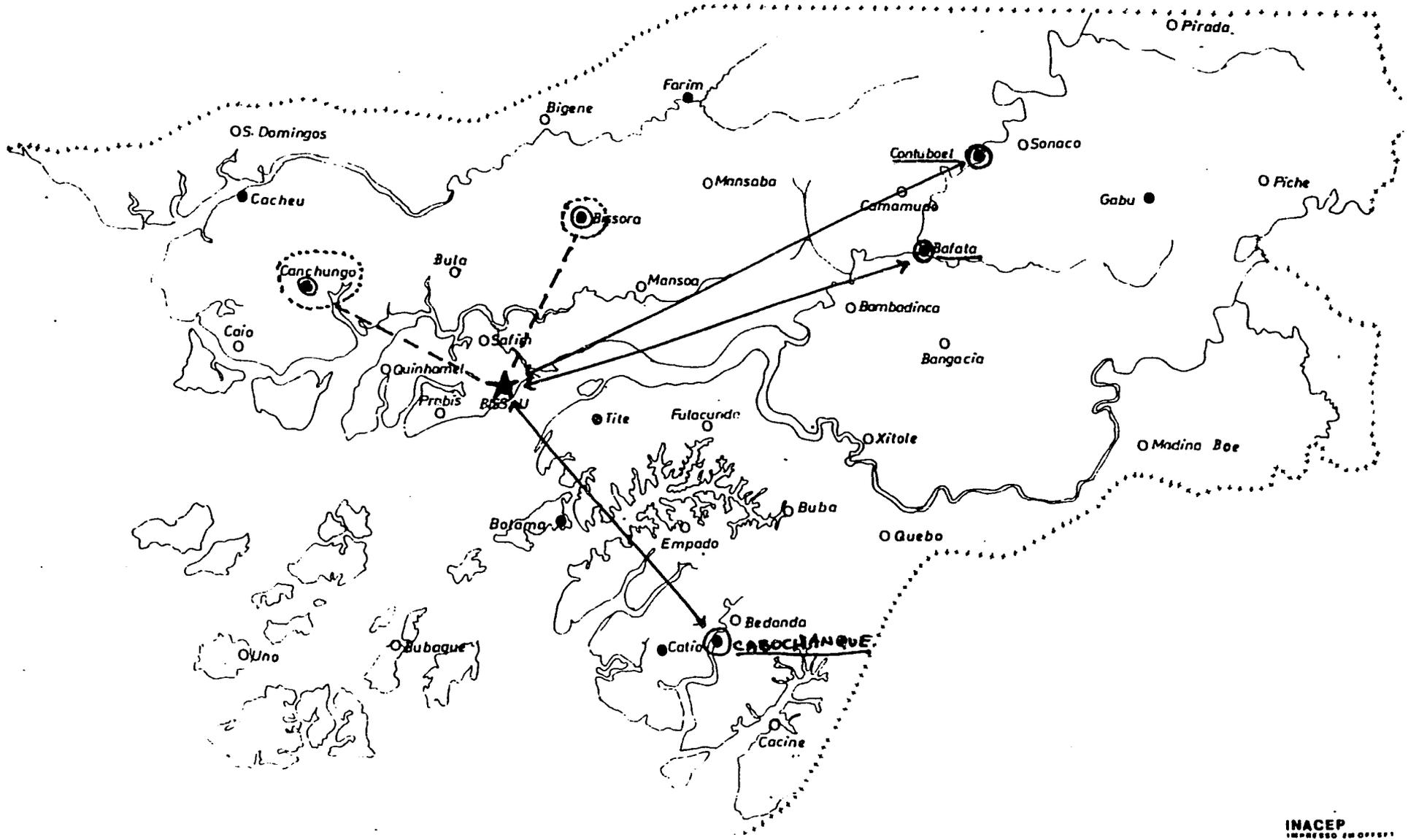
Seedburo Equipment Company (International Division)  
1022 West Jackson Boulevard  
Chicago, IL 60607

Stults Scientific Engr. Corp.  
3313 S. 6th Street Highway  
Frontage Road West  
Springfield, IL 62703

Spear Envelope Company  
2802 Hedberg Drive  
Hopkins, MN 55343

Fischer Scientific Co.  
P. O. Box 181150  
Memphis, TN

Anchor Paper  
480 Broadway  
P. O. Box 3648  
St. Paul, MN 55165



APPENDIX G

INACEP  
INSTITUTO NACIONAL DE ESTADÍSTICA

APPENDIX H  
EQUIPMENT AND SUPPLIES  
FOR  
SEED PATHOLOGY LABORATORY

ITEM NO.	QUANTITY	CAT. NO.	DESCRIPTION	UNIT COST	APPROX. TOTAL
1	1	14-462-5	Lightweight Sterilizer -Chamber 30L x 32cm. dia., portable (240°F/10psi), operate on 220V, 50Hz	\$ 289.95	\$ 289.95
2	1	14-461-5A	Accessory stand for 14-462-5	26.00	26.00
3	1	13-988-105	Model 812 Lab Refrigerator/ freezer for 220V, 50Hz.	1,370.00	1,370.00
4	1	A056M-2	Table Model Stereoscope Microscope with mag. 10x, 15x, 20x, 30x, 40x with type M Magni-Changer	960.00	960.00
5	1	A0L150BGA-FW	Laboratory Light Microscope 4x, 10x, 40x, 100x objective	1,380.00	1,380.00
6	1	13-245-256G	Gravity Convection Lab oven Model No. 255G - 220V, 50Hz	807.00	807.00
7	2 cases	10-041-17B	Nalgene Polycarbonate Erlenmeyers	74.52	149.04
8	20/500gm.	A360-500	Agar Powder	80.15	1,603.00
9	10 gross	12-550-14	Disposable Microscope	13.25	119.00
10	10 pk. case	12-548-5M	Cover glass	50.00	50.00
11	10	03-447	Microslide baker for 25 x 75mm	8.75	87.50
12	72	14-955F	Pyrex test tubes 18 x 150mm	26.13	26.13
13	5	04-245AA	Glass Alcohol burner	3.43	17.15

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14	12 pack	04-250	Replacement wicks for alcohol burner	2.50	2.50
15	72 case	13-700-10A	Plastic dropping pipets	97.20	97.20
16	1 pack	13-070-1	Inoculating needles - 1ul loops	75.00	75.00

NOTE: Recommended sources for items 1-16:

Fischer scientific  
711 Forbes Avenue  
Pittsburgh, Pennsylvania 15219

17	100 lbs. in 1 Lb. pkg.		DIFCO potato dextrose Agar Conventional for assays	35.00/lb	3,500.00
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Source: American Scientific Product  
155 Brookhollow Esplanade  
Harhau, LA 70183

18	1	01-703-23	Metal Microvoid dust hood - table model, ringed safety viewing window, 18 gauge steel, 24" fluorescent lighting, 220V, 50HZ, 130 watts, size 34" x 29" x 24"	1,000.00	1,000.00
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Source: Air Control  
Huntingdon Valley, PA

TOTAL \$11,559.43

NOTE: This approximate total is catalogue price and does not include crating and shipping overseas. Therefore, appropriate allowances must be made to adjust this cost accordingly.

## APPENDIX I

RECOMMENDED TAXONOMIC KEYS  
FOR IDENTIFYING SEEDBORNE FUNGI

Barnett, H. L., and B. B. Hunter. 1972.  
Illustrated Genera of Imperfect Fungi.  
3rd ed.

Barron, G. L. 1968. The Genera of  
Hyphomycetes From Soil.

Von Arx, J. A. 1974. The Genera of  
Fungi Sporulating in Pure Culture.  
2nd ed.

Booth, C. 1971. The Genus Fusarium.

U.S.D.A. Handbook #165. 1960. Index  
of Plant Diseases in The U.S.

Dennis, R. W. G. 1978. British  
Ascomycetes.

TOTAL \$500.00

NOTE: Approximate costs to obtain these references will be \$500.