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9. ABSTRACT

A field plan and equipment specifications for a foundation seed project at Ahmadu Bello University/Institute for Agricultural Research (ABU/IAR) in Nigeria are presented by the Seed Technology Laboratory at Mississippi State University. Preliminary drawings of office and laboratory space, storage areas, and processing facilities are included. The specifications are suitable for processing corn, millet, sorghum, and rice, but exclude peanuts and cottonseed.

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REPORT TO
AHMADU BELLO UNIVERSITY/INSTITUTE FOR AGRICULTURAL RESEARCH
OAU JOINT CEREAL GRAINS RESEARCH PROJECT 26
USAID/LAGOS AND AID/W
FOUNDATION SEED PROJECT FACILITIES FOR ABU/IAR

SERVICES RENDERED
UNDER THE CONTRACT BETWEEN
AID/W AND MSU
AID/ta-C-12-19

SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI

SEPTEMBER, 1975

REPORT SUMMARY

TITLE: Report to Ahmadu Bello University/Institute for Agricultural Research, OAU Joint Cereal Grains Research Project 26, USAID/ Lagos and AID/W --- Foundation Seed Project Facilities for ABU/IAR

CONTRACT NO.: Services under AID/CM/ta-C-12-19 Mississippi State University

CONSULTANT: A. H. Boyd

PERIOD OF TRAVEL: 9 June - 1 July, 1975

SUMMARY

1. At the request of Joint Cereals Project 26, USAID/Lagos requested assistance in developing facilities for a foundation seed project at IAR/ABU.

2. Current facilities were recognized as totally inadequate to support the expanded food production effort and supply the new varieties now available through the research projects.

3. Specifications for equipment and buildings are presented. The drawings accompanying this report are preliminary and should be used for planning purposes. They are not construction drawings. All final construction should be specified by a local engineer who has knowledge of local construction capabilities, materials, soil bearing characteristics, etc.

4. Building recommendations are:

Building Area	Approximate Area (sq. ft.)
a. Processing	1440
b. Storage	2880
c. Office, Quality Control, Genetic Bank	750
d. Drying Shed	800

5. Processing equipment to process corn, millet, sorghum, or rice at an average capacity of at least 1 ton per hour is specified. This facility is not suitable for processing peanuts or cottonseed.

6. Equipment for a small seed testing and quality control laboratory is specified. This laboratory can do service work to a limited extent but should not be considered for expansion into a regional service and regulatory facility.

7. Coordination with the Federal Ministry of Agriculture and UNDP seed improvement project is advised. It is strongly recommended that the UNDP project take advantage of the lead time gained by ABU/IAR and support this facility as a part of their production effort. The climate at

Samaru also favors production and storage of cereal grains over Ibadan.

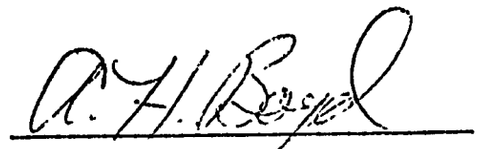
8. A vigorous sales and promotion effort for distributing seeds at a price which reflects production costs and true seed value is important. Maximum utilization of the private sector in sales and distribution is advised.

9. Provisions for further training at Mississippi State University Summer Seed Improvement Short Course should be made for Mr. B.A. Alimi, Training to occur summer of 1976. Mr. I.A. Usman should be considered for further training to the B.S. degree in seed technology.

ACKNOWLEDGEMENTS

The author expresses his sincere appreciation to Mr. James H. Clifton seed specialist, JP26, Mr. Tom Cooper administration officer and Dr. Karl Stockinger team leader and the entire PASA team for their cordial reception, support and advice during this visit.

Special thanks go to my colleague, Mr. George Dougherty for assistance in preparation of drawings and specifications for this report.



A.H. Boyd
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REPORT TO
AHMADU BELLO UNIVERSITY/INSTITUTE FOR AGRICULTURAL RESEARCH
OAU JOINT CEREAL GRAINS RESEARCH PROJECT 26
USAID/LAGOS AND AID/W
ON
FOUNDATION SEED PROJECT FACILITIES
FOR
ABU/IAR

JUNE 9 - JULY 1, 1975

I. BACKGROUND

The impending implementation of the National Accelerated Food Production Project (NAFPP) by the Federal Government and the thrust of agricultural technology from research centers such as the Ahmadu Bello University/Institute for Agricultural Research (ABU/IAR) and the International Institute of Tropical Agriculture (IITA) has created a strong need for and a major interest in providing adequate seed stocks of the major food crops.

Activities covered by this report are centered around ABU/IAR and the Organization of African Unity, USAID, West African Major Cereals Research Project, Joint Project 26 (JP-26) which is stationed at IAR/Samaru and operates a coordinated research project on development of the major food grains, primarly corn (maize), millet, and sorghum. The project operates in association with ABU/IAR which is in turn supported by the six northern states of Nigeria (North western state, North Central state, North Eastern state, Kano state, Kwara state, and Benue Plateau state). It has been primarily through research at IAR that maize has been shown to be a good crop for the semi-arid savanna of northern Nigeria.

Mr. J.H. Clifton, seed specialist for JP-26 at IAR/Samaru has been operating a seed production scheme which serves as a foundation seed project for all the six northern states. This project has been able to supply the effective demand for the area and on occasion supply seed to some of the other countries in the West African Region. This effective demand has been admittedly fairly small with a total production/sales of about 35 tons in 1973/74 and slightly less in 1974/75 (see tables 1 & 2). The lower sales in 1974/75 are probably due almost entirely to the acute fuel shortage that occurred in early 1975 effectively preventing movement of the seeds to the more distant states and especially to adjacent countries.

The above production was accomplished with the bare minimum of equipment, notably a Clipper M 2-B (farm type) air screen cleaner and research type or hand threshing and shelling equipment. It was obvious to Mr. Clifton and others that processing and storage facilities will be necessary if the seed production targets from previous studies (table 3) were to be reached.

Table 1. 1973/74 Foundation Seed Project Summary

Variety Composite Hybrid	kg. seed Received	kg. seed Delivered	Weighed Clean Out	Seed on Hand to Date kg.	Unaccounted Seed Loss kg.
Maize					
S1, 2, 3	14,673	12,965	-	15	
NCA	1,206	970	-	5	
NCB	2,488	1,164	-	45	
096	693	415	-	-	
C-10 x BY	262	249	-	55	
Total	19,322	15,763	413	120	3,026
Sorghum					
SA 7706	11,652	9,526	-	39	
R 960	6,519	4,476	-	57	
Total	18,171	14,002	1,506	96	2,567
Grand Total	37,493	29,765	1,919	216	5,593

1. Seed clean out (broken kernels, etc.) averaged slightly over 5%.

2. Unaccounted for losses seem to have been primarily pilferage. Some controls were exercised but the magnitude of the losses were not anticipated until the final accounting was made. It is obvious that a loss of almost 20% on the clean seed basis is unacceptable and very strenuous measures of control must be instituted.

Table 2. Preliminary summary of the Foundation Seed Project.

Seed distributed to 19/6/75

Crop - variety	Kg.
Maize	
S1, 2, 3	8,250
NCA	1,130
NCB	595
096	388
C 10 x By	10
Sorghum	
SA 7706	916
R 960	8,914
SK 5912	3,898
CK 60b	4
181	578
IS 473	21
Millet	
Nigerian Comp. S4C	3,395
Ex Ghana	7
Ex Bornu	9

Table 3. Seed Production Target for Nigeria In 5 Years

Production in recommended varieties			Seed Production (tons)		
Crop	%	Acres	Breeders	Basic	Certified
Rice	15	90,000	6.5	130	1,800
Maize	6	180,000	1.5	60	1,400
Cassava	5		5.0	200	
Sorghum	2	200,000	2.0	100	2,000

Source: Report to the Government of Nigeria on Seed Production and Distribution - FAO No. TA 2792, 1970.

In addition the NAFPP has under development several irrigated production schemes with wheat development work centered at the 50,000 acre project at Kadawa. If their development goes as anticipated as much as 100 tons of wheat basic stocks may be needed each year within a five year period. There is currently only one other facility capable of producing basic seed stocks, which is a small facility at IITA/Ibadan.

IAR is located in the Savanna (Figure 1) where the climate is well suited to cereal seed production. As soon as the rainy season ends the relative humidity decreases and conditions from October through May are reasonably good for open or unconditioned storage (table 4). This dry season provides a distinct advantage over similar facilities at, for example, Ibadan where relative humidities are well above 70% even at 10 a.m. during the entire year (table 5). For this reason all the storage should be cooled and de-humidified in southern Nigeria which would greatly increase construction costs and require a large continuing input of operating funds for electric power. Because of its climatic advantage it is expected that the foundation seed project at ABU/IAR will develop into the major basic seeds producer for cereal grains.

In response to the obvious need for development the Board of Governors of ABU/IAR authorized 60,000 ($97,800) to begin construction and procurement of equipment and an additional 60,000 for the coming year. A position of senior research fellow is open now for the foundation seed project in addition to the technicians (2) and labor currently employed.

To assist in implementing this expanded project Mr. Clifton requested the assistance of Mississippi State University Seed Technology Laboratory (MSU/STL) through AID/W and USAID/Lagos under terms of contract AID/CM/ta-C-73-34.

II Current Situation and Recommendations

A. Physical Facilities

The proposed foundation seed complex as shown in the accompanying

TABLE 4. METEOROLOGICAL OBSERVATIONS SAMARU

MONTH	RAINFALL(MM) 1924 to 1974	DAYS OF RAIN 1928 to 1974	RELATIVE HUMIDITY 1974 AM	1974 PM	1938-1974 AM	1938-1974 PM	AIR TEMPERATURES C 1938-1974 MIN	MAX	MEAN	SUNSHINE DAILY MEAN HOURS 1974	54-74
JANUARY	0.2	0.1	20.5	16.1	23.7	13.4	14.1	30.5	22.3	4.6	8.7
FEBRUARY	1.1	0.2	7.3	7.1	21.0	11.2	16.0	32.7	24.4	8.8	9.5
MARCH	7.7	1.0	16.9	11.0	30.9	14.5	19.5	35.3	27.5	8.5	8.6
APRIL	35.1	3.8	52.8	25.3	52.1	27.4	21.7	35.8	28.8	7.8	8.0
MAY	120.1	9.9	59.2	36.8	68.6	44.0	21.2	33.2	27.5	7.6	8.2
JUNE	162.0	13.0	64.8	52.5	77.4	57.8	19.2	30.8	25.5	7.9	7.8
JULY	225.3	16.3	82.3	67.4	83.3	67.0	19.4	28.5	23.9	5.4	6.1
AUGUST	285.1	20.6	79.8	67.9	85.4	71.1	19.3	27.7	23.5	5.9	5.1
SEPTEMBER	227.3	16.5	78.0	65.2	81.3	63.7	19.1	29.3	24.2	6.3	6.9
OCTOBER	36.4	3.9	65.7	44.1	68.3	43.1	17.6	31.4	24.9	8.8	8.9
NOVEMBER	1.2	0.2	24.5	19.1	36.2	21.1	15.7	31.6	25.6	9.2	9.5
DECEMBER	0.1	0.0	21.4	16.4	25.6	15.9	14.0	30.6	22.4	8.6	9.2
TOTAL	1101.6	85.5	-	-	-	-	-	-	-	89.4	96.5
MEANS	-	-	47.8	35.7	54.5	37.5	18.1	31.5	25.0	7.5	8.0

Note: (1) Before 1953 obervations taken at 0800 and 1300 G.M.T.
After 1953 observations taken at 0900 and 1500 G.M.T.

(2) Sunshine Records from Campbell-Stokes Recorder.

Source: Meteorological Section, Ahmadu Bello University

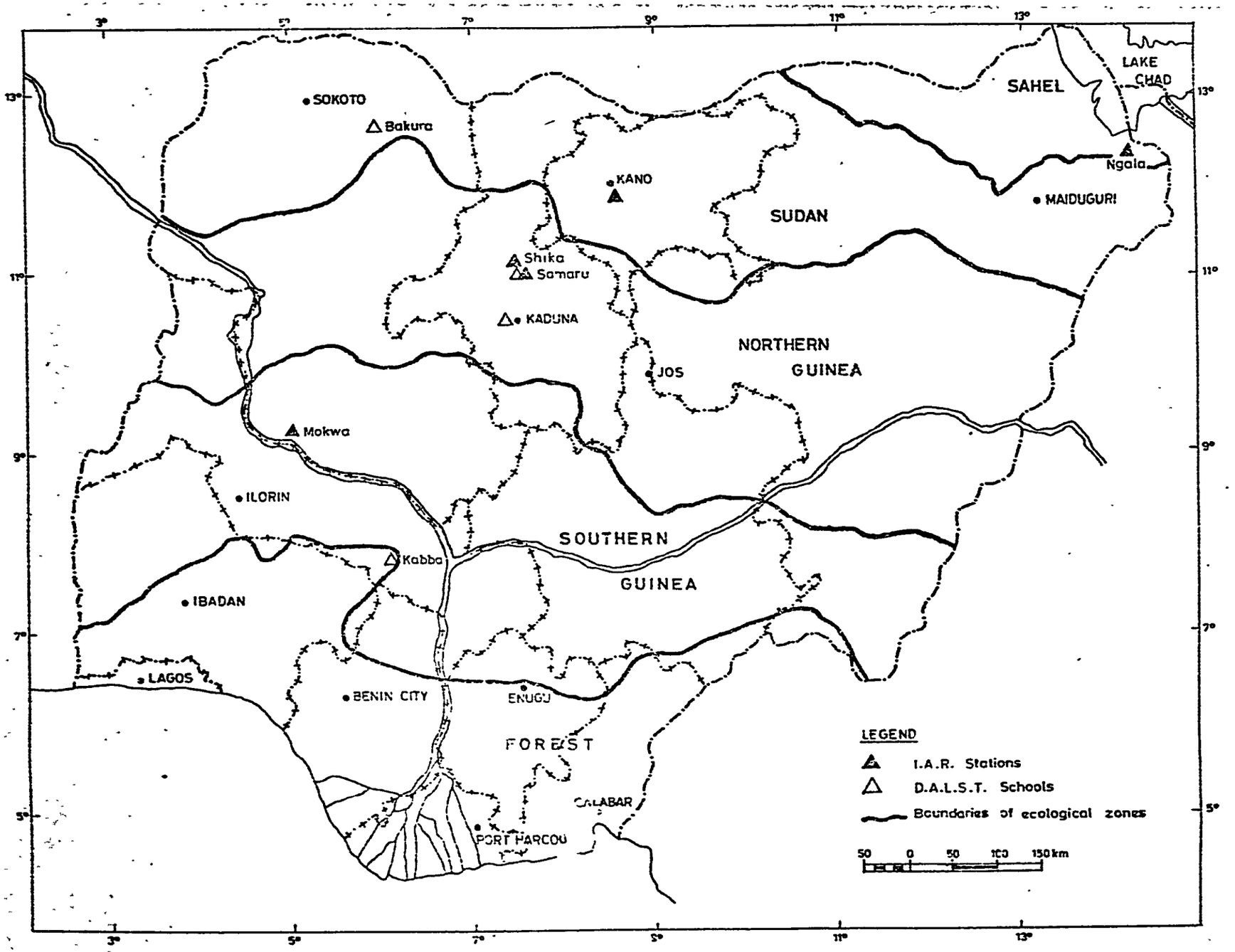


FIGURE 1. MAP OF NIGERIA SHOWING ECOLOGICAL ZONES

Table 5. CLIMATIC OBSERVATIONS AT UNIVERSITY OF IBADAN NIGERIA

MONTHLY SUMMARY OF STATISTICS

Monthly Summary of Statistics for the period February - May, 1974.

	February	March	April	May
Mean Daily Minimum Temperature ^{o}F.	72	74	72	72
Mean Daily Maximum Temperature ^{o}F.	94	95	90	88
Extreme Minimum Temperature ^{o}F.	65	69	67	68
Extreme Maximum Temperature ^{o}F.	98	99	93	94
Total Precipitation mm.	Nil	79.6	211.8	104.0
Most Precipitation in one day mm.	Nil	30.2	52.8	50.3
Number of days on which rain fell	Nil	8	12	12
Relative Humidity (%)				
(a) at 1000 hours	74	77	84	82
(b) at 1600 hours	37	46	65	67
Total Hours of Bright Sunshine	160.9	230.8	192.3	178.4
Wind Miles run: (a) Total	1357.4	2169.1	1706.9	1517.8
(b) Most in one day	78.1	101.6	78.5	73.8
(c) Least in one day	21.4	48.4	21.4	29.9

Source: Department of Geography, University of Ibadan, Nigeria

drawings and specifications are centered around a relatively small but efficient processing facility capable of about one ton per hour average output and a storage warehouse of 2880 sq. ft. The 1440 sq.ft. processing room allows ample room for expansion if the need arises. The storage facility can easily hold 150 - 200 tons if it is stacked to a height of only 6 feet and with most efficient use of floor space. Realistically, a foundation seed project can almost never utilize its bag storage most effeciently because of the necessity for maintaining small lots of numerous kinds and varieties of seeds in an easily accessible condition. There is also the added problem of packaging in more than one size bag. However, the facility should be able to handle 100 - 150 tons with all problems considered. Suggested locations for future expansion for both bulk and bag storage are indicated.

The limiting factor in production capacity will be first storage capacity and next management until the seed production has grown greatly. While the capacity should be more than adequate for the next several years some consideration for somewhat larger facilities may be in order and at this point adjustments can easily be made (see B. relation to other seed projects). The following were some assumptions made in determining design features:

1. Most of the seeds will arrive dry in bags.

2. Ample manual labor is available at a reasonable price.

3. Adequate amounts of electrical power is available even though there will be some problems with interruptions and voltage fluctuations.

4. After processing the seed will be held in 6 mil. or heavier polyethylene heat sealed bags.

5. Production will be mainly at IAR/Samaru or on irrigated plots at Kadawa.

6. The foundation seed project will have its own equipment for production, harvesting and transportation (not specified in this report).

7. The foundation seed processing facility will be expected to process, bag and store seeds for the mini-kits and production kits used in the promotion of accelerated food production, at least in initial phases.

8. Only small amounts of seed will be carried past the first year to preclude the necessity for large investments in climate controlled storage. The cold storage facility will be used only for breeder's seed or other valuable stocks.

9. Only occasional small lots will be dried when unexpected late season rains occur.

10. The facility will be located as indicated by * on Figure 2.

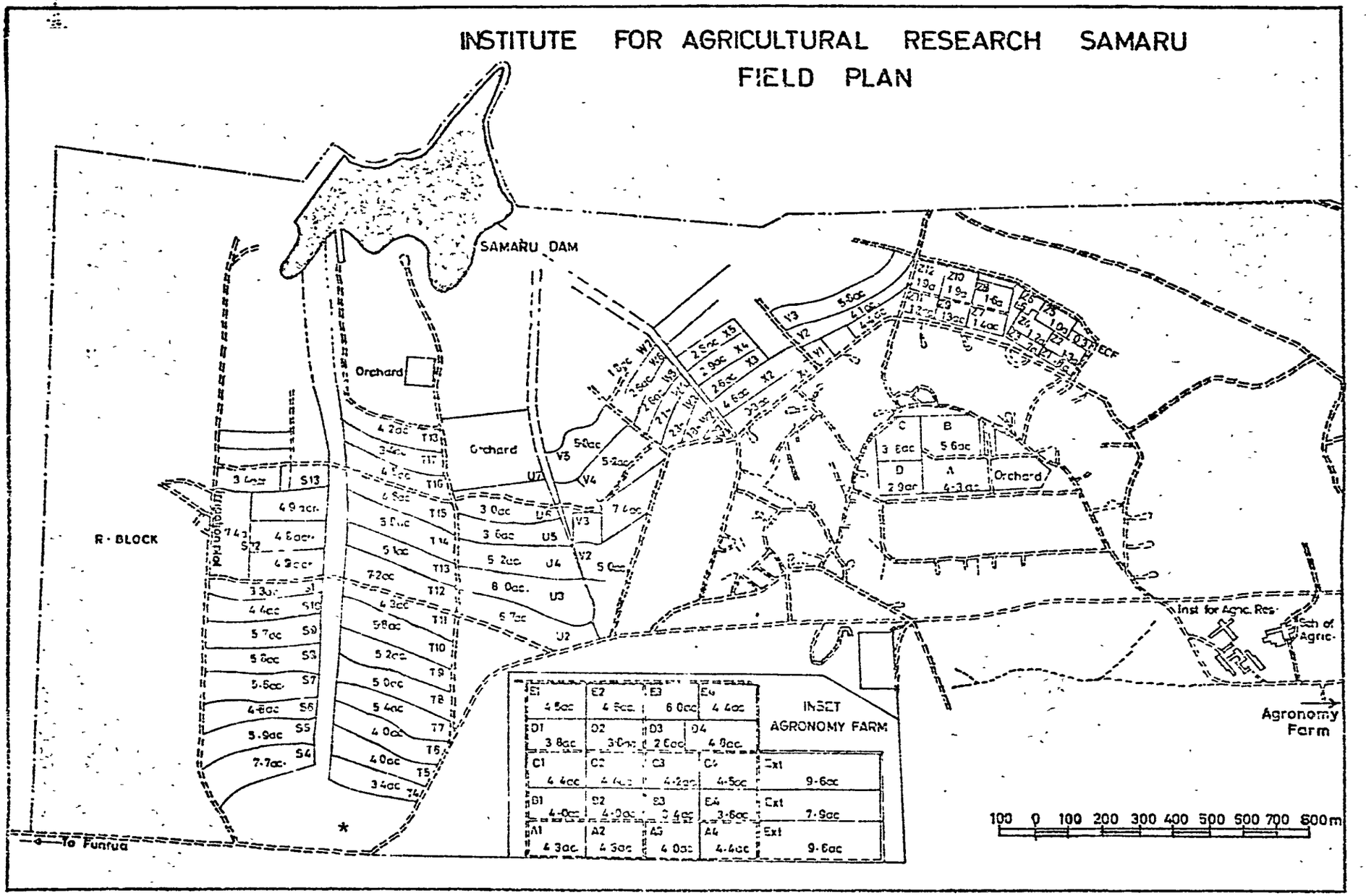


FIGURE 2. IAR FIELD PLAN

The office and quality control facility contains both a small quality control laboratory and storage for long term preservation of seed stocks. The long term storage room should be constructed as indicated or modifications should be made on recommendation of someone familiar with seed storage problems. There are several methods of obtaining a good storage room and so long as the room is capable of maintaining conditions of 50% relative humidity and 5°C under the expected climatic conditions at Samaru modifications to take advantage of local skills, building materials or equipment availability are acceptable. Vapor barrier installation and fit or seal of the refrigerator door are important since humidity control are almost always the most difficult part of seed storage room construction.

The quality control laboratory is intended for use of the foundation seed project for internal quality control, however, there should be ample time and facilities for service testing for farmers or other government projects until the regional laboratory proposed in the UNDP Project for the Improvement of Quantity and Quality of Seeds of Basic Food Crops has been initiated. The foundation seed project quality control laboratory should not be expanded to take over regulatory functions. It is not large enough and it is not anticipated that a full time seed analyst would be employed.

The truck scale is planned for installation under a roof with the scale beams outside but near the front door of the office building. Details of the scale pit and location of the beams will be influenced by the brand and model of scale purchased. Installation drawings should be furnished by the manufacturer before final construction plans are made.

The drying shed is an open sided structure with a plastic roof of the same type as is in use be the department of horticulture at ABU/IAR. It is intended for use in drying on the few occasions when unseasonably late rains require harvest of moist seeds. Most of the time it will serve as a work area for the corn sheller and thresher and as an equipment shelter.

All equipment specified for the processing area is necessary for a good job of seed processing. The only machine not necessary for corn, sorghum and millet is the length separator (item 3). It is, however, needed for rice and wheat and should be included now rather than waiting for more development in that area. The cylinder separator was specified rather than a disc separator to give more flexibility in cleaning and to give the capability of length grading corn of necessary.

It was necessary to specify two bagging scales to give a capability of bagging 2 and 5 kilo. bags of seeds. All the bagging equipment was selected for maximum simplicity, durability and ease of maintenance. Highly complicated and automated bagging equipment cannot be justified economically on the expected output and are almost always a major maintenance problem in locations where service is not readily available.

Vehicles, office equipment and associated farm equipment are not covered in this report since Mr. Clifton and his associates are in a better position than this consultant to evaluate those needs.

B. Relationship to Other Seed Production Projects.

The foundation seed project at IAR/ABU is well ahead in functioning as a basic seeds source for all the 6 northern states of Nigeria, however, the Federal Ministry of Agriculture in cooperation with UNDP is currently initiating a Project for Improvement of Quantity and Quality of Seeds of Basic Food Crops. In this project outline there are plans for two seed processing plants of about 200 - 300 tons capacity to be located in Ibadan and (possibly) Samaru. Since IAR/ABU already has taken the initiative in establishing a plant it is recommended that the Federal project take advantage of the lead time already gained and support the currently proposed facility. At this point modifications to increase storage space or to insure capability of processing seeds not covered by the present equipment could easily be made.

The irrigation project at Kadawa has tentatively reserved 100 hectares for IAR/ABU of which 80 ha. is for seed production. It is anticipated that close coordination and cooperation will be continued between the foundation seed project and the wheat project located there.

The foundation seed project is a service project to increase seeds enough to be of real impact on the production capability of the country. It cannot effectively do its job without the close support and cooperation of the plant breeders. In turn it can relieve the plant breeder of much field work and allow him to devote his attention back to genetic studies and varietal development work. Such a project is often of good use to extension or research - extension liaison personnel since it will in effect be a demonstration of the new varieties and production methods.

C. Sales and Distribution.

More seed production schemes fail because of the lack of a vigorous sales and distribution effort than for any other cause. This is especially true of government oriented schemes where a major effort is being made to increase production. It is a fallacy to think that availability of good seed of high producing varieties will solve the problem. Increased production will only happen when the good seed are planted in the farmers field along with the other associated technical inputs. This concept is so simple and so basic that it is often overlooked in planning.

It has been shown many times that farmers, even small farmers, will pay a reasonable price for technical inputs - seed, fertilizer, insecticides, etc. - when he is convinced that these inputs will return more than they cost him. It has also been shown that very cheap or free seeds are seldom cared for and are often not even planted. Production projects that do not sell their seed at a reasonable price are perpetually short on funds and have to justify their budget each year. This lack of funds causes delay in production, harvest, processing and distribution. Such delays are costly in funds and seed quality and often result in poor quality seeds arriving at the desired location only to find that the farmer had given up and planted the old varieties because planting time wouldn't wait.

It is recommended that open or self pollinated crops be sold at a price that reflects the production and distribution costs of the seeds.

This would probably be at least two times the price for grain. Hybrids would of necessity be higher because of production costs but would only be produced where their performance had been demonstrated to justify the higher costs and thus higher prices.

It is also recommended that the staff of the seed section take an active part in planning and implementation of a distribution scheme. It cannot be "assumed" that extension or other personnel are properly motivated or knowledgeable alone. Maximum utilization of the private sector in distribution will have the effect of gaining competent assistance and developing an infrastructure for a seed industry. It is neither possible nor desirable that this plant supply the total seed needs of the area. Further multiplication of the varieties must be accomplished by the farmers with foundation seed supplying a steady input of new and better varieties as they are released and/or a reliable source of pure stocks of the existing varieties.

D. Training

There are currently no well trained technicians capable of taking over the foundation seed project after JP-26 terminates in 1976. There is currently search underway for a Senior Research Fellow to accept the job. This will undoubtedly go to an expatriate. Two of the current staff, Mr. I.A. Usman, research technician and Mr. B.A. Alimi - Lab. Attendant I are doing good work and should be given more training. It is recommended that Mr. Alimi attend the Summer Seed Improvement Short Course at Mississippi State University in June, July, August, 1976 and that consideration be given to support of Mr. Usman to obtain a B.S. degree in Agronomy Seed Technology at MSU or other seed oriented training facility.

III. Equipment Specifications

Item No.	Description	No. Required
1	Air screen cleaner; four screen, similar to cripper model #434A Cleaner to have independent upper and lower air systems; syncronized brush type screen wipers; variable speed screen vibration; 4 screens with capability of use as 2 graders and 2 scalpers or 3 graders and 1 scalper; screen size approximately 34 x 44 inches; average capacity for large seeds 45-75bu. (1 - 2 tons) per hour. Overall dimensions approximately 2.0m height 1.6m width 3m length complete with the following:	1

a. roll feed hopper

b. fans mounted 45^{o} angle to rear

c. screen tappers

d. fan outlets to have square to round (30.4cm) dia. adaptors

e. waste product discharge outlets on right side; clean seed vibrating conveyor discharge outlet on right side

f. waste product bag holders

g. base support frame, 1M height

h. manufacturers recommended drives, guards, motor mounting and TEFC motor of required h.p. operational on 220 volt, 50 hz., 3 phase current

i. twenty-six (26) screens sized as follows:

Round holes: 6,7,8,9,10,11,12,14,16,18,20,22,24,28,30

Slotted: 1/13 x 1/2, 1/14 x 1/2, 1/15 x 1/2, 1/16 x 1/2, 5x3/4, 6x3/4, 7x3/4, 8x3/4, 9x3/4, 10x3/4, 11x3/4

Estimated Cost, FOB Supplier $8,400
Supplier: C,K (See Supplier Index)

2	Width and thickness grader, similar to Carter No. 2 precision grader with two (2) each of the following shells 10x3/4, 11x3/4, 9x3/4, 18, 20, complete with motor and drive operable on 220 volt, 50 hz., 1 phase current.	

Estimated cost $3,600
Supplier: B(See supplier index)

Item No.	Description	No. Required
a.	Vibrating conveyor for carter No. 2 precision grader (item 16) with motor and drive operable on 220 volt, 50 hz, 1 phase current. Estimated cost $500.00 Supplier: B(See supplier index)	1
3.	Length Separator - similar to Hart Uni-Flow Cylinder Separator No. 2 with the following cylinders Nos. 6,8,10,12,14,16 complete with motor and drive operable on 220v, 50 hz, 1 ph current. Estimated cost $2,600 Supplier: B(See supplier index)	1
4.	Seed treater, similar to Gustafson Model XL Treater to have 4.5 ton (150 BPH) per hour capacity and capability of applying Dust Type Seed Treatment products. Complete with drive and motors of required horsepower operational on 220 volt, 50 hz., 1 phase current. Estimated Cost, FOB Supplier $1,100 Supplier: A,G,K(See Supplier Index)	1
5.	Bagging Equipment	
a.	Bagging scale. Automatic dump scale - bag filler with capacity of 5 to 12.5 pounds per discharge for packaging free flowing seed grains. Accuracy: 95% of bags filled to plus or minus 1/3 to 3/4 ounces, Speed: At least 20.2 kilogram bags per minute. Similar or equal to Howe Richardson type Holm GF - Estimated cost, FOB Supplier $2,460 Supplier: A,I(See supplier index)	1
b.	Bagging scale to handle 25 to 140 lbs. open mouth paper, textile or plastic bags grass weighing bagger. Bag spout 6" square to accomodate bags 25" circumference or larger. Similar or equal to Howe Richardson model G-17 automatic scale. Estimated cost, FOB Supplier $800 Supplier: A,I(See supplier index)	1

Item No.	Description	No. Required
	c. Bag sealing equipment. Power hand sealer for sealing polyethylene bags of 2 to 10mil. thickness. Continuous band type, motor driven, with teflon bands. Maintenance and repair kit included. Operable on 220 v., 1 ph., 50 hz.	1
	Estimated cost, FOB Supplier $575 Supplier: A(See supplier index)	
6.	Belt bucket elevator, self supporting, similar to Universal Model (C2-175 "Easy Dump: Elevator to have 5 tons (175 BPH) per hour capacity, (seed at 48 lbs./cu.ft.) at 75% bucket filling and 110-125 FPM belt speed. Discharge height to be 7.62 (25 ft.); O.A. height not to exceed 8.53 (28 ft.). Complete with the following:	1
	a. required buckets, splicing, pre-punched belting and assembling hardware.	
	b. spacers for insertion between belt and buckets (washer type).	
	c. one (1) dump hoppers w/cover on up leg.	
	d. one (1) 15.2cm (6-inch) dia. adjustable elbows with clamp rings (transitions included)	
	e. ten (10) 3.0m (10-ft.) section 15.2cm (6-inch) dia. 12 ga. flanged rigid spouting.	
	f. six (6) clamp rings	
	g. six (6) loose fanges	
	h. manufacturers recommended drive and (TEBB) motor of required horsepower operated on 220 volt, 50 hz.,	
	Estimated cost, FOB Supplier $1,300 Supplier: A,K,R,U(See supplier index)	
7	Belt-bucket elevator, self supporting, similar to Universal Model C2-175 "Easy Dump". Elevator to have 5 ton (175 BPH) per hour capacity, (seed at 48 lbs/cu.ft.) at 75% bucket filling and 110-125 (FPM) belt speed. Discharge height to be 6.7m (22 ft.); O.A.H. not to exceed 7.7m (25 ft.). Complete with the following:	1
	a. required buckets, splicing, pre-punched belting and assembled hardware.	

Item No.	Description	No. Required
	b. spacers for insertion between belt and buckets (washer type).	
	c. dump hopper on Down leg.	
	d. two (2), 15.2cm (6-inch) dia. adjustable elbows with clamp rings (transitions included).	
	e. one (1), 15.2cm (6-inch) dia. 2 way valve.	
	f. manufacturers recommended drive and (TEBB) motor of required horsepower operational 220 volt, 50 hz., 1.	
	Estimated cost, FOB Supplier $1.300 Supplier: A,K,R,U(See supplier index)	
8&9	Belt bucket elevator, self supporting similar to Universal Model C2-175 "Easy Dump". Elevator to 5 ton (175 BPH) per hour capacity, (seed at 48 lbs./cu.ft.) at 75% bucket filling and 110-125 (FPM) belt speed. Discharge height to be 6.1m (20 ft.); O.A. height not to exceed 7.0m (23 ft.) Complete with the following:	2
	a. required buckets, splicing, pre-punched belting and assembling hardware.	
	b. spacers for insertion between belt and buckets (washer type).	
	c. dump hopper on up leg.	
	d. one (1) 15.2cm (6-inch) dia. adjustable elbow with clamp rings.	
	e. manufacturers recommended drive and motor of required horse power operational on 220 volt, 50 hz., 1 phase current.	
	Estimated cost, FOB Supplier $1,300 Supplier: A,K,R,U(See supplier index)	
10	Belt bucket elevator, self supporting, similar to Universal Model C2-175 "Easy Dump". Elevator to have 5 ton (175 BPH) per hour capacity, (seed at 48 lbs./cu.ft.) at 75% bucket filling and 110-125 (FPM) belt speed. Discharge height to be 5.2m (17 ft.); O.A.H. not to exceed 6.1m (20 ft.). Complete with the following:	1

Item No.	Description	No. Required
	a. required buckets, splicing, pre-punched belting and assembling hardware.	
	b. spacers for insertion between belt and buckets (washer type).	
	c. dump hopper on up leg.	
	d. two (2), 15.2cm (6-inch) dia. adjustable elbows with clamp rings (transition included).	
	e. one (1), 15.2cm (6-inch) dia. 2 way valve.	
	f. manufacturers recommended drive and (TEBB) motor of required horsepower operational 220 volt, 50 hz., 1.	
	Estimated cost, FOB Supplier $1,300 Supplier: A,K,R,U(See supplier index)	
11	Surge Bin: Sheet metal approximately 1.6 metric ton capacity, hoppered bottom, floor supported, discharge gate to be fabricated to match feed hopper of air screen cleaner (Item 1)	1
	Local fabrication	
12	Surge Bin: Sheet metal approximately 0.45 metric ton capacity, hoppered bottom, floor supported, 6-inch x 6-inch square discharge.	
	Local fabrication	
13&14	Surge Bin: double unit in one frame, sheet metal, approximately 1.8 metric ton capacity each bin, hoppered bottoms, floor supported, 6-inch x 6-inch square discharge.	2
	Local fabrication	
15	Bag cleaner, similar to Burrows No. 1214 complete with fan and motor approximately 5 hp operable on 220 volt, 50 hz., 3 ph. current.	1
	Estimated cost, $800 Supplier: A(See supplier index)	

Item No.	Description	No. Required
16	Bag Holder, adjustable to height width of sack. Similar to Burrows No.1201 universal bag holder. Estimated cost, $90 for 2 units Supplier: A,R(See supplier index)	1
17	Set of twenty-six (26) hand screens, 22.8cm x 22.8cm (9 x 9 inch), complete with screen rack. Screens should be sized as follows: Round hole: 28,24,22,20,18,16,14,12,10,9,8,6,7,30. Slotted: 11 x 3/4, 10 x 3/4, 9 x 3/4, 8 x 3/4, 7 x 3/4, 6 x 3/4, 5 x 3/4, 1/13 x 1/2, 1/14 x 1/2, 1/15 x 1/2, 1/16 x 1/2. Estimated cost, FOB Supplier $190 Supplier: A,K,R(See supplier index)	1
18	Portable belt conveyor, 28 ft. (8.4M) O.A. length, complete with under carriage, drive and motor operational on 220 volt, 50 hz., 1 phase current. Burrows "2200 Series" or equivalent. Estimated cost, FOB Supplier $770 Supplier: A,R(See supplier index)	1
19	Portable platform scales, double beam (100 x 1/2 lb.). 0.5 ton capacity, similar to Fairbanks Morse No.1180 Estimated cost, FOB Supplier $600 for two Supplier: A,K,I,R(See supplier index)	2
20	Bag truck, 2-wheel, with 22.8cm (9-inch) nose; 20.3cm (8-inch) wheels; rubber tires; 1.2m (48-inch) handles; roller bearings. Similar to Minneapolis bag truck. Estimated cost, FOB Supplier $550 for 6 units Supplier: A,R(See supplier index)	6
21	Vacuum Cleaner, industrial type, portable. Complete with dust bag; 1 blower nozzle; hose connector; 4m (13 ft.) of 5.0cm (2-inch) diameter hose; operational on 220 volt, 50 hz., 1 phase current. Similar to Tornado Model 429. Estimated cost, FOB Supplier $500 Supplier: A,R(See supplier index)	1

Item No.	Description	No. Required
22	Blower, portable. Complete with nozzle and operational on 220 volt, 50 hz., 1 phase current. Similar to Tornado Model 850. Estimated cost,FOB Supplier $180 Supplier: A,R(See supplier index)	1
23	Conveyor, pneumatic, portable with 50 ft. of 10 inch diameter pipe, 2, 90° elbows, 2, 45° elbows and cyclone for discharge and approximately 3 hp operable on 220 v, 50 hz., 3 ph current. Similar or equivalent to Scotmech Model BL. Approximate cost: $500 Supplier: Q(See supplier index)	1
24	Conveyor Belt similar to Seedburo Hytrol Model R 13 ft. long with troughing and hopper attachments complete with motor and drive operable on 220 v, 50 hz., 1 phase current. Approximate cost $700 Supplier: R(See supplier index)	1
25	Elevator: Portable, aluminum drag chain conveyor 5¼ inch wide trough flared to 9½inchs overall depth 9 inches. Length 16 ft. complete with dolly and wheels, underslung motor mount, and ½ horsepower heavy duty TEFC motor operable on 220 volt, 1 phase, 50 hz. Similar or equivalent to No.2201 Estimated cost, FOB Supplier $600 Supplier: A,R(See supplier index)	1
26	Dust house, constructed from wood according to drawing attached. (Appendix V) Locally constructed	1
27	Dehumidifier: desiccant type capable of removing 1.5 pounds of moisture per hour at 50°F and inlet RH 75%. Operable on 220 volt, 50 hz., 1 phase current. Complete with controls and humidistat. Similar or equal to Una-Dyn A-15. Estimated cost, FOB Supplier $1,200 Supplier: A,R(See supplier index)	1

Item No.	Description	No. Required
28	Refrigeration equipment - complete system, compressor, condensor, evaporator, and all necessary controls - to deliver at least 15,000 B.T.U./hr. at 50°F. with equal or similar to Larkin Model CSO 300 HI. Operable on 220 volt, 50 hz., 1 phase current. Estimated cost, $3,000 Supplier: L,S(See supplier index)	1
29	Insulation: equivalent to 2 inches of styrofoam FR sufficient to cover 900 sq. ft. to be used in constructing cold storage room. Estimated cost, FOB supplier $450 Supplier: E,L(See supplier index)	1800 bd.ft.
30	Vapor barrier: 6 mil (.1524mm) high density polyethylene film sufficient for walls ceiling and floor of cold storage room with adequate overlap at joints. Sufficient adhesive for installation to cement block walls. Approximate cost, FOB Supplier $350 Supplier: E,L(See supplier index)	900 sq.ft.
31	Truck Scale: shallow pit type, 25 ton capacity, 9 ft. x 24 ft. deck size with standard weigh beam calibrated in metric system. Similar or equal to Winslow type "P". Estimated cost (less decking),FOB Supplier $3200 Supplier: A,I(See supplier index)	1
32	Gram scales: weighbeams calibrated as follows: (front) 10 x 0.1g; (rear) 100 x 10g; (center) 5000 x 100g. Complete with scoop. Similar to Burrows Model 1332. Estimated cost, FOB Supplier $190 for 2 units Supplier: A,N,O,R(See supplier index)	2
33	Official Boerner Weight per Bushel Apparatus: similar to Burrows Model No.315-M (calibrated in Kilograms per hectociter). Estimated cost, FOB Supplier $495 Supplier: A,R(See supplier index)	1

Item No.	Description	No. Required
34	Moisture Tester Steinlite: Model 500 RCT, complete with all available charts; operable on 220 volt, 50 hz., 1 phase current. Estimated cost, FOB Supplier $610 Supplier: A,R(See supplier index)	1
35	Moisture Tester: Battery operated portable electric moisture tester for field use. Similar or equal to Seedburo Model 300 complete with carrying case and battery. Estimated cost, FOB Supplier $400 for two units Supplier: A,R(See supplier index)	2
36	Dazor lamp, desk type, two (2) 15w. fluorescent tube; reflector and adjustable multiposition arm. Complete with tubes for operation on 220 volts, 50 hz., 1 phase current. Similar to Seedburo No. UL-M-270. Estimated cost, FOB Supplier $260 for 3 units Supplier: A,R(See supplier index)	3
37	Purity Work Board and Diaphanoscope. Similar to Seedburo Model No.135. Estimated cost, FOB Supplier $160 for 3 units Supplier: A,R(See supplier index)	3
38	DLM-1 Torsion Balance Scale; capacity 120g.; dial 1.0g. x .01g graduation; readibility 2 mg.; accuracy 5 mg. with polished steel scope, positive acting arrest, silicone fluid dash pots and metal case. Complete with Class P Stainless weight set (50gm.to 1g. in hinged box with forceps). Estimated cost, FOB Supplier $600 for 2 units Supplier: A,O,P(See supplier index)	2
39	Oven, stainless steel, similar to Cenco Stainless Steel Oven No.262. Temperature range to 218° C (425°F). Min. two inches of high density fiber-glass insulation completely surrounds the inner chamber (including door). Air intake valves at both sides of the chamber, near the bottom; a metal damper on the top of the oven for control of the air circulation; provision for the mounting of the thermometers to measure inside temperatures; all aluminum-clad steel int. (not painted); heavy guage	1

Item No.	Description	No. Required
	steel ext. w/hammerloid finish. Diamension, inside chamber (approximately) 18" w. x 14"d. x 14"h. Three shelves, 2 adjustable, operational on 220 volts, 50 hz., 1 phase current. Estimated cost, FOB Supplier $420 Supplier: A,R(See supplier index)	
40	Magnifier and stand; 4" diameter with 7" focus, similar to Seedburo No.4-3x-17. Estimated cost, FOB Supplier $70 for 3 units Supplier: A,N,O,R(See supplier index)	3
41	Forceps, nickel plated, 5-1/2" long, medium serrated point. Similar to Seedburo No.59. Estimated cost, FOB Supplier $30 for 12 units Supplier: A,N,O,R(See supplier index)	12
42	Forceps, nickle plated, 5" long, fine smooth point. Similar to Seedburo No.00B. Estimated cost, FOB Supplier $35 for 12 units Supplier: A,N,O,R(See supplier index)	12
43	Sample (Grain) Pan, triangular, heavy tin, dark blue enamel 10" x 10" x 2-1/2". Similar to Seedburo No.64. Estimated cost, FOB Supplier $30 for 6 units Supplier: A,R(See supplier index)	6
44	Divider, similar or equal to Official Boerner Sampler No.344. Mode of brass and copper; height approximately 31"; complete with two pans. Estimated cost, FOB Supplier $200 Supplier: A,R(See supplier index)	1
45	Sample (Grain) Pan, spout type, aluminum 1-1/2 qt. capacity 8-3/4" x 2-3/4". Similar to Seeburo No.32. Estimated cost, FOB Supplier $40 for 6 units Supplier: A,R (See supplier index)	6

Item No.	Description	No. Required
46	Sample (Grain) Pan, round tinplate metal, 2 qt. capacity, 8-3/4" x 2-3/4". Similar to Seedburo No.44-2. Estimated cost, FOB Supplier $5 for 6 units Supplier: A,R(See supplier index)	6
47	Binocular microscope (for examination of plant material) 10x paired wide field eyepieces; 0.7x through 30x stereozoom variable power pod; total magnification 7x to 30x, complete with plastic dust cover and matching variable intensity illuminator. Similar to B&L Stereozoom AVB73. Estimated cost, FOB Supplier $500 Supplier: A,N,O,R(See supplier index)	1
48	Bag trier, 1M (39-inch) length, 25cm (7/8-inch) outside diameter, double tube, six openings. Similar to Burrows No.536. Estimated cost, FOB Supplier $60 for 2 units Supplier: A,R(See supplier index)	2
49	Bag trier, 76.2cm (30-inch) length, 1.2cm (½-inch) outside diameter, double tube, 9 openings. Similar to Burrows No.530. Estimated cost, FOB Supplier $50 for 2 units Supplier: A,R(See supplier index)	2
50	Germination towels, 10" x 15" Estimated cost, FOB Supplier $120 for 10,000 sheets (5 reams) Supplier: D(See supplier index)	5 reams
51	Petri dishes, plastic, 6" (15.2cm) diameter, 1" (2.54cm) deep. Similar to Tri-State No.170. Estimated cost, FOB Supplier $20 for 100 Supplier: T(See supplier index)	100
52	Spear Grain Envelopes, 8 oz., 5 x 8. Estimated cost, FOB Supplier $45 for 1000 Supplier: H(See supplier index)	1000

Item No.	Description	No. Required
53	Spear Grain Envelopes, 12 oz., 6 x 10. Estimated cost, FOB Supplier $60 for 1000 Supplier: H(See supplier index)	1000
54	Crispers, plastic w/covers, 9" x 12 1/4" x 4 1/8". Similar to Tri-State No.295F. Estimated cost, FOB Supplier $50 for 36 units Supplier: A,R(See supplier index)	36
55	Grain Inspection Scale: scale graduated in grams to weigh up to 5 Kilograms. A chart to read 500 grams x 5 grams accuracy at least to 0.5g. Gram weight set to consist of 1-2kg., 2-1kg., and 1-500g. weights. Similar or equal to Toledo 3710 grain inspector scale. Estimated cost, FOB Supplier $725 Supplier: A,R(See suppler index)	1
56	Germinator, approximate O.A. dimensions: 19" width x 12" depth x 20" height. Fully automatic with moisture pan and fresh air chamber, insulated rust proof cabinet and thermopane plexiglass door. Containing: four (4) Dur-Aluminum trays, dial thermometer, strip heaters. Similar to Burrows Model 1880 germinator. Operational on 220 volts, 50 hz., 1 phase current. Estimated cost, FOB Supplier $960 for 2 units Supplier: C,U(See supplier index)	2
57	Hygro-thermograph, weekly recording w/spare parts, bottle of ink, 100 weekly charts, chart binder. Estimated cost, FOB Supplier $320 Supplier: A,R(See supplier index)	1
58	Sling psychrometer, w/one extra thermometer and package of extra wicks. Estimated cost, FOB Supplier $55 for 2 units Supplier: A,R,S(See supplier index)	2
59	Filter paper, Whatman No.1; 15.0cm diameter, size G Similar to Sargent-Welch No.S-33215. Estimated cost, FOB Supplier $15 for 10 pkg. Supplier: N(See supplier index)	10 pkg.

Item No.	Description	No. Required
60	Refrigerator Door, "Butcher Boy" type; Standard cooler and freezer door; single seal; 3 ft. (0.9m) x 6 1/2 ft. (1.95m) for door opening of 3'4" (1.01m) x 6' 81/2" (2.04m); 4" (10.1cm) semi-rigid board foam insulation; 3 hinges included; with frame and other galvanized hardware. Harry Alter Company, Inc. No.95451 or equivalent. Estimated cost, FOB Supplier $350 Supplier: S(See supplier index)	2
61	Refrigerator, 11.2 cu. ft. refrigeration section; 1.2 cu.ft. freezer section, manual-defrost. Similar to Sears Robuck No.46A 65121 N. Operational on 220 volts, 50 hz., 1 phase current. Estimated cost, FOB Supplier $250 Supplier: F,V(See supplier index)	1

Estimated cost of Imported items, FOB supplier $45840

1. Locally fabricated items and buildings not included.
2. Electrical wiring, motor starters, controls, etc. not included.
3. All above and as well as labor for installation of equipment must be estimated by competent local engineers.

Appendix I

Itinerary - Dr. Albert H. Boyd

9 June - 2 July

6/9	Leave Columbus, Ms.	0741	So 332
	Arr. Memphis, Tn.	0815	
	Leave Memphis, Tn.	1340	BN 118
	Arr. New York	1730	
	Leave New York	2100	PA 102
6/10	Arr. London	0840	
	Leave London	2200	WT 903
6/11	Arr. Kano	0620	

Travel Kano to Zaria, meet with Dr. Karl Stockinger, Team Leader, JP-26, Mr. Tom Cooper, Admin. Officer and Mr. James H. Clifton, Seed production specialist. Visit production farm.

6/12 Obtain background information from IAR and JP-26 offices.

6/13 Begin developing details of plant with Clifton, meet Dr. R.O. Olson, USAID/Lagos and Mr. Dan Todd, Inspector general/ Washington; participate in discussions concerning work at IAR.

6/14 Work on design.

6/15 Sunday.

6/16 Work on Plant design.

6/17 Meet with Dr. Matthew Dagg, Director, Institute for Agric. Research to present tentative layouts and estimates.

6/18 Work on Electrical requirements for plant and specifications. Travel to Kaduna for cholera shot and check in with Consulate.

6/19 Travel to Gusau Agricultural Development Project and Kano.

6/20 Visit Irrigation project at Kadawa and discuss wheat development project with Dr. Redden, return to Samaru.

6/21 Visit plant pathology, research, get administrative and clerical details attended to. Attempt contact with UNDP seed production project director.

6/22 Sunday.

6/23 Preparation of preliminary report and recommendations.

6/24 " " "

6/25 " " "

Appendix I (cont'd.)

6/26 - 6/28	-	Final preparation for end of consulting visit, work on assembly of special lab. equipment, and administrative details.		
6/29	-	Depart for Kano.		
6/30	-	Leave Kano	1230	WT 902
		Arrive London	0830	
7/1	-	Leave London	1145	TW 755
		Arrive Philadelphia	0430	
		Leave Philadelphia	0635	EA 121
		Arrive Atlanta	0701	
		Leave Atlanta	0835	So 145
		Arrive Columbus	0927	

Appendix II

Contacts while in Nigeria

Dr. Russell O. Olson
Food and Agric. Officer
USAID/Lagos, Nigeria

Dr. Karl Stockinger
Team Leader & Soil Scientist
OAU/STRC, Major Cereals Grains
Joint Research Project 26 (JP-26)
IAR/ABU, Samaru

Mr. James H. Clifton
Seed Specialist
JP-26

Mr. Tom Cooper
Administrative Officer
JP-26

Mr. Lew Wallace
Entomologist
JP-26

Dr. Natale Zummo
Plant Pathologist
JP-26

Mr. Dan Todd
Office of the Inspector General
Washington, D.C.

Mr. I.A. Usman
Research Technician
IAR/ABU

Mr. John E. Sorenson
US Consulate
Kaduna

Dr. Bob Redden
Wheat breeder
IITA - Kadawa Irrigation Project
Kadawa

Dr. Matthew Dagg
Director
Institute for Agric. Research
ABU

Dr. John Fewster
Dean of Agriculture
Ahmadu Bello University
IAR/ABU

Appendix II (cont'd.)

Mr. Clifford Grainger
Manager for Nigeria
Corn Products Corporation International

Mr. Don Hancock
World Bank Agricultural
Development Project - Gusau
Gusau

Mal. I. Yazidu, Director
Extension Research Liaison Service
IAR/ABU

Appendix III

Electrical Requirements Of Selected Equipment

Processing and Storage

Item	HP	3ph	1ph
1. Air screen cleaner	3	x	
2. Belt and Bucket elevator	0.5		x
3. Belt and Bucket elevator	0.5		x
4. Belt and Bucket elevator	0.5		x
5. Seed treater	0.75		x
6. Weigher bagger	0.33		x
Heat sealer			
Bag conveyor	0.5		x
.. Belt conveyor, portable	0.5		x
16. Precision Grader	0.5		x
17. Vibrating conveyor for item 16	0.33		x

Extension outlets along walls must be able to handle up to 1½ horsepower connected loead for cleanup equipment.

Lighting in processing area should be of sufficient level for safe working conditions at night.

Office and Laboratory Building

Refrigeration equipment

Compressor	3	x	
Condenser unit fans	0.25		x

Desiccant dehumidifier 5 KW total connected load

Office and laboratory building to be calculated for lighting and air conditioning as is customary. The quality control lab. should have at least two 1ph. electrical outlets on each wall for operation of laboratory equipment outlets to be on at least four (4) separate circuits.

Drying shed and threshing area

Corn sheller	7.5	x	

Sufficient wall outlets to operate portable conveyors and clean up equipment (3 or more) x

APPENDIX IV

SUPPLIER INDEX

Companies listed below are potential suppliers of the items shown in "Equipment Specifications" list. The referenced items may be available from sources in addition to those listed.

INDEX IDENTIFICATION	SUPPLIER
A	Burrows Equipment Company 1316 Sherman Avenue Evanston, Illinois 60204
B	CEA Carter Int. 655 19th Avenue Minneapolis, Minnesota 55418
C	Crippen Manufacturing Company Alma, Michigan 48801
D	Dillard Paper Company 200 Peters Street, SouthWest Atlanta, Georgia 30300
E	E.I. Dupont de Nemours & Company Biochemical Department Wilmington, Delaware 19898
F	General Electric Schenectady, New York 12300
G	Gustafson Manufacturing Company 6600 South County Road 18 Hopkins, Minnesota 55422
H	Heinrich Envelope Company 925 Lane Avenue No. Minneapolis, Minnesota 55422
I	Howe-Richardson Scale Company 680 Van Houten Avenue Clifton, New Jersey
J	McMaster-Carr Supply Company P.O.Box 4355 Chicago, Illinois 60680
K	Mercator Corporation P.O.Box 142 Reading, Pennsylvania 19600
L	Manford Engineering, Inc. 149 Lorenz Street Jackson, Mississippi 39204

Supplier Index - continued

INDEX IDENTIFICATION	SUPPLIER
M	ONAN Corporation International Sales 1400 73rd Avenue, Northeast Minneapolis, Minnesota 55432
N	Sargent-Welch Scientific Company 5915 Peeler Street Dallas, Texas 75235
O	Scientific Products 1210 Leon Place Evanston, Illinois 60200
P	Sears, Roebuck and Company Atlanta, Georgia 30395
Q	Scotmech, LTD. Ayr, Scotland
R	Seedburo Equipment Company 1022 West Jackson Boulevard Chicago, Illinois 60607
S	The Harry Alter Company 2399 South Archer Avenue Chicago, Illinois 60616
T	Tri-State Plastic Molding Company P.O.Box 337 Henderson, Kentucky 42420
U	Universal Industries 516 Grand Boulevard Cedar Falls, Iowa 50613
V	Westinghouse Electric Corporation 3 Gateway Center Pittsburgh, Pennsylvania 15200

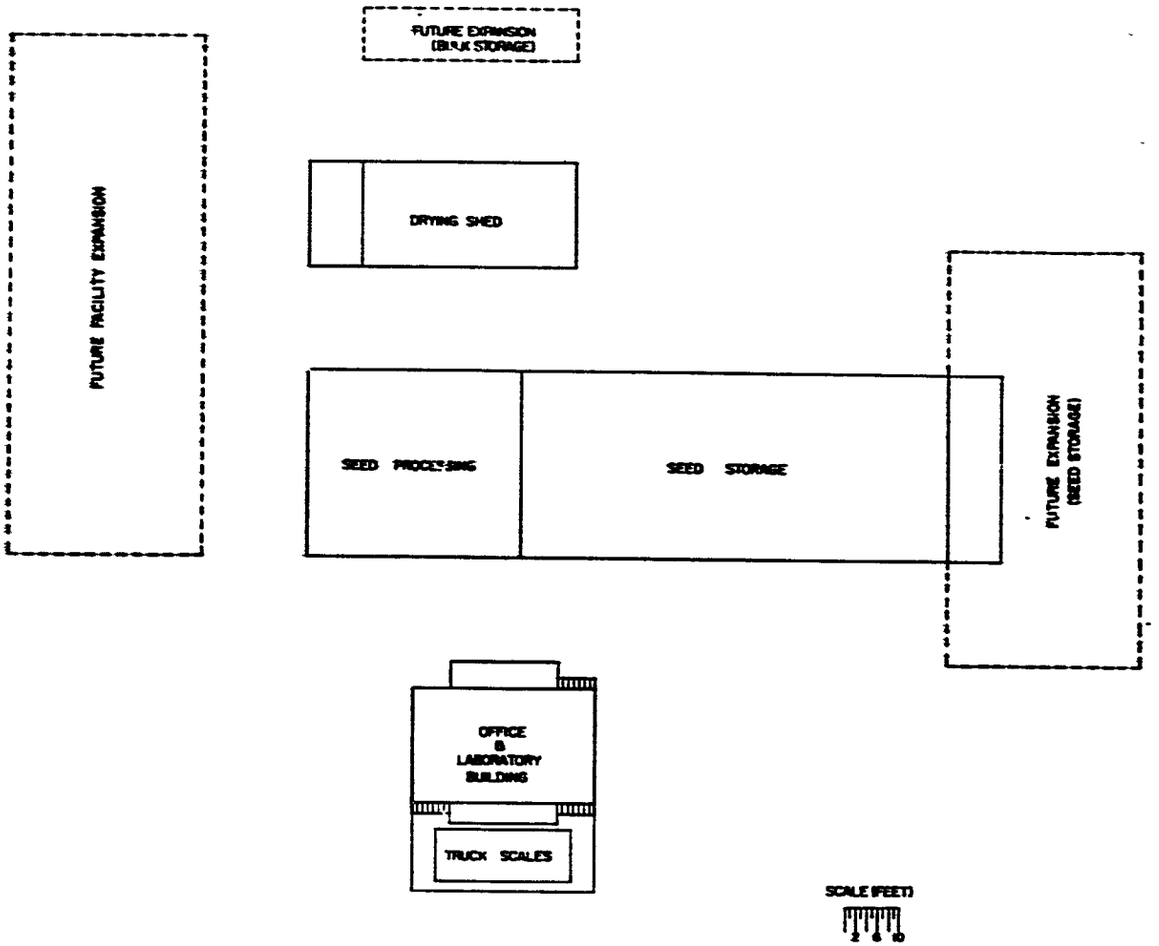
APPENDIX V

Abbreviations & Acronyms Utilized In This Report

1.	ABU	Ahmadu Bello University Zaria (Samaru) Nigeria
2.	AID/W	Agency for International Development - Washington
3.	FPM	Feet per minute
4.	hz	Hertz (electrical cycles per second)
5.	IAR	Institute for Agricultural Research and Special Projects Zaria (Samaru) Nigeria
6.	IITA	International Institute of Tropical Agriculture Ibadan, Nigeria
7.	JP-26	Organization for African Unity, and United State Department of Agriculture Major Cereal Grains Join Research Project No.26.
8.	NAFPP	National Accelerated Food Production Project.
9.	oah	Over-all height
10.	oal	Over-all length
11.	OAU	Organization for African Unity.
12.	ph.	phase (electrical)
13.	UNDP	United Nations Development Program
14.	USAID	United States Agency for International Development
15.	USDA	United States Department of Agriculture

APPENDIX VI

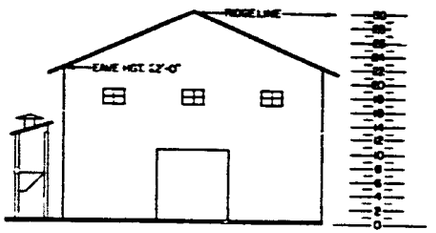
PRELIMINARY DRAWINGS

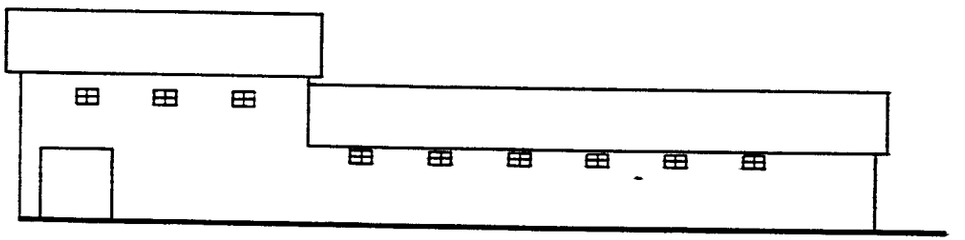


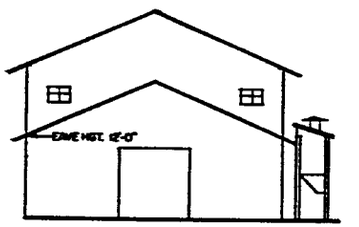
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
SEED TECHNOLOGY LABORATORY
STATE COLLEGE, MISSISSIPPI

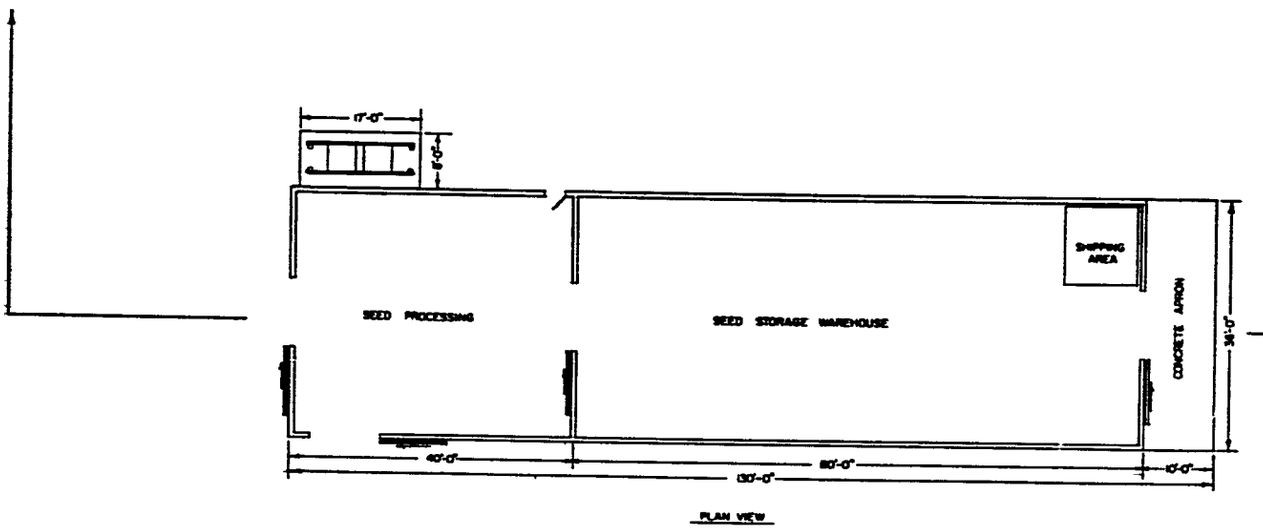
FOUNDATION SEED FACILITY
AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA

DESIGNED BY: AHB	DATE: AUG. '75	SHEET 1 of 5
DRAWN BY: GMD		
APPROVED BY: JCD	FILE NO. TA75-14	







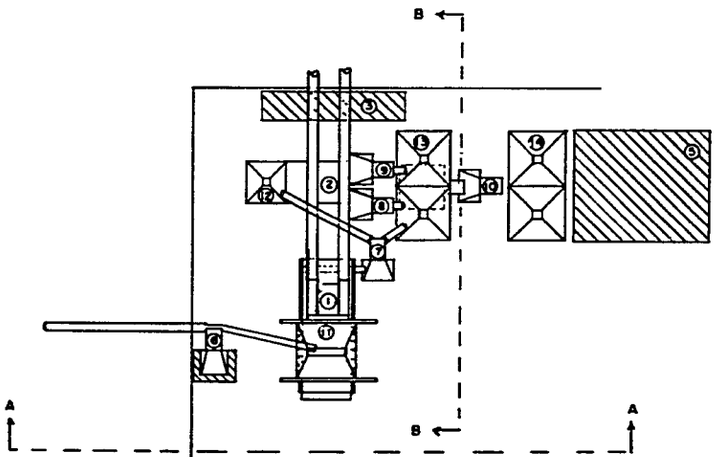


SCALE: 1/8" = 1'-0"

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
SEED TECHNOLOGY LABORATORY
STATE COLLEGE, MISSISSIPPI

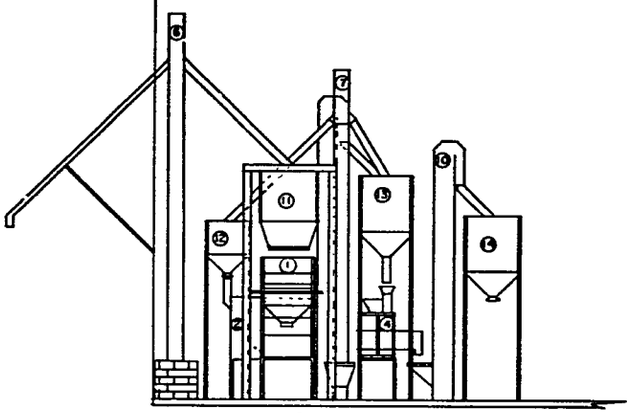
FOUNDATION SEED FACILITY
AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA

DESIGNED BY: AHB	DATE: AUG '75	SHEET 2 of 5
DRAWN BY: GMD	FILE NO. TA75-14	
APPROVED BY: JCD		

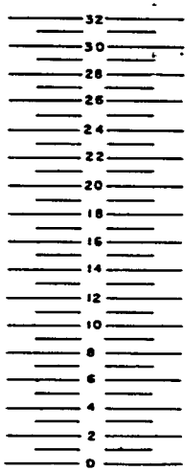


LEGEND

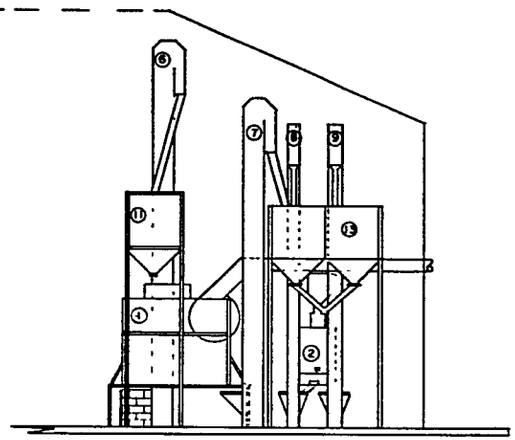
1. AIR-SCREEN CLEANER
2. WIDTH AND THICKNESS SEPARATOR
3. LENGTH SEPARATOR (NOT SHOWN)
4. SEED TREATER
5. BAGGING EQUIPMENT (NOT SHOWN)
6. 25' DISCHARGE HEIGHT ELEVATOR
7. 21' " " "
8. 18' " " "
9. 16' " " "
10. 15' " " "
11. 4'x 4' BIN
12. 3'x 3' "
13. DOUBLE UNIT 4'x4' BINS
14. " " 4'x4' "



SECTION A—A



ELEVATION FROM FLOOR (FEET)



SECTION B—B

SCALE: 1/4"=1'-0"

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ZARIA NIGERIA

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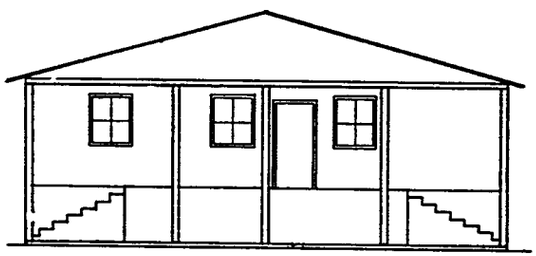
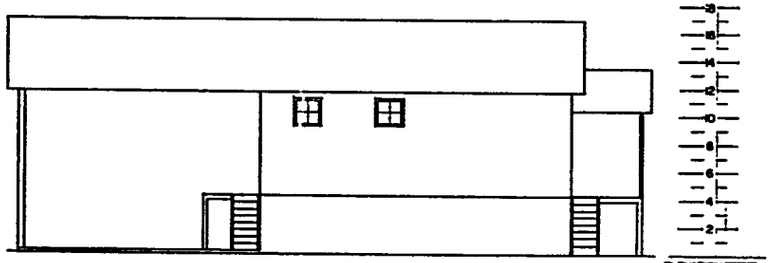
DRAWN BY: AHF		
APPROVED BY: JCD	FILE NO. TA-75-14	



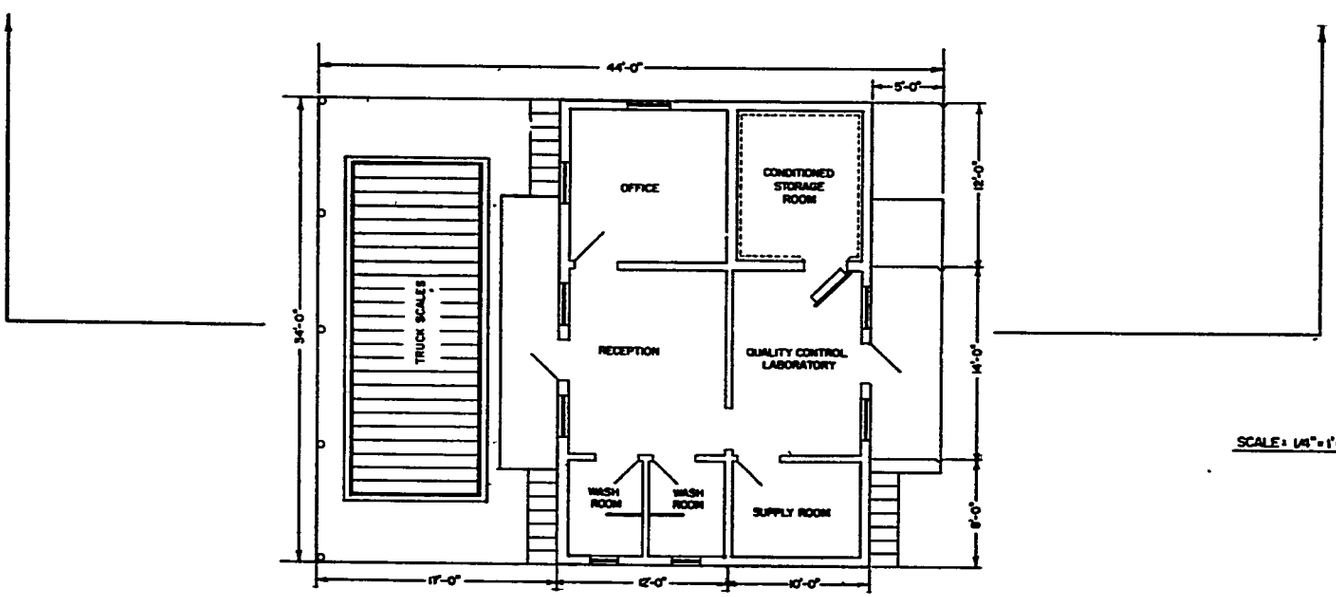
FRONT VIEW



SIDE VIEW

ELEVATION (FEET)

REAR VIEW



PLAN VIEW

SCALE: 1/4" = 1'0"

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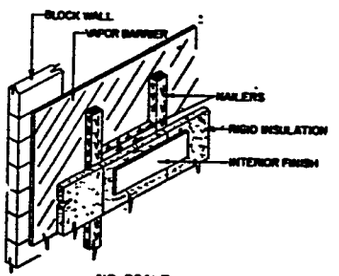
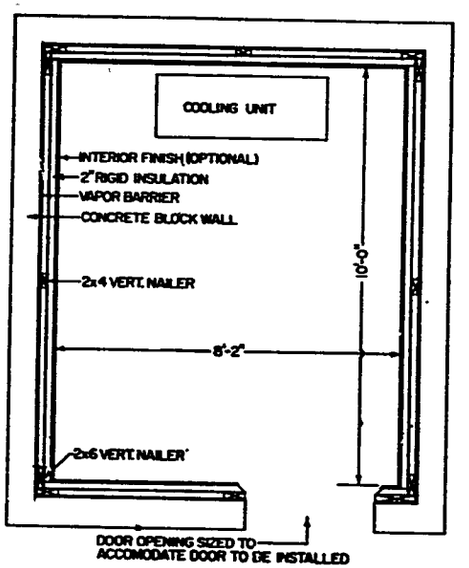
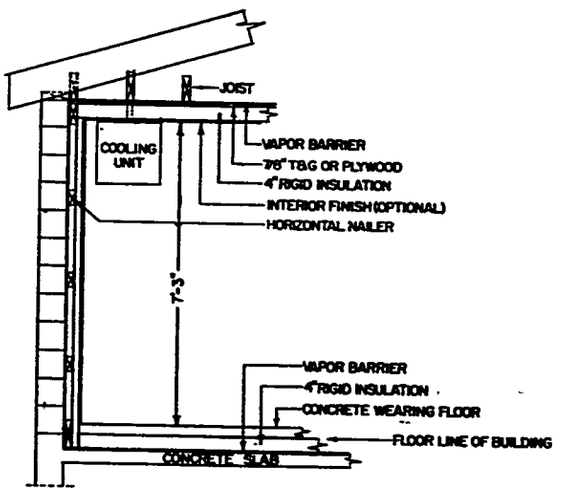
CONDITIONED STORAGE ROOM



NO SCALE



PLAN



ELEVATION

SCALE: 3/4" = 1'-0".

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