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TRIP REPORT - GUYANA

Date Submitted: Dec. 18, 1973

Name: Forster Davidson

Title: Soil Microbiologist (Soybean Inoculum)

Div./Unit: INTSOY (International Soybean Program)
University of Illinois, Urbana, Illinois 61801

Period of Travel: (Inclusive Dates) November 21 to December 14, 1973

Itinerary: By plane from Port of Spain, Trinidad, to Georgetown, Guyana. 0030/0230, November 21, 1973. Depart Georgetown, Guyana, 1315, December 14, 1973

Purpose:

1. Give assistance to the Microbiologist at Mon Repos.
2. To introduce additional strains of rhizobia into Guyana.
3. Assist in conducting rhizobial strain trials.
4. Discuss the feasibility of a legume inoculant pilot plant for Guyana.
5. To concentrate on research and development work in soil microbiology related to soybean production.

Organizations and Persons Contacted:

Officials of the Ministry of National Development and Agriculture, the Central Agricultural Station (Mon Repos), the Ebini Research Station, the Kibilibiri Station, and the USAID Mission to Guyana.

Results/Accomplishments:

1. Assisted in planning field trials for *Rhizobium Japonicum*.
2. Located and identified extensive peat deposits in Guyana.
3. Discussed in great detail research and development work in soil microbiology, e.g. methodology for testing and evaluating legume inoculants, isolation and screening of strains of rhizobia, techniques for evaluating peat as a carrier for rhizobia, basic procedure for doing serological testing, procedure for doing nitrogen fixation studies, etc.
4. A great deal of time was spent developing a plan for a legume inoculant pilot plant. (Attachment A)

Follow-up Action Required:

1. Additional strains of rhizobia for forage and grain legumes will be sent to the microbiologist at Mon Repos.

2. Additional information and literature will be forwarded on equipment and supplies needed in the soil microbiology program.

3. It would be desirable to make further observations on soybean field plots as well as the commercial soybeans planted at Kibilibiri at about flowering time or the pod filling stage.

Other Remarks:

1. It is important that the best strains of Rhizobium Japonicum be introduced into Guyana for commercial soybean production. This will involve fairly extensive "Mission Oriented" research and development work.

2. I sincerely appreciate the excellent cooperation and efforts of many organizations and persons in helping to make my visit as enjoyable and productive as possible. I am especially grateful to Harry Persaud.

3. I was greatly impressed by the dedication and sense of urgency of the research people at Mon Repos, Ebini and the Ministry of National Development and Agriculture. The heavy emphasis put on agricultural development by the Government of Guyana for 1974 is indicated by the fact that almost one third of the money appropriated for development projects is going to agriculture. This puts a lot of pressure on the limited number of research people in agriculture.

4. I was very favorably impressed with the work at Ebini and Kibilibiri. One gets the feeling from visiting these areas that they are dynamic areas of development. The experiment at Ebini on pasture improvement with combination of grasses and different forage legumes along with fertilization experiments obviously have great potential for commercial development of the intermediate savannas. The recognition of the fertility limitations of these soil types can have a marked influence on the development of crop production at Ebini and Kibilibiri. The fertility experiment on stylo at Ebini illustrates the potential of this forage legume under proper management. It will be interesting to see the final yield and nodulation data on this experiment. Citrus fruits and oil palm appear to be doing very well at Ebini and under proper management one would expect these to have commercial potential in this area. Data collected to date indicates that soybeans and peanuts both have great commercial potential. Since I have not had any experience in the dry season here, I can only speculate as to the possible effects of the dry season on crop production.

   When we visited Kibilibiri several hundred acres of commercial soybeans were observed. The plants were about three weeks old. Growth was vigorous and no visual symptoms of nutrient deficiencies or insect damage was evident. There was some problems with germination. No nodulation was found on the roots of the plants observed. Since 40 lbs. of N per acre had been applied at planting time, along with the fact that the soil PH was about 4.5 one would not expect nodulation to occur. Mr. Fletcher indicated he would expect a yield of about 1500 lbs. of soybeans per acre. Undoubtedly this area has great potential for commercial soybean production under the proper set of management practices.

   The white sands as observed at Long Creek appear to have considerably less potential for crop production than the brown sands at Ebini and Kibilibiri. Care should be taken not to drastically upset the ecological balance that exists in the white sands. When

the native vegetation is removed and crop production is allowed to deplete the soil organic matter what little fertility now exists may be lost. It may be difficult for these soils to revert to natural vegetation and water holding capacity.

Recommendations:

1. An urgent need exists to broaden the base of agricultural research to lend support to the commercial operations at Ebini and Kibilibiri as well as to offer some help for the small farmer.

2. The microbiologist at Mon Repos needs at least one or two well trained technicians. Laboratory, transfer room, and equipment are totally inadequate to do work on rhizobia or soil microbiology in general.

3. At Kibilibiri I would recommend that the rates of soybean inoculant application be increased - the amount of increase should be correlated with the results of the current field work in this area. N application should be reduced to about 15 lbs. per acre; however, if nodulation fails then yields of soybeans will be no more than the yields supported by 15 lbs. of N. If the soil cannot be limed adequately, one should at least apply some powdered $CaCo_3$ at the time of planting in order to create a micro-environment in the vicinity of the germinating seed which will favor rhizobial development and nodulation.

4. I would highly recommend the establishment of a pilot plant/commercial unit for the production of legume inoculants if the acreage objectives for soybeans and forage legumes are sufficient to warrant the capital investment. However, the suitability of indigenous peat for inoculant production is yet to be established. The loss is viability of imported inoculants as well as the cost are sufficient justification for indigenous production.

Distribution:

Ministry of National Development and Agriculture/Guyana: 5 copies (Attn. Mr. Ben Carter)

AID/Guyana: 5 copies

AID/Washington: 5 copies (Attn. Mr. George Parman)

University of Illinois: 15 copies (Internal Distribution)

Attachments:

Attachment A - Pilot Plant for the Production of Legume Inoculants

ATTACHMENT A

PILOT PLANT FOR THE PRODUCTION OF LEGUME INOCULANTS

Introduction

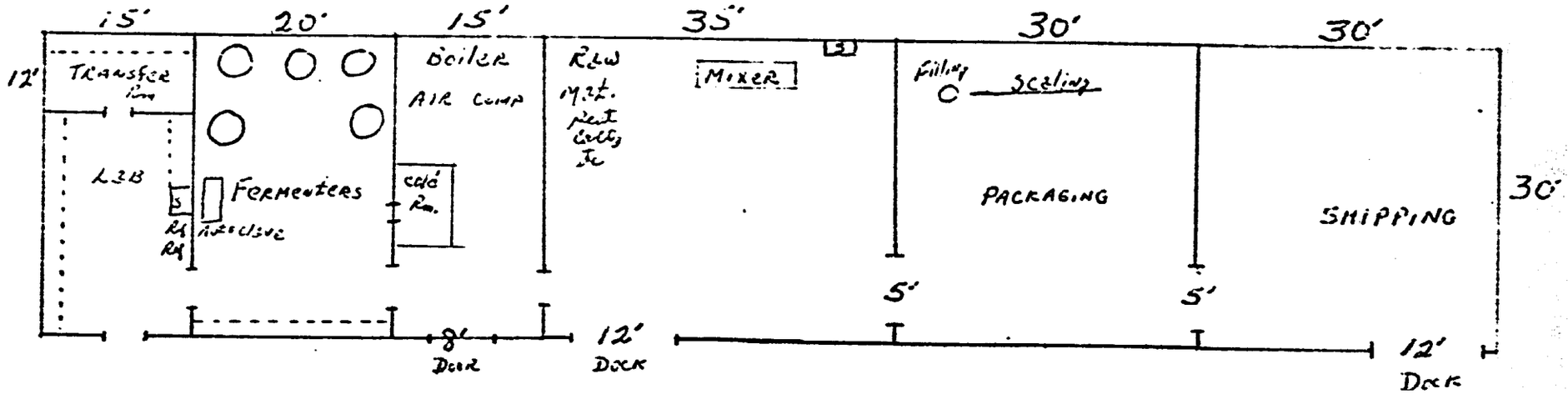
The author has tried to outline some of the basic requirements for a pilot plant/commercial operation for the production of legume inoculants. While there is nothing magic about the physical plant design, it is important to observe "flow-through" design as well as proper location of equipment. Since contamination can be a problem in the laboratory and fermenter room, these facilities should be designed with a high standard of sanitation in mind.

The Need for Inoculation

When a forage or grain legume is grown on a soil for the first time it is essential to inoculate or introduce the appropriate rhizobia at the time of planting. This is usually done by moistening the seed with water just before planting and applying a viable culture of rhizobia to the seed. Care should be taken to insure that the correct rhizobia are used on the plant species involved; eg. soybeans require Rhizobium japonicum. Rhizobium japonicum is not effective on other legume plants.

The appropriate rhizobium bacteria establishes a symbiotic relationship with the plant whereby the rhizobium is able to fix or enzymatically reduce atmospheric nitrogen which is used by the plant. The symbiotic relationship is established in the nodules on the roots of the plant. The plant provides the rhizobia with carbohydrates, minerals, and other essential growth substances.

There seems to be some diagreement among research workers as to the amount of nitrogen that is fixed by the rhizobia. Most soil microbiologists would agree that most if not all the nitrogen needs of the plant are met by the symbiosis when good nodulation occurs with an effective and an efficient N-fixing strain of rhizobia. Not all associations between rhizobia and legumes are beneficial. Some strains of rhizobia survive better, and fix more notrogen than other strains.


15'
20'
15'
35'
30'
30'
12'
TRANSFER Rm
LAB
Fermenters
Boiler
AIR COMP
Cold Rm.
RAW
MIXER
Filling
Sealing
PACKAGING
SHIPPING
30'
5'
5'
8'
Door
12'
Dock
12'
Dock

Laboratory and Transfer Room

A good laboratory and transfer room are essential components in an inoculant pilot plant or production unit. There should be adequate facilities and equipment for doing basic research and development work on rhizobia. Some basic research and development will consist of maintenance of a rhizobial culture collection, isolation and screening of new strains of rhizobia, nitrogen fixation studies, and general mission oriented research. Rigid quality control standards should be followed.

A good bacteriological transfer room is one of the most important elements in the production of quality legume inoculants. The importance of keeping a rhizobial culture collection well identified and free of contamination cannot be over-emphasized. The transfer room should have ultra violet lights installed, gas outlets for laboratory burners, electrical outlets for a water bath and possibly a microscope. There should not be any windows in the room, unless they are completely sealed, and there should be only one door which should open into the laboratory. One laboratory bench about 30 inches high and running the length of the transfer room on one side should be sufficient.

Generally speaking the laboratory and transfer room are designed for bacteriological work. Extensive work with fungi where fungal spores may become dispersed should be discouraged. The presence of fungal spores in a transfer room can create very difficult contamination problems in rhizobial work.

Fermenter Room

The fermenter room where cultures are produced will require a high degree of sanitation. It is necessary to steam sterilize the culture media and inoculate the culture tanks aseptically. Sterile air is sparged into the tanks by means of a pre-sterilized glass wool filter. In the production of Rhizobium japonicum (soybean) it takes 3-7 days to achieve an acceptable rhizobial count in a fermenter. It is difficult to generalize in regard to rates of growth, because of the influence of culture media, temperature, aeration, strains of rhizobia, etc.

The location of electrical outlets, water lines, air lines, etc. can be determined after the fermenters are installed. Installation of a large (30") exhaust fan about 18-24" from the ceiling in the vicinity of the fermenters should be done when the building is constructed. Ultra violet lights may have to be installed if unexpected problems of contamination arise. Floor drains should be well spaced and adequate.

There is no such thing as an "ideal" fermenter design. Each one has its own advantages and disadvantages. In general a continuous fermentation system for rhizobia is undesirable, because of the long generation times of rhizobia and the difficulty of operating a continuous system aseptically. For rhizobia production the batch system is much prefered. The fermenter should be made of stainless steel. Details of design of a fermenter are extremely important to the success of the operation. For a pilot plant the minimum size probably should be 150 gallons and the maximum 300 gallons.

A large horozontal autoclave(at least 30" deep x 22" diamter) should be installed in the fermenter room close to the door into the laboratory. It will be needed by the fermenter room operator as well as the laboratory. Laboratory base cabinets should be installed in one end of the fermenter room. A small balance and a larger balance(0-10 kg.) will also be needed.

Boiler Room

Space for a boiler or steam generator, an air compressor, and a cold room(8'x10') which opens into the fermenter room must be provided. It is preferable to locate the boiler and air compressor as close to the fermenter room as possible. The boiler or steam generator should be approximately 5BHP in order to sterilize fermenters, operate the autoclave, and steam sterilize transfer lines, etc.

Shipping Room

This room serves as an area for temporary storage of finished product and space for addressing and shipping. Benches may be needed, but can be added later as the need arises. The assumption is being made that temporary storage of the finished product can be done under ambient temperatures and humidity. If this assumption is later found to be incorrect, then it will be necessary to install a partition in the shipping room and install air conditioning.

Cartons, polyethylene bags, and sealing tape can be stored in this area, but care should be exercised in keeping them clean. A small manual tape dispensing machine along with a variety of carton sizes can facilitate shipment of orders of various quantities of inoculum. A set of scales (0-100 lbs) for determining weights will be needed.

Inoculum is a perishable product and one should emphasize the fact that care should be exercised in expediting shipment to the user. Expiration dates on the inoculum package should be strictly adhered to. Viability of the product must be assured at the time of use. Inoculum should not be sold or used after the expiration date or after unsatisfactory storage.

Manpower Requirements

Professional :

a. Soil microbiologist -

b. Technicians - 2

c. Laboratory assistants - 1

* Office - secretary - 1

Laborers:

a. Fermenter room operator

b. Mixer-blender operator

* c. Filling machine operator

* d. Shipping

* e. General laborers - 3

* These people can be recruited after volume production begins.

ANALYSIS OF COSTS AND RETURNS

	Approx. US $
Fixed Costs:	
Building and Land	
Greenhouse	
Machinery and Equipment:	
Air compressor, 15-25CFM, 5 HP	1000
Fermenter, 165 gallon, stainless steel, used	800
Air conditioners, 2	900
Laboratory oven	300
Refrigerators, 2	500
Laboratory shaker	800
Microscope, Nikon, interference phase	1500
Misc. Laboratory glassware and supplies	2500
Steam generator or boiler of 5 HP	3000
Autoclave	2000
Cold room, compressor, etc.	4500
Rotary mixer-blender, commercial size, 10 cu. ft.	4000
Packaging Equipment (filling machine and sealing machine	7500
Aging pans , 30"x22" x 8", fiberglass	1500
Misc. piping, valves, air regulators, air holding tk, etc.	1200
Scales, 0-200 lbs, 3	800
Serological water bath	300
Tape dispensing machine	200
½ gallon glazed crocks	200

Expendable Materials:

Plastic bags, 2½ mil, 5" x 7" for 1 acre, 50,000 - - - - - - 1000

Plastic bags, 3 mil, 5 acre size, 25,000 - - - - - - - - - -1250

Cartons: 1. size to hold 12 bags acre size, 4000 - - - - - -2000

2. size to hold 12 bags, 5 acre size, 2000 - - - 1200

Calcium carbonate, technical grade, powdered, 2000 lbs — 75

Peat, local - - - - - - - - - - - 10 tons - - - - - - - - - - -

Mineral oil, white- 55 gallon drum- - - - - - - - - - - - - - 55

Gummed tape, 25 rolls- 75

Brown wrapping paper, 5 rolls - - - - - - - - - - - - - - - - 60

Sucrose, cane sugar, 200 lbs- - - - - - - - - - - - - - - - - 100

Mannite (mannitol), 200 lbs - - - - - - - - - - - - - - - - - 250

Salts, NaCl, $MgSO_4$, KH_2PO_4, K_2HPO_4, etc. - - - - - - - - - - 200
5 kg each

Yeast, bakers, local market - - - - - - - - - - - - - - - - -

Other Costs:

Shipping

Advertising and sales

Transportation

Interest

Depreciation

Income:

25,000 bags (acres) at G$3.00 each - - - - - - - - - - - - - G$75,000

or

50,000 bags (acres) at G$3.00 each - - - - - - - - - - - - - - G$150,000

Summary:

Sales -

Operating costs:

Depreciation on buildings - - - - - - - - - - - - - - - - -

Depreciation on machinery & equipment- - - - - - - - - -

Expendable materials - - - - - - - - - - - - - - - - - - -

Interest -

Labor -

Utilities -

Total Operating Costs

Net Return:

Income from sales -

Minus operating costs - - - - - - - - - - - - - - - - - - -

Greenhouse

A greenhouse is essential for research and development work on inoculants as well as quality control work on the finished product. Total bench length of about 60 feet should be sufficient for an inoculant pilot plant. A 7 ft. x 30 ft. structure with 30 inch benches on each side should be sufficient. Artificial lighting may be needed. The greenhouse should be located close to or even attached to the laboratory.

PEAT PROCESSING

There are three basic steps in processing peat for inoculant use. The first step involves the removal of peat from the bog, preferably during the dry season. The second step involves drying the peat to about 10% moisture after the excess water has drained out. The final step is grinding the peat to about 200 mesh. A commercial hammer mill should work for this step, but may require more than one pass through the mill.

Detailed list of laboratory equipment and supplies

1. Nikon phase contrast microscope
2. Test tubes---500
3. Petri plates--500 glass or plastic disposable
4. Pipettes: 10 ml----100
   1 ml----100
5. Beakers: 100 ml----100
   150 ml----50
   250 ml----50
   400 ml----7
   600 ml----7
6. Stainless steel pipette cases---6
7. Erlenmeyer flasks: 1000 ml-------60
   500 ml-------20
   2000 ml------6
   3000 ml------6
8. Laboratory shaker capable of handling 18 flasks of 1 liter size.
9. Graduated cylinders:
   2000 ml-----2
   1000 ml-----3
   100 ml -----3
   50 ml -----3
   25 ml -----3
   10 ml -----6
10. Inoculating needles---6
11. Tuberculin type, 1 ml syringe--6
12. Slides and cover glasses----6 boxes each
13. Haemocytometer
14. Petroff-Hausser bacterial counting chamber
15. Refrigerators --2
16. Bunsen burners,--- 2 large and 2 small
17. Florence flasks:
    3000 ml----6
    6000 ml----6
18. Laboratory oven
19. Laboratory balance
20. Hand tally
21 Quebec colony counter
22. Dilution Bottles
    8 oz.-----240
    16 oz.-----120
23. Metal trays to handle bottles
24. Test tube baskets
25. Test tube racks
26. Bacteriological Culture Media and Chemicals

Mannitol	
Sucrose	$CaSO_4$
Agar	Peptone
KH_2PO_4	Beef Extract
K_2HPO_4	Brom Thymol Blue indicator
NaCl	$KMnO_4$
$MgSO_4$	Hyamine
	etc.

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Dr. S.C. Litzenberger

AID/Cm/ta-C-73-19 Re
PN-AAC-282

TRIP REPORT - GUYANA

NAME: Scott E. Cramer

TITLE: University of Illinois/Consultant

DIV./UNIT: INTSOY (International Soybean Program)
University of Illinois

PERIOD OF TRAVEL (inclusive dates): January 13 to February 8, 1974

TASK ORDER NO. 1 - Area of soybean production and processing plant requirements

PURPOSE:

As a member of an INTSOY team to make an assessment of the two existing processing plants and the available raw materials, copra, soybeans, and other crops; and develop a technical and economic feasibility on multi-purpose processing plants as outlined in Mr. Ben Carter's letter of January 15, 1974, attached; Attachment A.

ORGANIZATIONS AND PERSONS CONTACTED:

Officials of the Ministry of Agriculture, the Central Agricultural Station (Mon Repos), the Ebini Research Station, the Kibilibiri Station, the USAID Mission to Guyana, and several private sector individuals and representatives of corporations with emphasis on two oil mills, feed mill, layer and broiler growing operations, flour mill, vegetable oil refinery, transportation and carrier firms, sugar, rice, coconut, and palm oil plantations.

RESULTS/ACCOMPLISHMENTS:

1. Developed an understanding of the need for the production of an increased supply of vegetable oils and protein to assist Guyana in becoming more self sufficient.

2. Guyana is now producing annually vegetable oil - 8.2 to 9.3 million pounds, and import a total of 7.3 to 6.1 or total consumption 15.5 to 15.4 million pounds.

3. The problem simply resolves to:
   - Copra production is not increasing.
   - Palm oil production is approximately five years away (minimum except for 200 acres).
   - Cottonseed and peanut production undetermined.
   - Can or cannot soybeans be profitably grown, with application of expertise from United States and by the private sector which was the motivating force in the USA, Canada and Brazil to take the research from the scientist and put it effectively to work on the farm - Applied Research.

A.I.D.
Reference Center
Room 1656 NS

4. Application of Applied Research - Worked with all concerned on an agreed test plot program for soybeans to be planted April - early May, 1974, on commercial basis. Involves 100/165 acres by private sector - up to 1,314 acres by the Ministry of National Development and Agriculture in 1974.

5. Efficient and effective farm management of prime importance and this is where further work is so vitally needed by the farm manager.

6. Proceed with specifications for a 100 ton solvent mill with time table for need 1977-1978. In the meantime, the two copra mills can crush those beans which may be raised and not needed for seed. When the soybean harvest and yields are determined this September-October, 1974, changes should be made in new plant time table.

GOALS AND PRODUCTION POLICIES OF MINISTRY OF NATIONAL DEVELOPMENT AND AGRICULTURE OF GUYANA:

A. Development Goals:

1. To increase the production and marketing of specific agricultural commodities to a leveal of domestic self-sufficiency.

2. To maximize the export of agricultural commodities - with emphasis upon the marketing of surplus within the Caribbean community.

3. To allocate development investments equitably among the geographic regions of Guyana.

4. To create 10,000 new agricultural employment opportunities.

5. To increase and distribute income in the agricultural sector equitably between the smaller and larger producers.

B. Major Production Programs of Ministry Relative to Oils and Proteins:

1. A significant increase in the production of cereals - rice and corn.

2. An increase in production of peanuts, black-eyed peas, and other peas and beans.

3. A rapid increase in the soybean acreage.

4. Breakthrough in corn production in Intermediate Savannahs.

5. The attainment of an all time record output of copra and copra oil.

6. The introduction of oil palm cultivation by Demerara Co. in the Demerara River and then planting 800 to 1000 acres at Wauna.

7. A very great increase in poultry production.

8. Encouraging the formation of breeder farms.

9. Increasing the production of milk, beef and pork.

10. Manufacture of nutritious food for children and adults - based on soybean and rice.

THE GOVERNMENT'S NEED FOR GROWING MORE OILS AND PROTEINS VERY SOUND AND A NECESSITY:

Since 1968 the Guyana economy continues to expand mainly as a result of growth of bauxite construction and government services - the overall rate of real growth of GDP about 3% per annum.

Farming is still the largest sector of employment (about 1/3) second largest in terms of value output. There still is less than 5% of total area of Guyana under cultivation.

Population expansion has slowed some - growth rate now about 2 1/2% per annum. Now estimated as follows:

	1967	565,000 people
	1970	700,000
	1972	727,000
Projected	1981	848,000

The production of vegetable oils has remained fairly constant, ranging 7,000,000 to 9,835,000 pounds - 1964-1972, while import of vegetable oils has nearly doubled to 6,336,000 pounds during the years 1964-1972.

Poultry, eggs, and corn have risen mainly through the efforts of a few large producers, the sharp increase in output of pork has resulted from the activities of a large number of very small producers.

Poultry meat is the outstanding example of consumers choice of wanting protein on their table. The following striking example parallels the early development of the broiler industry in the USA with the development of high protein soybean meal, effective antibiotics and efficient management of layer and broiler flocks.

Years	Million pounds poultry meat produced
1964	1,882
1970	7,500
1973	12,500

CONCLUSION:

Soybean production - It is therefore decisive, in my opinion, of all the oil bearing seeds available to Guyana, that soybeans offer one of the highest potential crops for the farmers to produce successfully. I am greatly impressed with some of the management capabilities in the private sector and their eagerness to make some supervised soybean growing tests. The "time gap" existing from planting to harvest is most favorable compared to oil palm and/or coconuts.

My observations and recommendations are:

1. Applied Research - At this date we should place high priority on a program for planned growing tests and proceed with the one best variety developed - Jupiter. Mon Repos has custody of the seed. It has been agreed with Ben Carter to have several well managed growing tests with planting in early May to be harvested during September-October (dry season).

   In view of the 90" rainfall they have a major need for help from University of Illinois on:

   A. Proper handling of planting seed and inoculant.

   B. The application of weed killer and fertilizer (slow release).

   C. Control of ants.

   D. Preparation of soil and depth to plant.

   E. Combining or hand cutting, threshing, clearing and drying (several growers have lost their crop by storing bulk or sacked - without drying to 10/12° moisture).

A. TEST PLOT AGREEMENTS:

Agreements between Mr. Ben Carter and each of the following business firms or individuals have been made for April/May 1974 plantings.

			Acres
1.	Blairmont Estates, Ltd. West Bank, Barbice Guyana, S.A.	Winston E. H. Tyrell Administrative Manager	30/50
2.	Diamond Estates Diamond, East Bank Demerara	John Smith, Director Oil Palm Project	10
3.	D. A. Yearwood 48 Robb Street Lacytown		10/15
4.	Essur Doobay Land of Plenty, Essequibo	(son Bobbie) Phone 234 (Georgetown phone 68869)	10/50
5.	Baldeo Ramgoolan Sand Hills		20
6.	40 farmers - picked by government extension by Ben Carter		20
		Total Test Acreage to be Planted:	100/165

B. ACREAGE AND TEST PLOT AGREEMENTS WITH MINISTRY:

Ministry of National Development and Agriculture has targeted for 1974 planting according to Ben Carter:

		Acres
Ebini Research Station (sandy loam)		10
Mon Repos - North Plot		2
South Plot (sandy)		2
Global, Kibilibiri	Up to	800
Matthews Ridge	Up to	500
Total Acreage	Up to	1,314

C. FARM MANAGEMENT is of major importance. Previously, as an example, I reported some growers lost their soybeans by storing too high in moisture. These unfortunate happenings remind me of the many mistakes some of the USA farmers in Arkansas, Alabama, and Georgia made 25-30 years ago when first raising soybeans.

Good farm management practices are critically important to success.

It is most fortunate that George Eason has been raising soybeans in northwestern Iowa for nearly 30 years. After our many visits with farmers, he strongly recommends, and I fully support, that the University of Illinois seriously consider selecting an experienced farmer from the southern states who has raised soybeans successfully for 15 years or more to spend adequate time with the management of Kibilibiri.

Successfully managed soybean plots planted April-May this year can assist Guyana greatly. They cannot afford a management failure. These cross section plots should provide the knowledge whether soybeans can successfully be grown here.

2. Agronomic Research Projects on Soybeans - I am giving this second priority among the projects and recommend University of Illinois move ahead as Dr. Hittle outlined in his report of October 30, 1973.

3. Facilities for Crushing Oil Bearing Seeds -

A. Short Term:

Additional quantities of copra. soybeans, can be handled most advantageously through the established surplus capacity existing at the two copra plants because:

Any sizeable increase in copra looks very doubtful.
Oil palm is two years away.
Cottonseed and peanut are still in test plots.
A large part of the soybeans harvested in 1974 will be saved for seed - so there may be 100 to 600 tons available for crush.

Our estimate of soybeans harvested in 1974 range as follows:

Private sector:

Acres	Bushels	Long tons
100 20 bu/acre	2,000	60
200 " "	4,000	120

Combined private and government operations:

500 20 bu/acre	10,000	300
1,000 " "	20,000	600

B. Longer Term:

Proposed Solvent Crushing Plant

I recommend proceeding with plans for a business proposal with cost estimates for a multi-purpose plant located on the East Bank of the Demerara River with the capability of:

1. Receiving raw materials on water.
2. Shipping meal (eventually) to other Caribbean countries.

This location differs from H. A. L. Morris' report July 1973 - A Review of Oil - Seed Processing Projects for Guyana.

The vegetable oil imported 1968-1972 was 5,300,000 pounds or 530,000 bushels of soybeans; Attachment B.

To overcome the deficit in edible oil supply/demand this would require a plant with 100 ton p/day capacity - if there is only one plant the first few years.

Example of Capacity

Days operated per year	330	300	330	330
Tons crushed per day	25	50	100	150
Annual tons crushed:	8,250	16,500	33,000	49,500
Estimated Raw Materials Crushed - 1977				
Copra	8,000	8,000	8,000	8,000
Cottonseed	--	--	--	--
Peanuts	--	--	--	--
Oil Palm		three years away		
Rice Bran - possibility	1,000	1,000	1,000	1,000
Tons soybeans needed	--	7,650	24,000	40,500
Bushels soybeans needed	--	252,000	792,000	1,336,000

I will proceed with development of a plan and have by April 1, 1974 detailed equipment, estimated cost, with time table.

I am most appreciative of the excellent assistance and guidance obtained from Mr. Ben Carter, Mr. George Eason, and other organizations.

ATTACHMENTS:

A - Letter from B. W. Carter

B - Table: Estimated consumption of fats and oils, 1964-1972

DISTRIBUTION:

Ministry of National Development and Agriculture/Guyana - 5 copies (Attn: Mr. Ben Carter)

AID/Guyana - 5 copies

AID/Washington - 5 copies (Attn: Mr. George Parman)

University of Illinois - 15 copies (Internal distribution)

MINISTRY OF NATIONAL DEVELOPMENT & AGRICULTURE,
P.O. Box 1001,
Georgetown.

ATTACHMENT A

IN REPLYING QUOTE DATE HEREOF AND No.

Guyana

15th January, 1974.

Cooperatively yours,

From:- .....
B.W. Carter
Chief Agricultural Officer

Dr. S.E. Cramer,
U.S.A.I.D.,
Main Street,
Georgetown.

Dear Dr. Cramer,

Study to determine the technical and economic feasibility of establishing a multipurpose solvent extraction plant in Guyana.

With regard to the above-mentioned project, I am supplying as requested, a list of the objectives of the study:-

Objectives:

1. To determine the amount of soyabean, rice bran and copra meal available for solvent extraction;

2. To determine the possibility of establishing a solvent extraction plant of 50 tons per 24 hours capacity (with the possibility of expansion) capable of extracting rice bran, copra meal and soyabean meal and the economics of its operation;

3. To determine the size and cost of a refining unit to cater for the output of the factory;

4. To estimate the size and cost of a batch hydrogenation unit and the economics of its operation;

5. To visit the two existing oil mills and advise the owners on the feasibility of expelling soyabean and of the refining of soyabean oil;

6. To appraise the proposal for the 25 ton plant;

7. To advise on the utilisation of crude rice bran oil for soap and other forms of useage;

8. To fill out the Rosedowns questionnaire on the solvent extraction plant and the other on oil processing equipment.

FATS AND OILS

Table: Estimated Consumption of Fats and Oils, 1964-1972

Item	In thousands of pounds unless otherwise indicated								
	1964	1965	1966	1967	1968	1969	1970	1971	1972
Butter and Ghee									
Produced	1,781	2,074	2,302	2,756	2,739	2,488	1,806	2,494	3,366
Imported	854	1,017	1,034	833	788	1,021	953	911	1,274
Exported	-	-	-	-	-	-	-	-	-
Consumed	2,635	3,091	3,336	3,589	3,527	3,509	2,759	3,413	4,640
Consumed per capita (pounds)	3.90	4.96	5.19	5.45	5.22	5.10	3.94	4.78	6.30
Vegetable Oils									
Produced	8,485	6,365	8,094	8,443	8,773	7,331	7,841	8,188	9,835
Imported	2,813	6,340	3,372	3,596	4,511	6,378	3,464	7,668	6,336
Exported	-	-	-	-	-	-	-	-	493
Used for soap	347	340	320	278	308	329	347	331	319
Consumed	10,951	12,365	11,046	11,711	12,976	13,380	10,958	15,525	15,357
Consumed per capita (pounds)	18.06	20.39	17.74	18.25	19.71	19.82	15.94	71.74	20.88
Animal Fats									
Produced	6	7	10	14	22	13	9	25	23
Imported	1,916	1,358	1,877	1,617	2,172	2,131	2,798	1,763	2,679
Exported	-	-	-	-	-	-	-	-	-
Used for soap	-	-	-	-	-	-	-	-	-
Consumed	1,972	1,365	1,887	1,631	2,194	2,144	2,807	1,788	2,702
Consumed per capita (pounds)	3.16	2.19	2.94	2.47	3.25	3.11	4.01	2.50	3.67

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TRIP REPORT

Guyana

Date Submitted: 16 December 1974

NAME: A. H. Boyd

TITLE: University of Illinois Consultant

DIV/UNIT: INTSOY (International Soybean Program) University of Illinois, Urbana, Illinois

PERIOD OF REPORT: November 12-22, 1974

ITINERARY: See attachment A

PURPOSE:

1. Make follow-up visit on previous trip covered by report dated September 2, 1974.

2. Identify problems and constraints in the areas of seed processing, drying, storage, production, and program development, and to give assistance to the Ministry of Agriculture or other interested parties.

3. Check on progress of INTSOY trials and report observations.

ORGANIZATIONS AND PERSONS CONTACTED:

1. USAID - Mr. George Eason, RDO
   Dr. Fred Marti, Agriculture Advisor

2. Ministry of Agriculture Central Equipment Station
   - Dr. Alfred V. Downer, Chief Agricultural Officer - Crops
   - Mr. Herman Adams - Plant Breeder - Soybeans
   - Mr. Christian Nwasike - Plant Breeder - Corn
   - Mr. Neville McAndrew - Seed Specialist
   - Mr. Sonny Persaud - Asst. to McAndrew

3. Bookers Group - Project Evaluation Unit
   - Mr. Jonathan Harlow - Business Analyst
   - Dr. Abdul Wahab - Crop Development Officer

RESULTS AND ACCOMPLISHMENTS

1. Visited Central Experiment Station at Mon Repos to consult with the staff on production, processing and handling soybeans for seed.

Gave advice on modifications in drying equipment and processing.

2. Gave help to the instructor of a proposed seed processing course at the National School of Agriculture by presenting pertinent slides for teaching (see attachment B) and mimeographed or offprint materials useful to the course or staff members (see attachment C).

3. Discussed production and seed problems with Bookers Project Evaluation Unit. Needed specifications and other information requested will be forwarded from U.S. Obtained interim report on their soybean project which is being forwarded toINTSOY.

4. Discussed INTSOY trials with Herman Adams and obtained data sheets on Mon Repos and Ibini from Christian Nwasike for forwarding to Dr. Hittle.

OBSERVATIONS/COMMENTS:

1. The Blairmont Estate produced 150 bushels of seed which reportedly germinated about 95%. This yield is approximately twice this consultants' estimate in August. As of 20 November, 1974 Global Agri Industries at Kibilibiri reported 1215 bushels harvested off 65 acres with a total of 114 acres on the farm. It appears that the country may have a little over 2000 bushels of seed for planting if they are moved in rapidly and processed for planting.

2. No concrete plans or timetable for planting were obtained anywhere but from Bookers Project Evaluation Unit which was 49 acres planted at Blairmont and is trying hard to get a total of 100 acres planted on various soil types. They are currently held up by non-arrival of a shipment of inoculant from the U.S.

3. At last report Global Agri-Industries had agreed to share inoculant until a resupply was obtained from the U.S.

4. The seed section at the Central ExperimentStation in its function of support for the research program was engaged in shelling by hand small lots of blackeye peas, pigeon peas and corn and processing small (1 bag) lots of rice. No soybeans were being processed, but the Blairmont production had been processed the week before this consultant's arrival. Seeds were expected from Kibilibiri "next week." The seeds from Blairmont were inspected and found to contain large sticks, pods, stems, and soil peds. This indicated that the air screen cleaner was being operated with no top or scalping screen as it was observed to be set up on the previous visit. This was questioned and we were told that the new screens for the cleaner had arrived from the U.S., but they were still in a crate in the warehouse.

5. Drying was being accomplished by stacking seeds of various kinds (peanuts, soybeans, sorghum, corn) in bags in such a manner as to leave a tunnel for air from the Lister dryer to pass among the bags. Drying was accomplished but it is impossible to dry evenly or

consistently or to monitor progress with any precision with this system. We were informed that there are plans for construction of a more efficient system as soon as planting is completed. While the above described system was not as good as desired, it will work rather well if it is properly handled. The key to this or any drying operation will be careful management and operation.

6. Four new Clipper 27A air screen machines were on hand to be sent to proposed seed centers. Locations under serious consideration were Black Bush Polder, Charity, the Rupununi, and Matthews Ridge. It was recognized that drying and storage would also be necessary for the centers. We were not able to obtain any concrete plans or specifications for any of these locations even though it was expected that funding for at least two would be forthcoming in 1975. While the centers will be very rudimentary installations it will be impossible to estimate needs for funds until some plans are made.

7. Mr. McAndrew was very interested in obtaining help in his proposed course in seed processing at the National School of Agriculture. Several suggestions for laboratory exercises or demonstrations to strengthen the course were discussed with him. Slides and literature were also made available (attachment B & C).

8. Planting of INTSOY trials was in progress, previous trials had been harvested.

RECOMMENDATIONS:

1. The air screen machine at the Central Equipment Station should be set up and operated with proper screens in place when processing soybean seeds. A suggested set up for Jupiter is top 22, middle 20, bottom 11/64 x 3/4 slot.

2. A drying platform for bagged seed should be constructed for the Lister dryer as soon as possible.

3. Concrete plans and specifications should be made for drying and storage at the new seed centers. A concise statement of needs and expected costs should be prepared. This consultant was informed by Mr. McAndrew that specifications would be prepared when the funds were available but this should be made so that efficient allocation of funds can be justified. A bag dryer platform similar to a design left with Mr. McAndrew has been found to work very well. Help in calculating fan and heater sizes, etc., can be provided by request thru the USAID office to this consultant.

4. The problems that Bookers have had with coordination and operation of their soybean project only serve to solidify our previous recommendation that they should develop their own capability in seed production. For the next few years, the simplest of air-screen cleaners will suffice.

Literature and most recent available prices will be forwarded them on the Clipper M-2B, 27A and Crippen model A cleaners.

5. Price and other information will also be forwarded on planting equipment which is also essential to the success of their project.

6. It is hoped that Bookers will not become discouraged but will continue their soybean project since it appears to be the bright spot in the whole soybean development scheme at this time.

ACKNOWLEDGEMENT:

The help and courtesies of George Eason and Fred Marti are gratefully acknowledged. They were always generous with their time for advice and logistic support both of which were much needed.

DISTRIBUTION:

AID/Washington - 5 copies

Ministry of National Development and Agriculture/Guyana - 5 copies
(Attention: Ben Carter)

AID/Guyana - 5 copies

Central Agricultural Station, Mon Repos - 5 copies
(Attention: Dr. Alfred V. Downer)

Dr. A. H. Boyd

Dr. J. C. Delouche

Bookers Sugar Estates, Ltd. - Project Evaluation Unit - 5 copies
(Attention: Mr. Jonathan Harlow)

University of Illinois - 20 copies

ATTACHMENT A

ITINERARY - A.H. Boyd - November 12-21, 1974

November 12	7:40 P.M.	Arrived Timehri Airport, met by AID car and driven to hotel.
13		National holiday. Reviewed previous trip reports and worked on Trinidad report.
14	A.M.	Checked in at USAID office, discussed progress in soybean and general agricultural situation with George Eason and Fred Marti.
	P.M.	Travel to Mon Repos with George Eason to set up appointments and begin work. Had short visits with Dr. Downer, Herman Adams, Neville McAndrew and Mr. Thomas.
15	A.M.	Travel to Mon Repos to meet with Neville McAndrew and staff. Discussed his drying, processing and storage problems, also his plans for use of new equipment, storage room and two new technicians he expects to add.
	P.M.	Travel to Mon Repos to discuss plans for new course in seed processing to be taught at the school of agriculture by McAndrew. Presented set of 24 slides from personal collection for his use and suggested various laboratory exercises on demonstrations to broaden the scope of the course. Met briefly with Christian Nwasiko. He has his final work on INTSOY trials almost completed.
16 & 17		Weekend. Completed Trinidad report. Prepared comments for Dr. Hittle
18	A.M.	Travel to Mon Repos. No contact with McAndrew. Checked malfunctioning moisture meter and returned to USAID office.
	P.M.	Return to Mon Repos for appointment with McAndrew but he was not in again. Returned to USAID office, began preparation of report and recommendations on work and observations to date.

6

19	A.M.	Work at USAID office on report to USAID and INTSOY. Attempt contact with Nwasike for further information on his INTSOY trial data.
	P.M.	Meet with Mr. Jonathan Harlow, Bookers Project Evaluation Unit.
20	A.M.	Travel to LBI Estate to meet with Dr. Abdul Wahab, Crop Development Officer for Bookers Project Evaluation Unit.
	P.M.	Travel to Mon Repos to meet with Mr. Fisher, McAndrew and Nwasike for discussion of seed program, and development plans.
21	A.M.	USAID office - Turn in interim report to Mr. Eason. Meet briefly with Dr. Wahab, and make preparation for return to U.S.
	P.M.	Depart for U.S.

ATTACHMENT B

Slides furnished the Central Experiment Station, Mon Repos for use in developing seed course at the school of agriculture:

1. Unloading system on bins at a soybean seed company.
2. Air-screen cleaner installed showing several points for better operation.
3. Disc (length) separator - closeup of disc pockets.
4. Disc separator - deagram of operation.
5. Disc separator picture.
6. Spiral separator.
7. Pneumatic separator - diagram.
8. Pneumatic separator - picture.
9. Gravity table separating soybeans.
10. Rollmill - diagram.
11. Rack of hand screens.
12. Equilibirum moisture content illustrations.
13. Title slides (6) illustrating steps and objectives of seed processing.
14. Cartoon slides (5) illustrating principles of processing.

ATTACHMENT C

Publications and printed articles furnished the Central Experiment Station, Mon Repos:

1. Differences in metabolic activity in peanut seed of different size classes - Baskin, Charles C. and Delouch, J.C. - MAFES journal No. 2192.

2. Effects of mechanical shelling on storability of peanut seed - Baskin, Charles C. and Delouch, J. C. MAFES journal No. 2194.

3. Systems for controlling relative humidity and temperature - Beck, James M.

4. How a psychrometric chart is used to determine air properties - Beck, James M.

5. Principles and methods of moisture measurement - Boyd, A. H.

6. Processamiento de semillas - Boyd, A.H.

7. Potential applications of color sorting techniques in seed technology - Boyd, A. H.

8. Harvesting handling and storage of soybeans - Delouche, J. C.

9. Maintaining soybean seed quality - Delouche, J. C.

10. Determinants of seed quality - Delouche, J. C.

11. Storage of seed in sub-tropical and tropical environments - Delouche, J. C., Matthes, R. K., Dougherty, G. M., and Boyd, A. H.

12. Seed conditioning for tropical environments - Matthes, R. K., Delouche, J. C., and Welch, G. B. - MAFES journal No. 1738.

13. Drying processing and storage of corn seed in tropical and sub-tropical regions - Matthes, R. K., Welch, G. B., Delouche, J. C., and Dougherty, G. M. MAFES journal No. 1839.

14. Electrical properties of seed associated with viability and vigor Matthes, R. K., and Boyd, A. H. - MAFES journal No. 1703

15. Physical properties related to seed viability and vigor - Matthes, R. K., Boyd, A. H., and Delouche, J. C. - MAFES journal No. 1609.

16. Heated air drying of soybean seed - Matthes, R. K., Boyd, A. H., and Welch, G. B. - MAFES information sheet No. 1246.

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17. Harvesting, source of many problems - Miller, Lee.

18. Controlled temperature and humidity storage - Munford, R. S.

19. Low cost temperature controlled rooms - Welch, G. B. and Delouche, J. C.

20. Seed processing and storage facilities for tropical environments - Welch, G. B. and Delouche, J. C.

21. Relation of moisture content, height of drop ad number of drops of soybean seed to germination. Mimeographed data sheet.

22. Drying manual - The Reed Joseph Company, Greenville, Mississippi.

Note:

All information sheets and reprints listed above were supplied by the Seed Technology Laboratory, Department of Agronomy, Mississippi State University, Mississippi State, MS 39762