

## LIST OF ABBREVIATIONS

ARC	-	Agricultural Research Committee
BHC	-	British High Commission
BRAFCO	-	Berbice River Agroforestry Company Ltd
CARICOM	-	Caribbean Community
CPCE	-	Cyril Potter College of Education
CSEC	-	Caribbean Secondary Education Certificate
CTV	-	Citrus tristeza virus
GGMC	-	Guyana Geology and Mines Commission
GLSC	-	Guyana Lands and Surveys
GSA	-	Guyana School of Agriculture
GUYSUCO	-	Guyana Sugar Corporation
ICAR	-	Indian Council for Agricultural Research
IICA	-	International Institute for Cooperation in Agriculture
IITA	-	International Institute for Tropical Agriculture
INIBAP	-	International Network for the Improvement of Banana and Plantain
LIDCO	-	Livestock Development Company
MHOGCA	-	Mabaruma/Hosororo Cocoa Growers Association
NARI	-	National Agricultural Research Institute
NGMC	-	“New” Guyana Marketing Corporation
PGR	-	Plant Genetic Resources
PHMB	-	Pink Hibiscus Mealy Bug
PRCSSP	-	Poor Rural Communities Support Services Project
SBA	-	School Based Assessment
SRDA	-	Strategic Research and Development Agenda
UGBC	-	University of Guyana Berbice Campus
USAID	-	United States Agency for International Development

## TABLE OF CONTENTS

	<b>PAGE #</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>i - xvi</b>
<b>I. OFFICE OF THE DIRECTOR</b>	
1.0 Research on ‘New’ Crop types .....	2
2.0 Analysis of Farming Systems.....	3
3.0 Marketing Information Systems.....	6
4.0 Organic Agriculture.....	7
5.0 Information Technology & Agricultural Support Services.....	9
6.0 Intermediate Savannahs – Ebini Unit.....	10
7.0 Special Projects .....	19
8.0 Seed Technology .....	29
<b>II. DEPARTMENT OF BIOTECHNOLOGY, PLANT GENETIC RESOURCES AND CROP PROTECTION .....</b>	<b>35</b>
<b>III. AGRONOMY DEPARTMENT</b>	
1.0 Crop Improvement .....	45
2.0 Crop Management .....	49
3.0 Seed Production .....	51
4.0 Trials in Progress at the end of 2004 .....	52
<b>IV. LIVESTOCK DEPARTMENT .....</b>	<b>53</b>

<b>V.</b>	<b>DEPARTMENT OF POST HARVEST AND AGROPROCESSING.....</b>	<b>63</b>
<b>VI.</b>	<b>SOIL AND WATER MANAGEMENT DEPARTMENT...</b>	<b>69</b>
<b>VII.</b>	<b>HORTICULTURE DEPARTMENT .....</b>	<b>92</b>
<b>VIII.</b>	<b>HUMAN RESOURCES REPORT - 2004 .....</b>	<b>103</b>
<b>IX.</b>	<b>FINANCAL REPORT .....</b>	<b>114</b>

## LIST OF FIGURE

<b>FIGURE #</b>	<b>TITLE</b>	<b>PAGE #</b>
1	Forecasts of production to major non-traditional product groups in Guyana	5

## LIST OF TABLES

TABLE #	TITLE	PAGE #
1	Yield of chive from two methods of harvesting, Fort Wellington, 2004	50
2	Flock size of sheep at the Livestock Farm, Mon Repos, 2004	58
3	Production parameters of the sheep production unit, Livestock Farm, Mon Repos, 2004	59
4	Yield of Boulanger as affected by fertilizer treatments	89
5	Yield and yield components as affected by different strains of Rhizobia	90
6	Fruit types of Montserrat Pineapple obtained during 2004, Kairuni	99
7	Plant Nurseries – Plant production to October for years 2003/2004	101
8	Staffing at NARI, 2004	109
9	Staffing in the Administration Category NARI, 2004	110
10	Staffing in the Senior Technical Category NARI, 2004	110
11	Staffing in the Clerical and Office Support Category NARI, 2004	111
12	Staffing in the Other Technical and Craft Skilled Category, NARI, 2002	112
13	Staffing in the Semi-skilled and Unskilled Category, NARI, 2002	113

## DEPARTMENTAL REPORTS – 2004

### I. OFFICE OF THE DIRECTOR

- |                                |   |                                   |
|--------------------------------|---|-----------------------------------|
| 1. Dr. Oudho Homenauth         | - | Director                          |
| 2. Ms M. Pooran                | - | Confidential Secretary            |
| 3. Dr. V. C. Mathur            | - | Crop Planner, ITEC Programme      |
| 4. Dr. R. S. Kharb             | - | Seed Expert, ITEC Programme       |
| 5. Dr. L. Munroe               | - | Head of Unit                      |
| 6. Ms S. Pooran                | - | Research Assistant                |
| 7. Ms M. Lutchman              | - | Research Assistant                |
| 8. Ms J. Garnett               | - | Research Assistant                |
| 9. Mr. R. Adrian               | - | Research Assistant                |
| 10. Ms L. Badal                | - | Communication Officer             |
| 11. Mr. R. Chan                | - | Communication Specialist          |
| 12. Ms N. Hutson               | - | Information Technology Technician |
| 13. Mr Khemraj Singh<br>Polder | - | Research Technician, Black Bush   |
| 14. Mr. J. Gonsalves           | - | Farm Manager, St. Ignatius        |

The areas of focus under the Office of the Director were as follows:

1. Research on 'New' Crop Types;
2. Marketing Information Systems;
3. Analysis of Farming Systems;
4. Organic Agriculture;
5. Information Technology & Agricultural Support Services;
6. Intermediate Savannahs;
7. Special Projects

## 8. Seed Technology

Special projects were executed in the following:

1. Poor Rural Communities Support Services Project (PRCSSP)
2. GGMC – Vegetation of a mined out site in Region 10.

Staff members from other Departments were integral in the execution of some of the projects. These included Dr. P. Chesney (Organic Agriculture) and Mr. M. Livan and Mr. D. Fredericks (revegetation of a mined out site in Region 10).

### **1.0 RESEARCH ON 'NEW' CROP TYPES**

#### **(a) CARROTS**

**Project Title:** On-farm demonstration of carrot production at Laluni

The diversification drive to introduce new crop types to the Agricultural Sector is ongoing at NARI. Three carrot varieties, New Kuroda, Amazonia and F1 Talena were tested on larger size demonstration plots at Laluni.

New Kuroda gave the highest marketable yield of 5 t/ha while F1 Talena gave the lowest marketable yield of 1.2 t/ha. Partial enterprise budget revealed that carrot cultivation is feasible and can contribute to farmers' net income and livelihood. Correct spacing and good timing of thinning are two important criteria that need to be followed. Without the recommended thinning out, a high proportion of undersized and malformed taproots are produced.

**Project Title:** Organic carrot cultivation

Following organic principles, carrot plots were set up at NARI- field # 37. Yields were reasonable but carrots were shorter in length as compared to other sites. The soil compaction and stickiness made it difficult for carrot tap roots to penetrate the soil. Once the soil can be well managed, organic carrot production can be further tested.

## **(b) ONIONS**

**Project Title:** On-farm demonstration of Onion production at Kairuni

In its quest to enhance diversification initiatives in the crop sector in Guyana, NARI is moving apace to promote onion cultivation. Superex onion variety was tested on brown sandy soil at Kairuni. From observations, this demonstration plot showed that onion can be successfully grown in Guyana. The plot yielded 3.7t/ha.

## **(c) PEANUTS**

**Project Title:** Seed production of five cultivars of peanuts at Kairuni

Seed production of five cultivars - Florunner, GN, AK 62, Basanti and Guyana Jumbo was done at Kairuni. Guyana Jumbo gave the highest yield of 9.5t/ha. A high percentage of wind nuts was recorded. This will be further investigated in 2005.

## **2.0 ANALYSIS OF FARMING SYSTEMS**

### **PRODUCTION OF NON-TRADITIONAL COMMODITIES IN GUYANA: STATUS AND PROSPECTS**

**(a) Trends in Production, Area and Yields**

Analysis of national and regional production of major non-traditional commodities was undertaken to determine the trends and variability in their production and to forecast production trends for the medium term.

The analysis revealed that as compared to the period 1990-2003, growth in production was higher in the recent period 1997-2003 for vegetables including melons, fruits excluding melons and citrus. Production growth, however, declined in the recent period for coarse grains, pulses, oil crops and roots and tubers.

While the growth in area was low in general during both periods, significant increases in area growth were observed in 1997-2003 for fruits and citrus commodities. Other commodity groups showed a decline in area growth in the recent period.

Growth in yields of major commodity groups was substantially higher in 1997-2003 as compared to 1990-2003 for vegetables, fruits, citrus and pulses. Growth was very low to negative in case of coarse grains, oil crops and roots and tuber crops.

A comparison of the production, area and yield growth suggests that growth in production is largely contributed by growth in yields. Area growth effect is much lower. Hence, production is increasing on account of improvements in yields of vegetables, fruits, citrus and pulses.

**(b) Variability in production, area and yields**

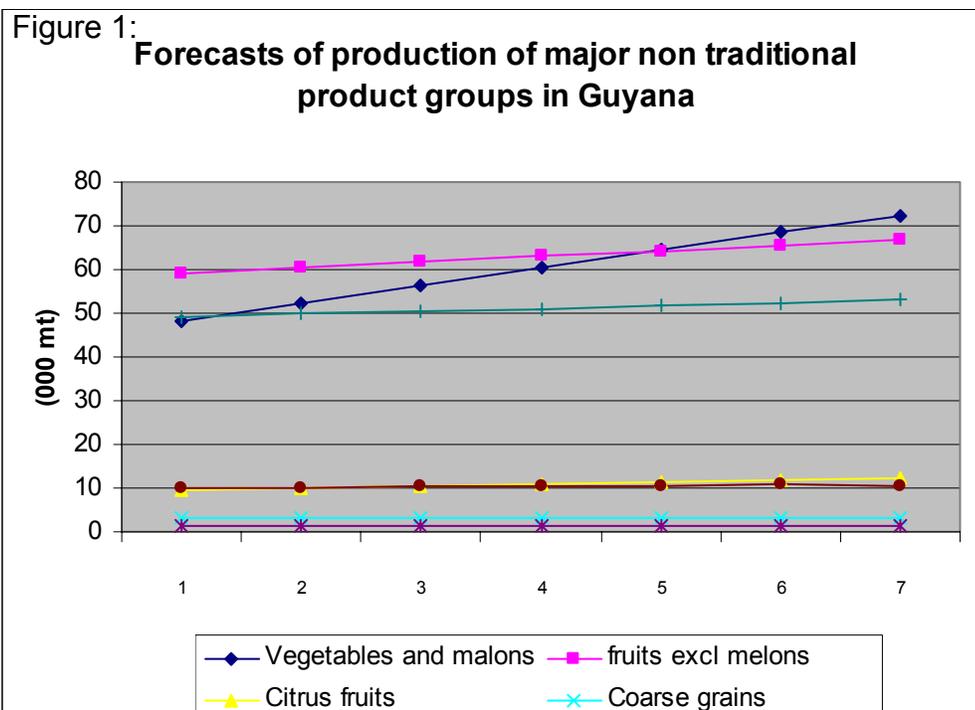
A comparison of the coefficients of variation revealed that variability in production, area and yield declined significantly during the recent years 1997-2003 in comparison with variability during 1990-2003. The

considerably lower variability in yields and production in the recent years indicate a trend towards greater stability in production of non-traditional commodities.

**(c) Production Forecasts**

In order to forecast production of non-traditional commodity groups for the medium-term, trend in production was quantified by estimating a quadratic function which gave the best fit to the data (Figure 1).

Production of vegetables and fruits in Guyana is forecast to increase to around 100 and 118 thousand metric tonnes respectively by 2005. The corresponding forecasts for 2010 are nearly 126 and 380 thousand mt, respectively. While the production of pulses is forecast to virtually stagnate at around 1.25 thousand mt during 2005 and 2010, production of oil crops and coarse grains will decline significantly if current trends continue. This finding is also supported by the negative compound annual rates of growth observed for these commodity groups, especially in the recent years.



2010  
2004 2005 2006 2007 2008 2009

### **3.0 MARKETING INFORMATION SYSTEMS**

#### **Marketing Systems for Fruits and Vegetables**

To improve efficiency in marketing of agricultural commodities, eliminate malpractices and ensure a fair deal for the producer farmers, varying forms of state intervention have been tried in different countries. State trading enterprises, marketing boards, marketing cooperatives and other types of parastatal organizations, and, at the level of markets, regulation of markets, are some of the forms in which governments have sought to intervene to protect the interests of farmers, improve domestic marketing and promote exports of agricultural commodities. In India, for instance, regulation of markets has helped to eliminate malpractices indulged in by middlemen and provide fair prices to farmers. There are no regulated wholesale markets for fruits and vegetables in Guyana. The New Guyana Marketing Corporation, however, undertakes the purchasing and selling of farmers' produce.

The Bourda market in Georgetown is perhaps the major wholesale market in the country. From this market, produce is distributed to other markets in the country including the small municipal markets in different regions. The Bourda market is also the terminal market for consumers located in and around Georgetown. Some of the other important markets are Stabroek, Parika, Port Mourant,

Skeldon and Charity. In addition to these, there are a number of small, weekly markets spread over different regions.

Household gardeners grow vegetables in and around their homes mainly for their own consumption. The surplus production after the household's requirement is sold in the local markets (Kumar, 1999). These producers transport the produce themselves to the nearby local markets for sale. Similarly, the specialized vegetable producers located in and around cities also generally transport their produce to the nearby markets themselves. The large farmers use middlemen to sell their produce. The middlemen collect the produce from the farmer's gate and transport it to the market for sale.

For exports, support services are provided to farmers by the New Guyana Marketing Corporation (NGMC). The NGMC provides guidance to farmers on production of non-traditional crops for the export markets, assists in documentation for exports and disseminates market information to farmers, traders and exporters.

Many countries in south and south – east Asia have found that formal or informal associations of the local market participants have helped to boost exports and processing of agricultural commodities (Kumar, 1996; Mathur, 2001; Titapiwatanakun 2001). Such formal and informal associations are conspicuous by their absence in Guyana. It may be useful to provide appropriate extension and institutional support to farmer producers to form such associations. Producers' or processors' associations can provide better bargaining power to them as a group, reduce processing and marketing overheads from the management and handling of large collective volumes and promote capital investment in essential processing equipment and cold chains.

#### **4.0 ORGANIC AGRICULTURE**

## **Cocoa**

A summary of the activities undertaken with reference to organic cocoa production in Region # 1 is provided below:

- The British High Commission (BHC) approved a Small Grant to the tune of US \$ 43,000 to the Mabaruma Hosororo Organic Cocoa Growers Association (MHOCCGA) for rehabilitation of existing cocoa plots, certification fee, procurement of a vehicle and other human and physical resources;
- Rehabilitation and pruning of 4,500 old cocoa trees were completed, 22 farms (82.5 ha) benefited from the exercise;
- Reconstruction of Artificial Dryer;
- Construction of two nursery sheds for cocoa production;
- Shipment of 742 Kgs of organic beans;
- New members received training on organic cocoa production, sixty seven farmers are now officially registered with the MHOCCGA;
- Submission of documents to the Soils UK Association. Ltd for certification of organic cocoa plots;
- Re-organizing of MHOCCGA new set of Executive Committee members;
- Drafting, review and registration of MHOCCGA constitution;
- Twenty three farm holdings covering 140.9 ha organically certified;
- MHOCCGA stakeholders meeting held in August 2004, to review the viability and sustainability of organic cocoa in Region # 1. Possible markets, diversification initiatives, technical inputs and other agricultural development plans and priorities for the region were identified;
- In June 18<sup>th</sup> 2004, the MHOCCGA was formally acknowledged as a member under the Friendly Societies Act Chapter 36:04; and
- NARI/ BHC agreed to the Extension of service of Mr. Lorenzo Soriano as Technical Advisor to the MHOCCGA;

## **Pineapple**

The pineapple plot at Mainstay, Region 2 was maintained. The yield data are currently being analyzed.

### **Developing alternate bait products for the management of Acoushi ants in Guyana**

Laboratory evaluation started on alternative insecticides to replace persistent, phenyl pyrazole (Regent) in leaf cutting ant bait. Synthetic pyrethroids: alphacypermethrin and cyhalothrin, biopesticides: Natural pyrethrum and mammey were tested. In all solutions the 0.1% concentration gave a 100% kill within the first hour. In the other concentrations (0.01% to 0.0001%) no kill was observed in the first hour until after 24 hours exposure. More tests were done using lower concentrations of 0.01% and 0.05% for alphacypermethrin, pyrethrum and fipronil. None of the solutions gave any kill at 0.01% concentration after 1-hour exposure.

## **5.0 INFORMATION TECHNOLOGY & AGRICULTURAL SUPPORT SERVICES**

### **Information technology**

The following tasks were accomplished by the Information Technology Department for the year 2004:

1. Routine maintenance of computers and peripherals.
2. Maintenance of NARI's website.
3. Addition of one computer from the Soils and Water Management Department, and two computers from Cleveland Paul's office to NARI's Local Area Network.
4. Creation of three booklets and two leaflets (drafts) for the Entomology department. These are still to be corrected in order to be finalized.

This year the I. T. Department acquired new equipment:

1. One HP DeskJet 5150 printer.
2. One D-Link DI-704P router.
3. Two AOC 15" monitors.

The HP DeskJet 5150 was given to Dr. Mathur to replace his HP DeskJet 3650 which was damaged due to a power surge.

The D-Link DI-704P router was retained by the I. T. Department to replace an older router which was damaged due to aging.

The two AOC 15" monitors were given to the Horticulture Department to replace two that were damaged, one due to aging and one due to undetermined causes.

Equipment damaged were:

1. Two HP DeskJet 3650 printer
2. One HP DeskJet 720C printer
3. Two motherboards
4. One APC 500 UPS
5. One APC 350 UPS
6. One APC 650 UPS
7. One Compaq black 15" monitor
8. One Hyundai white 17" monitor

### **Agricultural Support Services – Soil Chemistry Laboratory**

For the year (2004), the Chemistry Laboratory provided analytical services to farmers, N.A.R.I. researchers, Guyana Forestry Commission, and University of Guyana Students.

### **Sample Status**

Five hundred and thirty-nine samples were received in 2004. Of the 539, 451 were soil samples. Researchers brought 288, seven came from agencies and 163 from farmers. From this lot 401 soil samples were processed.

Eighty-two plant tissue samples were received in 2004 and thirty are still to be processed. These samples were from researchers at N.A.R.I. The determinations done were nitrogen (N), and phosphorus (P).

Six water samples were received and analysed for the year. These samples came from farmers. The water samples were analysed for pH and electrical conductivity.

## **6.0 INTERMEDIATE SAVANNAHS – EBINI UNIT**

### **Staff:**

Mr. L.Chester	Officer-in-Charge	Resigned April 2004
Mr. F. Benjamin	Officer- in- Charge (ag)	Appointed May 2004
Mr. K. Gonsalves	Research Technician II	

### **INTRODUCTION:**

The Intermediate Savannas have been described as the next frontier for agricultural development in Guyana, and the Ebini Unit was therefore established and continues to be maintained mainly to provide technical support for the farmers/investors who occupy the savannas and those who are expected to occupy the savannas.

The Ebini Unit has over the years developed and tested a number of useful systems and methodologies for the successful farming in the savannas, however, in recent times the Unit has been undergoing a renaissance of sorts

and as part of the rebirth a conscious effort must be made to nurture its development and guide its progress so that it could continue to play a useful and major role in the development of the Intermediate Savannahs.

The unit needs to be retooled and re-capitalized, the physical infrastructure repaired and new machinery acquired. In addition, programmes must be developed not only to cater for the large scale farming communities of the savannahs, but also for the small subsistence farming communities particularly those found in the Wiruni savannahs. The farming community of that savannah system has continued to eke out an existence albeit mainly due to trial and error, for the past 25 years. The Ebini Unit must therefore seek to consolidate its position and utilize some of the results and experiences of the past to develop programmes that would improve the welfare of the savannah farming community and impact positively on farming in general. One such project that should impact positively in the savannahs is the Agro-forestry research project, which seeks to increase the yields of grain legumes by utilizing an alley cropping system. The results from a previous study were heartening and can have a tremendous impact on the small farming systems. Another such project should be an integrated/crop livestock rotation aimed at enhancing the production parameters of both crop and livestock components. This project should assist in ensuring that there is continuity in farming in the savannahs and would ensure that the Ebini Unit continues to serve the interest of the farming community of the Intermediate Savannahs.

#### **Orchard Crops:**

The orchard crops are located mainly in the crop station, there is also a citrus orchard, which is situated in an area of close proximity to the generator room. During the reporting year routine maintenance of these crops was undertaken. The trees were circle weeded, pruned and fertilized with a combination of Muriate of Potash and Triple Super Phosphate at the rate of 225g per plant. Small quantities of fruits were also harvested and sold to the community. Some of the

rough lemon trees had shown symptoms of an attack by leaf minor, and small quantities of rough lemon seeds were harvested, prepared and propagated in the greenhouse mainly to expand the acreage of the crop station. The following is a listing of the plant types in the orchards.

<b>Fruit type</b>	<b>Acreage</b>	<b>Location</b>	<b>Work Done</b>
Rough lemon	8700 m <sup>2</sup>	Crop Station	Maintenance
Guava	1800 m <sup>2</sup>	Crop Station	Maintenance
Pineapple	11130 m <sup>2</sup>	Crop Station	Maintenance
Passion fruit	7788 m <sup>2</sup>	Crop Station	Maintenance
Cashew	5000 m <sup>2</sup>	Crop Station	Maintenance
Dwarf Golden Apple		Vegetable Garden	Maintenance
Mango	3 ha	Crop Station	None
Oil Palm	3 ha	Crop Station	None
West Indian cherry		Crop Station	Maintenance
Sweet cherry		Crop Station	Maintenance
Orange	0.25 ha	Citrus orchard	Maintenance
Grapefruit	0.25 ha	Citrus orchard	Maintenance

#### **Agro-forestry Research trial:**

A study was undertaken to increase the yield of maize, cowpea and pasture on the infertile soils of the Intermediate Savannahs, by replacing chemical inputs with tree mulch. The justification for the study hinges on the thought that by using acid tolerant, fast growing, nitrogen-fixing trees together with open row crops the nutrient needs of the crop could be met. The correct application of this technology could lead to increased crop yields, reduced fertilizer use and enhanced tropical ecosystem health. Three fast growing, nitrogen fixing plants, *Gliricida sepium*, *Acacia mangium* and *Leucaena leucocephala* were planted in bags in the green house in June 2004. After a period of germination and hardening the *Gliricida* and *Leucaena* plants were planted in the field in October

2004. There were problems with the growth of the Acacia, which prevented these plants from being planted in the field along with the two other plant species. Apparently, the medium used to set the Acacia did not encourage growth after germination and therefore the medium had to be changed to include ten parts of white sand and one part of organic matter. With the use of this medium, the growth rate observed was quite encouraging.

The experimental design for the study is a randomized complete block with four replications, and the objectives of the study are:

- (a) To increase by 20% in two years the yield of cowpea and maize by replacing costly chemical fertilizers with Acacia, Leucaena and Gliricida tree mulch in simultaneous arrangements of tree and crop.
- (b) To achieve positive interaction between the three tree types and cowpea and maize alley crops by increasing the fertility effect over the competition effect.
- (c) To improve the productivity and nutritional content of an adaptable pasture grass in a silvopastoral system.

The preliminary observations indicate there has been a good take of most of the plants, particularly the Glyricida plants; observations also show that the Glyricida plants appear to be better adapted than those of the Leucaena. As a result of the problems previously mentioned with the growth of the Acacia these plants have not been planted in the field.

In an effort to acquire some additional data from the agro-forestry study, an abandoned alley cropping area which was previously used to conduct field studies was cleaned and the area limed in preparation for planting. Soil samples were also taken both prior to and after liming.

## **Agro-forestry - Paulownia**

The Paulownia observation trial was planted in May 2002. At the commencement of this trial, half of the area was limed prior to planting and the other half was not limed. Preliminary observations of the plants indicated that the plants from the area that received lime had a better growth rate than those from the area that did not receive lime. Plant height and girth measurements were also periodically taken from all plants.

During the reporting year and indeed the previous reporting year, no maintenance work was done on the plants, however, in December 2004, following the visit of Mr. Jack Dickie and Mr. Dennis Yearwood, Directors of the Berbice River Agro Forestry Company Ltd. (BRAFCO), who indicated that they still had an interest in the project, maintenance work was undertaken. The trees were cut to ground level, fertilized with 0.5kg of urea per plant and mulched. The area was brush cut and cleaned. Most of the trees have sprouted, particularly those planted in the area which was limed prior to planting, some of the plants in that area had at least five sprouts per plant.

## **Seed and grain production**

The seed and grain programme is one of the main activities of the Ebini Unit, however this activity has always been hindered by the lack of inputs; the untimely supply of inputs, the lack of fertilizer, fuel, chemicals and the unavailability of machinery to effect land preparation and this year was no different. In spite of the numerous problems, the following crops were planted during the November 2003-January 2004 planting season.

<b>Accessions</b>	<b>Acreage (ha)</b>	<b>Yield</b>
-------------------	---------------------	--------------

Cowpea Minica 4	1.60	635 kg
California 5 Black-eye	1.20	194 kg
Cowpea Minica 1	0.22	Not available
Cowpea CP91A6	0.22	Not available
Cowpea CP91A7	0.22	Not available
Cowpea CP91B11	0.22	Not available
Cowpea CP95A1	0.22	Not available
Cowpea CP95A4	0.22	Not available
Cowpea CP95A5	0.22	Not available

The yields during this season were extremely low, because no fertilizer was available, during the cropping season hence the plants were not even given the first dose of fertilizer.

The May –June 2004 planting season was also beset by problems, the main problem being the lack of machinery to effect land preparation. In addition, there were also the usual lack of chemicals and the late acquisition of fertilizer. The following crops were planted in the May-June 2004 planting season.

<b>Accessions</b>	<b>Acreage</b>	<b>Yield (kg)</b>
Cowpea Minica 4	2.00 ha	850.0
California 5 Black-eye	1.20 ha	430.5
Cowpea Minica 1	0.16 ha	207.3
Cowpea CP91A6	0.16 ha	113.0
Cowpea CP91A7	0.16 ha	106.3
Cowpea CP91B11	0.16 ha	117.7
Cowpea CP95A1	0.16 ha	73.8
Cowpea CP95A4	0.16 ha	120.3
Cowpea CP95A3	0.16 ha	103.6
Cowpea CP91X1	0.16 ha	154.0
Jumbo Peanut	904 m <sup>2</sup>	29.0
Basanti Peanut	1400 m <sup>2</sup>	203.6
AK-62 Peanut	792 m <sup>2</sup>	30.0
Florunner Peanut	104 m <sup>2</sup>	14.0

In the November- December 2004 planting season, only 1ha of cowpea and 1 ha of peanut were planted. A lack of fuel was the main reason for the small acreages planted.

**Germplasm maintenance:**

The crop germplasm plot was also maintained during the reporting year, the crops planted in the collection include mung bean, sorghum, maize, cowpea, pigeon pea and peanut. The total germplasm area was 2460 m<sup>2</sup>. In addition five lines of sweet potato and two cassava lines were planted as part of the collection during the reporting year. In the December 2003-January 2004 planting season, the following were planted in the collection.

<b>Plant type</b>	<b>Number of lines/accessions</b>
Mung bean	5 lines
Peanut	4 accessions
Sorghum	3 lines
Maize	1 line
Cowpea	9 accession
Pigeon pea	1 line

In the May-June 2004, planting season the following were planted in the germplasm collection.

<b>Plant type</b>	<b>Number of lines/accessions</b>
Mung bean	5 lines
Peanut	4 accessions
Sorghum	3 lines
Maize	1 line
Cowpea	7 accessions
Pigeon pea	1 line

## Livestock Programme

The small ruminant programme particularly the sheep programme, instituted a multiple sire breeding system during the latter half of the year, mainly in an effort to increase the flock size. Two breeding males were transferred from the Mon Repos Unit to augment the ram power of the Ebini Unit. These animals were placed into the breeding groups to run with the dams in an all-year breeding programme. This all year breeding programme has resulted in an increase of the flock size mainly because the Unit is no longer employing the seasonal breeding system. In addition, the animals are allowed to graze extensively, rather than being restricted to grazing the enclosed pastures, mineral is also provided ad libitum.

The Ebini small ruminant programme transferred 19 breeding rams to the Mon Repos Unit during the reporting year, these animals were sold to the farming community as breeding males.

The sheep inventory at the Ebini Unit was as follows.

<b>Animal Class</b>	<b>Opening Stock</b>	<b>Closing Stock</b>
Breeding males	2	3
Breeding females	82	83
Weaned males	22	27
Weaned females	0	45
Male lambs	3	9
Female lambs	4	12
<b>Total</b>	<b>111</b>	<b>179</b>

The goat programme also had some level of success during the reporting year. This programme is in dire need of a breeding buck. The flock count reflects the following.

<b>Animal Class</b>	<b>Opening Stock</b>	<b>Closing Stock</b>
Breeding males	1	1
Breeding females	6	19
Weaned males	5	7
Weaned females	6	0
Male kids	3	2
Female kids	2	2
<b>Total</b>	<b>23</b>	<b>31</b>

In February 2004, the Livestock programme also rescued/acquired the remaining 48 beef cattle owned by the Livestock Development Company. These animals were abandoned by LIDCO and would have faced certain death from neglect, if they were not managed and cared for by the Livestock programme of NARI. The Institute had to immediately commence a programme of providing mineral ad-libitum for the animals as well as providing supplemental feed to the calves, in order to protect the herd and reduce the high calf and indeed adult mortality rate. The herd count at the end of 2004 was 78 animals, including the calves, and all of these animals are in excellent condition. The programme must also report that no calf born after the acquisition of the animals by NARI in February 2004, had died.

### **Administrative Matters**

In an effort to increase the revenue base from the Unit, as well as to assist the Unit in becoming self sustaining, the Unit, in addition to selling produce within the vicinity has began to transfer produce from the Unit to the Mon Repos Unit. During the latter half of the year the unit transferred the following produce to the Mon Repos Unit for sale.

No	Commodity	Amount
1	Peanut AK-62	30 kg
2	Peanut Basanti	186 kg
3	Cowpea Minica 4	273 kg
4	Cowpea Black eye pea	318 kg
5	Cowpea Minica 1	181 kg
6	Cowpea CP 91 B11	45 kg
7	Cowpea CP 91 X1	90 kg
8	Cowpea CP 95 A1	45 kg
9	Cowpea CP 91 A6	90 kg
11	Cowpea CP 91 A7	90 kg
12	Cowpea CP 95 A4	90 kg
13	Breeding Rams	19
14	Breeding Buck	1

## 7.0 SPECIAL PROJECTS

- (i) **Project Title:** Study of the insect complex involved in the pollination of West Indian Cherry, *Malpighia emarginata*

**Location:** Mr. Fitzroy Fletcher's, 60 acres cherry cultivation, Essequibo River

**Objectives:**

- i) Determine the insect species visiting West Indian Cherry flowers and their importance in pollination, with particular reference to *Centris* spp. bees.

- ii) Determine the bioecology of the species
- iii) Create conditions, if they do not already exist, for nesting of the species within the cultivation.

**Status:** The West Indian Cherry flowers profusely yet its fruit set is extremely low; poor fruit set has been attributed to the absence of pollination. Studies in Brazil identified *Centris tarsata*, an anthophorid bee, as the major pollinator of the crop in that country. Similarly, another *Centris* species, *C. dirrhoda*, was determined to be important for pollination in Jamaica.

In the study, two groups of bees were observed to visit cherry flowers, viz. a *Centris*-like species, and the bumblebee, Also observed alighting on fruits were fruit flies, *Anastrepha obliqua*.

The number of *Centris*-like species seen had been so small that collection of the insect for confirmation of identity was not possible (the species had not been recorded in Guyana probably because so little interest had been placed on the agronomy of cherry in the country). The one sample seen fits the description of the genus, however, the species still needs to be determined.

No natural nesting sites of the *Centris*-like species were observed within the cultivation or its immediate environs; however, farm workers noted that they observed the same bees nesting in clay “firesides”.

A fireside was built at the side of one of the farmhouses and this has attracted the *Centris*-like species, which has nested in the

structure. Nest density has been extremely low, and as a consequence, insect population density also.

(ii) **Project Title:** Management of the soursop wasp *Bephrata maculicollis*.

**Location:** Damion Da Silva's farm, Parika

**Objective:** To develop an integrated system, excluding the use of pesticides, for protecting soursop fruits against damage

**Status:** During the year the area cultivated with soursop was mapped to determine whether there was a pattern to the infestation, i.e. whether there were areas of high, medium and low infestation intensity. Simultaneously, the plot was studied to determine the existence of peculiar conditions which might be associated with infestation severity.

No particular pattern was observed, however, at least two cultivars of the crop were identified, and it appeared as though one was more severely affected by the wasp than the other.

(iii) **Project Title:** Assistance to the Government of Suriname for management of the Pink Hibiscus Mealybug. (PHMB)

**Objective:** Provide technical assistance to the Government of Suriname, through an FAO TCDC programme, for the management of the (PHMB).

**Status:** Dr. Munroe served as a biological control expert on the project. The project involved three missions to Suriname. First an assessment was made of the problem and a plan of action drawn up with Ministry of Agriculture personnel. The Ministry staff was also trained in survey methodology, sampling and identification of PHMB and its natural enemies. During the subsequent visits evaluations were made and further training given.

The pest was successfully brought under control.

(iv) **Project Title:** Technical assistance to the Plant Health Services, Ministry of Fisheries, Crops and Livestock.

**Objective:** Support the effective functioning of the Plant Health Services

**Status:** The support given to the department took the form of advisory and diagnostic services and staff and farmer training. Attention was focused primarily in the areas related to the export trade in fresh agricultural produce.

The author served as a resource person on seminars/workshops on Good Agricultural Practices (GAPs) in Regions 3, 4, 5 and 10.

#### **Miscellaneous Activities:**

a) ***Cleaning pesticide spill***

A major problem developed when metal drums containing obsolete pesticides (names unknown, but apparently organophosphates) leaked their contents into the surrounding environment; a mop up exercise was undertaken. This comprised of neutralizing the effects of the pesticides with calcium oxide, and transferring all remaining pesticides to plastic drums.

There is now an urgent need for proper storage facilities for all pesticides, obsolete or otherwise, held on the Institute's premises.

**b) *Managing coconut caterpillar with entomopathogens***

During the year efforts were made to source entomopathogens, which could be used to manage the coconut caterpillar, *Brassolis sophorae*. Currently, no suitable formulation is commercially available for use. The spatial distribution of the pest renders the products on the market inappropriate for use.

One input supplier suggested the use of injectable neem; this is to be attempted in 2005.

## **7.2 GGMC**

### **RE-VEGETATION OF THE NORTH EAST KARA KARA MINES**

#### **Introduction:**

The project is a result of a collaborative effort between the GGMC and NARI to re-vegetate the area at the base of the mine spoils in the Northeast Kara Kara mined out area with plant species of economic value. Work commenced in October 2003 with the planting of Vetiver grass along the contour for erosion

control and the establishment of the pasture species (*B. humidicola*), the forest species (Paulownia) and the orchard species (lime). This report attempts to highlight the status at the end of 2004

**General Objective:**

To re-vegetate 4 hectares of mine spoils subjacent to the spoil piles with a tree or crop spp. of economic importance and simultaneously the base of the spoil piles by reducing runoff and erosion.

**Specific Objectives:**

1. To control run-off and erosion on the slopes by establishing lines of *Vetiver* grass along the contour
2. To establish 1.3 ha of pasture using *Brachiaria humidicola* for grazing by small ruminants
3. To establish 1.3 ha of *Paulownia spp.* on the mine spoils
4. To establish 1.3 ha of limes on the mine spoils
5. To increase the organic matter content of the area

**EROSION CONTROL:**

Seven lines of vetiver grass were planted along the contour 30m apart. Due to heavy runoff in the north eastern and south eastern areas the vetiver in those areas were washed away before they were able to establish themselves. In the other areas where they were planted they have good establishment and have reduced the flow of water and movement of sediments down the slope. Silt fences were erected in the north eastern and south eastern gullies in December 2004. These were able to trap an average 12” (30 cm) of sediments by the end of December.

**PASTURE:**

*B. humidicola* was planted in the entire area (4 ha) both for pasture (grazing of small ruminants) and land cover. An area of approximately 0.135 ha was hand planted and the remainder broadcast onto the surface and harrowed into the soil. The erosion in the north eastern and south eastern areas have prevented the firm establishment of the grass but in the area between there has been 99% coverage. This grass is being constantly grazed by cattle.

#### **FOREST:**

Four hundred *Paulownia* plants were planted in December (30/12/2003). These plants were well established by June 30, 2004. The plant height ranged from 40 cm to 180 cm. An attack by acoushi ants defoliated and destroyed the growing tips of the plants while marauding cattle broke the others. Regrowth is being observed on 20 of these plants. It has been planned to fence the area and replant the *Paulownia*. The acoushi ants nests were baited and destroyed.

#### **LIMES:**

Seventy five lime seedlings were planted in January of 2004. These were pruned and fertilized during the period and by December 2004 they were approximately 90 cm tall with a mean diameter of the foliage of 75cm. During the November – December 2004 wet season a further 325 plants were planted. Of these 200 were destroyed by cattle which either uprooted the plants as the cattle grazed the succulent grass around the planting holes, or trampled the plants as the cattle grazed.

#### **OTHERS:**

At a meeting between GGMC and NARI – the commissioner of GGMC directed that fat poke and cashew be planted in the area. Fat poke seeds were collected and set for germination but germination was poor. By the end of December of the 400 seeds set only about 100 germinated the others rotted in the bags.

Twenty-five cashew plants were planted on the upper slope. These have established and new leaves were emerging.

## **7.3 PRCSSP**

### **INTRODUCTION**

The modified Research Action Plan was resubmitted to the CDB and the Bank provided its “no objections” in February. The trials/activities were grouped under the five research objectives in the Research Action Plan. This report represents the status of the projects as at December 2004.

#### **1. Conducting Pest, Soil and Farming Systems Survey**

##### **Project 1 - Survey**

The activities of the Pest, Soil Management and Farming System Survey commenced in March with a training seminar for the enumerators and field Supervisors. The questionnaire was “field tested” and field activities (data collection/completion of questionnaires) for the Survey also commenced in March.

The field activities were suspended at the end of April due to problems experienced with the enumerators. The activities recommenced in July and were completed in November by students from the Guyana School of Agriculture as the enumerators.

In Region 2, four thousand, one hundred and fifty four households were recorded and 491 questionnaires were completed. In Region 3, twelve thousand, two hundred and ninety nine households were recorded and 753 questionnaires were completed.

## **2. Developing appropriate farming systems, including crop rotational systems**

### **Project 2 - Integrated Pest Management of Insect Pests, Diseases and Weeds.**

A Surveillance Programme is on going in the two Regions, this includes the physical collection of insects, diseases and weeds. It is being conducted in collaboration with the National Agricultural Research Institute.

Twenty percent of collection in Region 2 was completed. The information gathered from the specimens collected, together with the results from the Survey will allow for recommendations to be made on Integrated Pest Management practices for specific crops.

### **Project 3 - The effect of pruning and transplanting on tomato**

Two trials and one demonstration were established. One trial and the demonstration (only observe the effects of pruning) were established on at Capoey in Region 2. The other trial was established at Parika Backlands in Region 3.

### **Project 4 - The effects of plastics in the control of weeds in tomato**

The order to procure the plastic film from the USA was completed and it is expected in Guyana in December. Two trials are planned and the transplanting of the seedlings into the trials plots has been scheduled to coincide with the availability of the plastic film. Land preparation has commenced at Capoey in Region 2 and Hague Backlands in Region 3.

### **Project 5 - The effects of crop rotation in farming systems**

Two trials were established. One trial was fully established at Hague Backlands in Region 3. Land preparation has commenced and the sowing of seedlings in trays was completed for the other trial at Pomeroun in Region 2.

### **3. Developing Post Harvest Management Systems**

#### **Project 6 - The effects of sleeving and packaging on the quality of plantain/ banana**

Two trials and one demonstration were established. The trials were established at Salem and Truly Island in Region 3. The demonstration was established at Lananaballi in Region 3.

An additional farm was selected in the Supernaam area in Region 2 for the establishment of another trial.

#### **Project 7 - The effects of Hot Water Treatment on Quality of Plantain/ Banana**

Three trials will be executed. Discussions began and will continue with the Guyana Marketing Corporation on the equipment necessary for this trial.

### **4. Developing Irrigation Systems, including Drip Irrigation**

#### **Project 8 – The effects of Drip Irrigation on the yields of tomato**

The equipment to establish these trials was acquired in December. Land preparation has commenced at Spring Garden in Region 2 and at Hague Backlands in Region 3. Seedlings for both trials were sown in December, 2004.

**5. Developing the six-component programme for organic production systems including practices and procedures.**

**Project 9 - Demonstrations to develop protocols for organic production systems**

The sites for two trials are being reconsidered, this process was completed in December 2004. Land preparation at the two new sites will commence in January, 2005.

**6. Unplanned Projects**

**Project 10 - The effects of plant spacing on red pea yields**

This trial was added after it was observed that farmers were using very low seeding rates in the pea growing areas. Land preparation and the design of the trial area were completed in December, 2004, at Dartmouth in Region 2.

**Project 11 - The effects of plant spacing on tomato yields**

This trial was added after it was observed that farmers were not using standard seeding rates across the Regions. Land preparation commenced in November at Parika Backlands in Region 3 and the sowing of the seedlings in trays was completed in December, 2004.

**Project 12 - The effects of a standard Phosphorus and Potassium application and varying levels of nitrogen on the yields of plantain**

This trial was added after it was observed that farmers had no proper fertilizer programme. A trial site was selected at Truly Island in Region 3 and the first fertilizer application will be done in January, 2005.

## 8.0 SEED TECHNOLOGY

**Project:** Seed production of non-traditional crops  
(Dr. O. Homenauth, Mr. L. Jagbir and Dr. R. Kharb)

### Results:

During the last three seasons, the following quantity of high quality seed of non-traditional crops like corn, sorghum and cowpea was produced at NARI. The processed seed would be utilized by various agencies and farmers for further multiplication and crop growing.

Crop	Seed quantity produced (lbs)		
	Season I	Season II	Season III
Corn	2000	465	*
Sorghum	4000	1640	*
Cowpea (Minica-4)	200	635	225

\* crop could not be planted.

In each season, the true-to-type plants were selected in sufficient quantity for maintaining the genetic purity of the crop varieties. The possibility of seed production of different vegetables was also assessed at the newly acquired facility at Lesbeholden (Black Bush Polder). It was observed that good quality seeds of all fruit, legume and cucurbit vegetable crops can successfully be produced at this location in Region 6.

**Project:** Seed quality testing  
(Dr. R. Kharb)

### Results:

Seed quality testing is an essential activity in a successful seed programme. It is essentially required for assessing the planting value of seed-lots, suitability of seed for sowing and in national and international seed trade. For instance, the germination test was conducted on two samples of cowpea, one from Mon Repos and another from Ebini. Germination percentages of the samples were recorded as 96% and 22%, respectively. It was evident that the sample from Ebini was of very poor quality and could not be used for seed purposes. The germination of a peanut sample (cv. Basanti) from Ebini was 92%, clearly indicated high quality and suitability for planting.

A manual entitled “Vegetable Seed Testing Manual” was prepared for testing the quality aspects of vegetable seeds according to the international rules recommended by the ISTA (International Seed Testing Association). The manual recorded principles and procedures used to test different seed quality parameters generally for seed sampling, physical purity analysis, moisture determination, germination, viability and vigour testing. This manual would be very useful for seed analysts, scientists, teachers, students and workers dealing with seed business.

**Project:** Germplasm Evaluation  
(Dr. R. Kharb, Dr. O. Homenauth and Mr. L. Jagbir)

**Results:**

A few genotypes / lines of spices viz. fenugreek (*Trigonella foenum-graecum*), coriander (*Coriandrum sativum*), geera (*Cuminum cyminum*) and fennel (*Foeniculum officinale*) were received during the year. Prior to sowing, their germinability was tested. The germination percentages were recorded as follows:

Coriander	I = 00%, II = 46%,	Fenugreek = 92%,
Fennel(saunf)	I = 56%, II = 82%,	geera = nil.

Trials on these spices were planted at a few places at Mon Repos and at Lesbeholden during October – November, 2004; but all trials totally

failed/damaged by disastrous January floods. A trial on wheat also failed because of the same reason. However, trials on these crops will be conducted during the year 2005.

**Project:** Preliminary potato evaluation trial on the coastal plains  
**(Dr. R. Kharb and Dr. O. Homenauth)**

**Results:**

A trial was conducted at NARI, Mon Repos to assess the possibility of potato cultivation on the coastal plains. Two varieties were obtained from the local market and the tubers were allowed to sprout for two weeks at room temperature. Then the sprouted tubers of both the varieties, whole or cut into two pieces depending on the position of the sprouts on the tubers, were planted at a distance of eight inches on ridges spaced two feet apart and covered with a 1-2 inches layer of fine soil. Similarly, three tuber plantings were done i.e. the first on December 12, 2003; the second on December 29, 2003 and the third on March 7, 2004.

In the December plantings, growth and development of the plants were normal and tuberization started in all the plants. Most probably due to increase in temperature and day-length the well grown healthy plants started drying up after 70-80 days and tuber growth was further checked. The first and second plantings were harvested on 7<sup>th</sup> and 19<sup>th</sup> March, respectively, when plants were completely dried up. Number of tubers per plant ranged from 2-6, comparatively smaller in size than normal. The third planting was very late, only one seedling came out of the soil and didn't develop into a normal plant. Hence this planting time was not found suitable. Overall a concrete conclusion cannot be drawn from this small trial, however, with the use of suitable planting material (heat-tolerant, photo-insensitive) and the use of appropriate production technology, there seems to be fair chances of potato cultivation on the coastal plains of Guyana.

**Project:** Agro-ecological factors and identification of suitable areas for seed production of vegetable crops in Guyana

**(Dr. R. Kharb and Dr. O. Homenauth)**

**Results:**

The non-availability of high quality seed of well adapted varieties in sufficient quantity is one of the major constraints to enhancing production, productivity and quality of vegetables in the country. The majority of the farmers either use their own seed particularly in legumes and cucurbits or largely depend on expensive, imported seed of private dealers/retailers. Seed production must be carried out under standardized and favourable conditions. Reasonably all kind of seeds should not be produced in a single area, but should be produced in suitable selected areas of different agro-ecological zones. Therefore, an attempt was made to identify the appropriate areas / locations on the basis of agro-ecological requirements of vegetable crops.

Seed quality is influenced by numerous factors that can be broadly grouped into general, climatic, edaphic and biological factors. The agro-climatic and soil crop suitability were found to have profound influence on seasonality and site specificity of vegetable seed production. The ideal climatic requirements for seed production are:

- suitable temperature, radiation and rainfall for crop growth and development;
- favourable photoperiod and temperature for floral induction;
- dry and relatively calm weather during maturation and harvesting;
- soil suitability and fertility with assured irrigation facility.

All these factors / criteria and climatic requirements of vegetable crops have to be considered when selecting suitable areas / locations for seed production.

Regions or locations within region may vary in their suitability for seed production. Even at one site, the seed yield can be higher in one location than in another location with the same level of care and attention. The main vegetable growing areas are Regions 2 - 6 which together produce more than 90 per cent of the country's total production. Considering data on climatic factors of some locations in these Regions, Regions 2 and 3 (Dawa and Leonora locations) are more humid and cloudy and less suitable for quality seed production. However, some vegetable crops like hot-peppers, wiri-wiri, bora, boulangier, sweet corn, pumpkin, cucumber, etc. can be raised in the Parika back-dam area. The prevailing environmental conditions would affect the longevity and storability of seeds considerably. Nearly more than average rainfall, ample solar radiation and the coastal clay soils of the Region 4 seem to be suitable for seed production of vegetable crops like ochro, boulangier, pepper, tomato, cowpea, bora, pigeonpea, corn, pumpkin, etc., especially at NARI's farm and adjoining areas. Ecological factors such as moderate precipitation, more sunshine hours and the loamy to clayey soils of the Region 5 (Fort Wellington, Blairmont, Bath Settlement) might be more suitable for seed production of popular annual vegetable crops. Region 6 receives optimum monthly rainfall (100-150mm). Constant temperatures, more net radiation time and well drained loamy to light clay soils of Albion, Rose Hall, Black Bush Polder areas might be the most prevailing conditions for quality seed production of fruit, legume and cucurbit vegetables. The possibility for seed production of various vegetable crops was assessed at the newly acquired facility at Lesbeholden (Black Bush Polder) and it was observed that the seed of ochro, tomato, boulangier, hot-pepper, cowpea, bora and all cucurbits can be successfully produced. Among Regions, Region 6 seems to be overall the most suitable for quality seed production of important vegetable crops except the Skeldon area where mean relative humidity remains very high (>82%).

**Project:** Compilations

**Results:**

Information on the following two aspects were compiled at one place.

1. "Minimum Seed Certification Standards" - for popular and vegetable crops of Guyana are compiled. These are standards to which seed crops or seed-lots should conform and with which seed producers and certification agencies should comply.
2. "Mean Monthly Data of Different Locations of Guyana" - information about climate/ weather forecasts help in planning and efficient management of crop production, water resources, etc. Time series data can also be used in various weather simulation models for crop monitoring and forecasting. Thus, mean monthly climatic data averaged over years for different locations were compiled. These data can be utilized for various purposes.

## **II. DEPARTMENT OF BIOTECHNOLOGY, PLANT GENETIC RESOURCES AND CROP PROTECTION**

The Department consists of three sections; Biotechnology, Plant Genetic Resources and Crop Protection. There are four operational laboratories namely, Plant Tissue Culture, Plant Pathology, Entomology (including an insectarium), Weed Science (including a herbarium) and Virology. These laboratories together with the Plant Genetic Resources (PGR) Documentation Centre have the capability of providing valuable service in Guyana.

Within the department staffing comprises of a Head, five Research Scientists, two Research Assistants, six Research Technicians, five non-technical staff and a Voluntary Service Officer, Mr. Christopher Warui.

Head of Department: Dr. Patrick Chesney

Project Officers: Ms. Kaye Mc Allister  
Mr. Cleveland Paul  
Dr. R Chandranauth  
Mr. C. Warui  
Mr. Evan Willabus  
Ms. C. Wilson

Project Technicians: Mr. Ramphal Mohabir  
Ms. Shelly Dennis

Ms. Loyce Ifill  
Ms. Sharon Nicholson  
Ms. Amanda Connell-Chester  
Ms. Nathalie Miller-Brisette

Non- Technical Staff: Ms. Noelle Moses  
Ms. Sheila Kellman  
Ms. Sarujdai Singh  
Ms. Lorraine Gordon  
Ms. Lavern Benjamin

## **Introduction**

The objectives of the Department of Biotechnology, Plant Genetic Resources and Crop Protection created in 2003, are as follows:

1. To acquire, conserve, characterize, evaluate, multiply and document selected crop germplasm.
2. To generate information for improved management of crop pests and diseases.

During 2004, research projects were conducted in the areas of biotechnology, plant genetic resources and crop protection. Six projects were undertaken.

Project 1: Provision of effective, timely and affordable laboratory services in biotechnology, entomology, plant pathology and weed science.

Aim:

To develop and maintain a skill and laboratory capability to provide support for the national quarantine system and in addition, a diagnostic and advisory service to the farming community as a whole.

Status:

A total of 13,260 micro propagated plants were produced. Of this amount 7,486 were plantain and 5, 774 were

pineapple with a total sale value of \$265,200. The expected output for this activity thus being achieved.

Horse plantain variety was successfully micro-propagated bringing to two the total number of plantain varieties available to farmers.

Four important food crops (pineapple, cassava, yam, sweet potato) were maintained in *in-vitro* storage.

About 100 crop plant samples submitted by farmers and researchers were for diagnostic purposes. The largest number of samples for pest and disease diagnosis and advice/ recommendation were from Region 4 followed by Regions 5 and 2. No samples were received from Regions 7, 8, 9 & 10.

Twenty-two schools comprising a total of 398 persons visited the research laboratories as part of educational tours as well as for assistance in the identification and preservation of plant pests.

A total of 2,857 packets of ant bait was sold. The revenue received was \$199,990.

Training manuals on management of pests on food plants in Regions 2 & 3 were prepared in draft form. Expert assistance was provided to the PRCSSP in the survey of pests and diseases of food plants in Regions 2 & 3.

Project 2: *In-vitro* evaluations of selected crop germplasm.

Aim:

To adapt and evaluate techniques for longer storage, improved viability in storage, increased stress tolerance and regeneration of important food crop germplasm

Status:

No work was conducted on this project. This project will be integrated into USAID-funded PL 480 project to come on stream in 2005.

Project 3: Strengthening of the PGR management programme.

Aim:

Management of all of NARI's plant germplasm collections, a centralized documentation system (including data analysis) and supply raw materials for NARI's other crop research programmes

Status:

## PGR Research

The focus of PGR research has been on the acclimatization of some new landrace varieties of sweet potato and one exotic accession of yam to the sandy soils along the Soesdyke Linden Highway. Varieties are slated for release to farmers next year.

Work during this period saw the completion of the upgraded version of the intranet-based PGR Management System for NARI.

## **YAMS PGR RESEARCH**

An exotic accession of yam was sown between January 2004 and February 2004 to approximately 70 hills at the Kairuni Out-station. These plantings were in the form of pen manure-based seed trenches. Some seed tubers were recovered in late December 2004. The remainder is expected to net a total of about 150 pounds of seed tubers when harvest continues in the next reporting period. These seed tubers will enter the next cycle of seed yam production.

## **SWEET POTATO PGR RESEARCH**

### **Field Germplasm Banks**

Due to the loss of a considerable number of accessions from previous gene banks the section initiated a recovery activity that initially netted 6 varieties. This effort continued towards the end of the December 2004 and so far has netted 15 accessions that are currently kept in four on-farm field gene-banks at Kuru kururu on the Soesdyke-Linden Highway (Region 4).

### **Cassava PGR Gene-banks**

Currently there is only one field gene bank in a terminal state at the Kairuni Out-station. This field bank has 27 accessions and is due to be replanted during the first quarter of the next reporting period.

### **PGR Management System**

Work during this period saw the completion of the upgraded version of the intranet-based PGR Management System for NARI.

The system is currently accessible from within NARI's intranet.

Project 4: Commercial adaptation of important food crops.

### **Sweet Potato Trials**

During the period from May to June, 2004, three trials (Five-Varietal Comparison, Variety X time to Harvest, and Variety X Planting Density) were anchored at Kairuni. Owing to circumstances outside of this Section, only the Variety X Planting Density trial would be recoverable. Planting materials were recovered from all three trials and used to establish on-farm research plots at Kuru Kururu. By the end of December 2004, three trials (Variety X Density, Variety X Type of Cuttings, and Variety X Row Design) comprising 48 research plots (experimental units) were established on

four farms; one farm being one replicate. These on-farm trials are transitory in nature and during the first quarter of the next reporting period will be expanded to a total of six trials comprising about 200 plots.

Project 5: Integrated Pest Management of crop pests in selected growing environments.

Aim:

To develop and promote effective environmentally sound integrated pest management systems including the use of microbial pesticides.

This project consists of four activities which will follow systematically.

### **Activity 1**

Status:

Characterization of Agroecosystems and diagnosis of insect pests, diseases and weeds in a typical coastal and riverain agroecosystem

Two areas were identified for this project namely; De Hoop, Western Mahaicony -a typical coastal agroecosystem and Hubu- Parika Back, Left Bank Essequibo River- a typical riverain agroecosystem.

Data on pest control measures used in farms at Parika Back and DeHoop/Mahaica area were collected. Information on soil type and crop production activities were also collected. Additional information needs to be sourced and the information gathered in each agroecosystem will be compiled and documented. Activity 1 is on going and would be followed by Activity 2. which is a detailed survey of available control measures for pest problems.

Project 6: Identification, conservation and evaluation of plants with biopesticidal properties.

Aim:

To make available semi-chemicals or plants producing such agents associated with plant-pest interactions as alternatives to broad spectrum eradicant pesticides.

Status:

Fifteen native plants were collected from locations in various regions in Guyana based on anecdotal information. The testing of these native plants with pesticidal properties commenced with two bioassays utilizing two plants, namely; Asikoni (*Lonchocarpus spp.*) in extracts of crude liquid and powder form and Jackbean (*Canavalia ensiformis*) as crude liquid. The extracts were tested against five plant pathogens- *Colletotrichum spp.* (Hot pepper), *Colletotrichum spp.*(Tomato), *Fusarium sp.* (Tomato), *Nigrospora sp.* (Tomato) and *Sclerotium rolfsii* (Sweet pepper).

Diametrical growth was recorded at five days after inoculating dishes and percentage inhibition was calculated. Results indicate that crude extracts from *Asikonina* show promise in the control of fungal pathogens of solanaceous vegetable crops especially *Fusarium spp.* on tomato.

*Asikonina* powder gave the best results with 70 percentage inhibition in both assays conducted. The powder will shortly be tested further on other pathogens of solanaceous vegetable crops as well as other important crops.

#### Capital works- Repairs to facilities

The Acoushi ant bait facility was repaired. Partial repairs were done to the Virology Unit. Work is scheduled to be completed during 2005

#### Resource Mobilization:

##### Staff Addition

1. Human resource was mobilised during the reporting period with the addition of a plant virologist/ research scientist, Dr. R. Chandranauth. This addition will enhance the range of skills available as well as the provision of services in the field of crop protection.
2. Mr. Christopher Warui, joined the staff in February as a VSO Volunteer. Mr. Warui is an Entomologist.
3. Staff members received training in two important areas;
  - a. Use of GPS/GIS in pest Monitoring and detection and
  - b. Biological control of papaya mealy bug in Guyana.
4. The sum of \$50,000,000 G was secured from USAID administered PL- 480, Food for Progress programme, for the management of PGR for food and agriculture at NARI. The Plant Tech Department is the Departmental beneficiary of the funds.
5. A computer workstation and \$750,000 G worth of laboratory equipment and materials were provided to the Department from an ISF individual grant to the Head of Department.

#### **Collaborative Project**

The four sigatoka resistant accessions received from INIBAP in November 2003 were maintained on suitable multiplication media and regenerated. These accessions along with two local landraces were utilized in pot studies in the green house to screen for resistance against *Ralstonia solanacearum*, the organism that causes Moko disease.

The study was initiated in November 2004 with the inoculation of plants at four-leaf stage with bacterial suspension. Observation and data collection were done once weekly.

The materials utilized are as follows:

Accession Name/No.	Origin/Source
ITC.0506 FHIA-03	INIBAP
ITC. 0504 FHIA-01	INIBAP
ITC.1418 FHIA-25	INIBAP
ITC. 1344 CRBP-39	INIBAP
Horse Plantain	Local
Creole Plantain	Local

Preliminary results after the first trial showed that of the four INIBAP accessions, inoculated only ITC 1418.FHIA- showed no symptoms of infection after being observed over a three week period. The three other INIBAP accessions inoculated had 25-100% plant mortality over the same period of observation. The local landraces horse plantain and creole plantain showed no infection symptoms and all appeared healthy.

## VISITORS TO CROP PROTECTION SECTION 2004

DATE	NAME OF SCHOOL	NUMBER OF PERSONS/ STUDENTS	PURPOSE OF VISIT
2004-02-04	Saint Stanislaus College	2	Identification of Insects.
2004-02-04	Saint John's College	18	S.B.A Programme
2004-03-04	Mackenzie High School	22	S.B.A/CSEC Programme
2004-03-26	N.A. Multilateral School	70	Agriculture Field Trip.
2004-04-15	Saint Rose's High School	23	S.B.A Skills/Field Visit.
2004-04-26	Alleyne's High School	2	Collect Entomology Information.
2004-04-30	Belladrum Secondary School	18	Collect Information.
2004-06-04	Golden Grove Secondary	4	Press and Preserve Weeds.
2004-06-07	G.S.A	6	Press and Preserve weeds.
2004-06-07	Golden Grove Secondary	3	Collect and Preserve Weeds.
2004-06-24	Corentyne Comprehensive	48	Identification of different Pests and their control.

2004-07-15	Central Demerara Academy	15	Studying Breathing and Feeding habits of Insects.
2004-07-17	Golden Grove Secondary	4	Research on three types of Weeds.
2004-08-30	Saint John's College	15	Research on the types of weeds and Insects.
2004-10-08	Saint Joseph High School	2	Research on Disease caused by Pathogens.
2004-10-08	Saint Joseph High School	1	Research on Pests and Diseases
2004-10-13	Mahaicony Secondary	20	Field Trip
2004-10-20	North Georgetown Secondary	40	Plant Information
2004-10-22	Bush Lot Secondary W.C.B	59	Educational
2004-10-26	UGBC – Tain	15	Educational
2004-11-24	C.P.C.E Rosehall Centre	10	Acquisition of Information in Crop Protection.
2004-12-07	Bishop's High School	1	Identification and Mounting specimens.
	Total	398	

### III. AGRONOMY DEPARTMENT

#### 1.0 STAFF

**Head of Department:** Ms. B. Forde

**Research Scientist:** Mr. E. Ralph

**Research Assistants:** Mr. C. Kissonchand<sup>1</sup>  
Ms. A. Peters  
Mr. R. Seepaul

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<sup>1</sup> Resigned from NARI, 2004, May 05

**Research Technicians:** Ms. C. Cort  
Ms. R. Cato

## **2.0 INTRODUCTION**

The crops in the department's work programme for 2004 were bora (*Vigna sesquipedalis*), boulangier (*Solanum melongena*), cassava (*Manihot esculenta*), chive (*Allium schoenoprasum*), cowpea (*Vigna unguiculata*), hot pepper (*Capsicum annuum*), plantain (*Musa* sp), poi (*Basella alba*), sweet pepper (*Capsicum annuum*) and tomato (*Lycopersicon esculentum*).

Work was conducted in the areas of crop improvement, crop management and seed production. Varietal evaluations were completed on boulangier and sweet pepper. A varietal observation was done on imported cowpea accessions and activities started in the evaluation of plantain clones for resistance/tolerance to Moko disease. Crop management trials were conducted on chive and poi and in the area of sheltered cultivation of vegetables. Seed were produced of selected vegetables and for cowpea.

Details of the department's work programme for 2004 are presented in this report.

### **1.0 CROP IMPROVEMENT**

#### **1.1 Project Title:** Evaluation of boulangier varieties

A trial was conducted, at Mon Repos, to investigate various characteristics and identify high yielding, adaptable varieties of boulangier.

The treatments were two locally obtained varieties, which were Black Boulangier and Pink and White and two varieties which were imported

from France. These were Kalende and Zebrina. Black Boulanger, Pink and White and Zebrina are open-pollinated varieties while Kalende is a hybrid.

The experimental design was randomized complete block with four replicates.

The results showed that there was no significant difference between the yield of the imported variety Kalende, which yielded 107.3 t/ha and the local variety Black Boulanger which yielded 109.7 t/ha. The yield (97.6 t/ha) of the imported variety Zebrina and the yield (64.4 t/ha) of the local variety Pink and White were lower than those Black of Boulanger and Kalende. The yield of Pink and White was also lower than the yield of Zebrina. The number of fruits per plant varied significantly among varieties. Zebrina produced the largest number (31.9) and Pink and White the smallest number (16.0). Kalende produced 25.9 fruits per plant and Black Boulanger 19.4 fruits per plant. Fruit length was greatest for Kalenda with fruit length of 16.0 cm and smallest for Zebrina with fruit length of 11.0 cm. Fruits of Black Boulanger were 15.6 cm long and those of Pink and White were 13.5 cm long.

## 1.2 **Project Title:** Sweet pepper evaluation

A trial to evaluate the performance of sweet pepper varieties was completed, at Fort Wellington, on Ithaca loamy sand.

The analysis of variance was unable to detect statistical differences in treatment means at significant probability levels ( $P=0.1$ ). Some trends were however, observed.

The variety F<sub>1</sub> Nobili produced the heaviest fruits at 61.1g each while the lightest fruits weighing 37.8g were produced by Capela, Stella had intermediate weight fruits weighing 51.2 g each. While F<sub>1</sub> Nobili had the heaviest fruits, the largest in size was produced by Stella. The variety Capela produced the smallest fruits in terms of weight. Fruits of this variety were also more bell shaped than those of the other varieties. F<sub>1</sub> Nobili produced the highest number (22.9) of fruits while Capela produced the lowest number (12.7). Stella produced an intermediate number (17.3) of fruits.

The extrapolated yield was calculated to be 13.3 t/ha for F<sub>1</sub> Nobili, 8.9 t/ha for Stella and 5.8 t/ha for Capela. The yields obtained in this trial were generally higher than those obtained earlier for the same varieties. The yields in this trial compared favourably with those obtained in previous trials with other varieties. This is an indication that the potential of the varieties in this trial is good for commercial production.

There were no significant incidences of pests or disease. Each variety had an incidence of anthracnose infection. Only a few fruits were affected in two of the harvests therefore the marketability of fruits was very high.

### 1.3 **Project Title:** Observation of Cowpea lines for agronomic traits

Forty cowpea lines were obtained from the International Institute of Tropical Agriculture (IITA), Nigeria. These lines were planted in an observation trial, at Mon Repos, in the November – December, 2003 planting season, to assess their adaptability to Guyana's conditions. Minica IV was used as the local check.

Each line was grown in a plot containing 25 plants. All the lines were characterized using the International Board for Plant Genetic Resources (IBPGR) Descriptors for Cowpea (1983).

Seven of the lines planted either failed to germinate or did not survive the growing conditions. Therefore 33 entries were observed and characterized.

The days to flowering varied between 35 and 46 days. One line reached flowering in 35 days four between 35 and 40 days, five in 40 days, ten in more than 40 to less than 45 days and 13 in 45 to 46 days. The duration of flowering days varied between 11 and 26 days.

The days to first mature pods varied between 50 to 65 days. The first mature pods occurred in 50 days for one entry. Eleven entries had their first mature pod in more than 50 days to 55 days, 15 entries had their first mature pod in 56 to 60 days and six entries had their first mature pods in 61 to 65 days.

Hundred seed weight varied between 12g and 24.1g. The entries were as follows.

<b>Range</b>	<b>No of entries</b>
12g to 15g/100 seed	7
> 15g < 20g/100 seed	18
> 20g/100 seed	8
<b>Total</b>	<b>33</b>

Yield per plant varied between 4.6g and 24.0g. The yields of three entries were less than 5g/plant. There were 12 entries that had yields than varied between more than 5g/plant and 10g per plant. Eight entries had yields varying between more than 10g/plant and less than 15g/plant. There were

also eight entries with yields varying between more than 15g/plant and less than 20g/plant and there were two entries with yields greater than 20g/plant.

Other qualitative characteristics recorded were growth habit, growth pattern, twining tendency, branches, petiole and peduncle pigmentation, plant hairiness, pod curvature, pod colour and seed shape and colour. Other quantitative data collected were pod length, number of locules per pod, hypocotyl length, terminal leaflet length, terminal leaflet width, stipule length and width, number of nodes on main stem, number of seeds per pod, seed length and seed width.

**1.4 Project Title:** Evaluation of local landraces and imported plantain clones for resistance/tolerance to Moko disease.

Moko disease is a major pathological problem effecting *Musa* spp in Guyana. This project which is expected to be completed in four years seeks to import clones and collect local clones of plantain and evaluate their reaction to Moko disease.

Four reportedly Moko resistant plantain accessions were obtained from the International Network for the Improvement of Banana and Plantain (INIBAP). These were ITC1344CRBP-39, ITC0506FHIA-03, ITC0504FHIA-01 and ITC1418FHIA-25.

The accessions were all sent to the Plant Tissue Culture Laboratory. Initially only two of the accessions responded to growth media. These were ITC1344CRBP-39 and ITC0506FHIA-03. At a later date, however, the accessions ITC0504GHIA-01 and ITC1418FHIA-25 responded to growth media supplied by INIBAP. All the accessions were rapidly

multiplied in the Tissue Culture Laboratory and weaned in the greenhouse of the Laboratory.

Plantlets of the imported accessions and 125 plantlets of local creole plantain were supplied to the Agronomy Department. These were first placed in plastic bags to be hardened in the greenhouse.

In the last quarter of 2004, 175 plantlets of both imported and local plantain clones were transferred from the Greenhouse into the field.

During this time, plantlets of the imported and local clones were inoculated with *Rastonia solanacearum* (the organism which causes Moko disease). These plantlets will be monitored to ascertain any resistance/tolerance to Moko disease.

## **2.0 CROP MANAGEMENT**

### **2.1 Project Title:** Comparison of two harvesting techniques in chive production

This trial was designed to investigate the feasibility of two harvesting techniques in chive production. The two techniques were prune harvesting (which is the severance of the shoots/foilage from the bulbs) and final harvesting (i.e the uprooting of the complete plant).

The experiment was conducted at Fort Wellington, West Coast Berbice over a five month period (January – May, 2004). The experimental design was randomised complete block with two treatments and six replications.

In the prune harvesting technique harvesting was done at eight, 13 and 18 weeks after planting. While in the final harvesting technique, harvesting was done at eight and nine weeks after planting. The results are presented in Table 1.

**Table 1: Yield of Chive from two methods of Harvesting, Fort Wellington, 2004**

YIELD (kg/ha)	PRUNE HARVESTING			FINAL HARVESTING		
	8 weeks after planting	13 weeks after planting	18 weeks after planting	8 weeks after planting	9 weeks after planting	
TOTAL	33449.5	30882.4	26117.7	54791.6		60280.0
MARKETABLE	29756.1	27757.3	22461.5	49062.5		55321.4

In prune harvesting, three harvests were possible. At eight weeks the harvest in prune harvesting was lower than that in final harvesting. The total harvest in prune harvesting was higher than the total in final harvesting. Total harvest in the pruning technique was realized in 18 weeks compared to eight or nine weeks in the final harvesting technique. The returns from final harvesting were, however, higher than returns from prune harvesting since the average price per unit was higher for the product obtained in final harvesting.

**2.2 Project Title:** Effect of plant spacing on the Field performance of poi

The trial set out to ascertain the effect of three plant spacings on the field performance of poi.

The trial was conducted in Field #19, Mon Repos. It consisted of two experiments each in a completely randomised statistical design. Seeds

of Malabar spinach, cultivar Green Stemmed were used. Number of edible leaves, number of plants from which leaves were harvested and weight of leaves were obtained at 46, 56 and 69 days after transplanting. Further harvesting was impossible because heavy rainfall resulted in flooding of the field and destruction of the crop.

There were significant differences between the number of leaves at the 25cm spacing and the number of leaves at the 30cm spacing. The 25cm spacing produced the greater number of leaves per plant. Yields were 3786.7g/plot at the 20cm spacing, 4031.7 g/plot at the 25cm spacing and 3054.9 g/plot at the 30cm spacing. The differences between yield at 20cm and 25cm spacing and between 20cm spacing and 30cm were not significant. The yield at 25cm spacing was, however, significantly higher than the yield at 30 cm spacing.

### **2.3 Project Title: Sheltered Cultivation**

One crop of lettuce was successfully cultivated under shelter. Subsequent flooding prevented further cultivations during the year.

## **3.0 SEED PRODUCTION**

Seed was produced to ensure that quality seed of local adapted varieties reached farmers. Several plantings of bora (yard long) and tomato (var Alafua Winner) were done during the year. Total yield of seed was 30.8 kg for bora and 404 g for tomato, although birds destroyed much of the tomato fruits and flowers of bora. The 1000 seed weight of tomato ranged from 4.0g to 4.5 g while that of bora ranged from 153.5g to 162g.

Cowpea (Minica IV) and hot pepper were also multiplied for seed. Cowpea yielded 15.2 kg while the harvest for hot pepper yielded 170g.

With the exception of hot pepper all cultivations were done at the Fort Wellington Nursery.

#### **4.0 TRIALS IN PROGRESS AT THE END OF 2004**

1. Influence of harvest time on cooking quality of tubers of two cassava cultivars.
2. The importance of nitrogen and potassium on the acceleration of flower formation in Boulanger.

#### **IV. LIVESTOCK DEPARTMENT**

**Head of Department:** Mr. R. N. Cumberbatch

**Research Scientist:** Dr. R. Austin

**Research Assistant:** Mr. J. F. Q. Solomon

**Farm Supervisor:** Mr. J. Gonsalves (transferred to the Rupununi in October 2004)

#### **INTRODUCTION**

The activities of the livestock programme of the Livestock Department of the National Agricultural Research Institute are geared towards the improvement of production parameters in four areas, ducks, sheep, beef and forage production.

The Livestock Department although beset by a series of problems during the reporting year was able to achieve some level of success because some aspects of the work programme was successfully completed during the reporting year.

The duck programme had acquired 395 (315 females and 80 males) Parent Stock Pekin breed ducklings in 2003. The farm, because of the acquisition of the new blood line therefore has 820 Pekin (F1) breeding ducks that are already in full production, hence as a result of the increased number of Pekin breeding ducks the farm produced in excess of 61,000 eggs and 22,000 ducklings were sold to the farming community for a total revenue of \$2.08M.

The Livestock Farm activities continue to remain the main focal point of the Livestock programme of the National Agricultural Research Institute. These

activities included duck breeding, duckling production, sheep breeding and forage production, however in 2004, with the acquisition of the St. Ignatius Livestock Station in the Rupununi Savannahs the programme has a herd of beef cattle and is in the process of increasing and upgrading the herd. The programme also intensified efforts in the Intermediate Savannahs with the rehabilitation of the Ebini sheep and cattle breeding units, which units were able to supply 19 quality breeding rams for sale to the farming community during the reporting year and produce 13 calves.

The Livestock Department in an effort to enhance the quality of life of the rural poor introduced duck rearing as an economic activity to three Amerindian communities, these communities were Tapakuma and Capoey in Region 2 and Toca in Region 9. In addition to increasing the earning of these communities, the duck rearing activities were beneficial to the communities by:

- Empowering the women of the villages/farming communities.
- Improvement of the diet and nutrition of the communities.
- Providing alternative farming activities and additional means of earning a livelihood in the Amerindian communities.
- Increased income to the farming family.

The transfer of technology was another important aspect of the Livestock Programme; officers of the Department made farm visits and established duck production facilities in Regions 2 and 3 and assisted in improving the management systems of pastures. The Livestock Farm was also used as a teaching laboratory by various groups, which included both farmers and students who visited the Farm. In addition, the Department also produced one publication during the year, the publication is entitled: Beef Production: An analysis of the requirements for export.

**The Duck Unit**

The problems previously reported pertaining to low levels of egg production in 2002 and 2003, continued to plague the duck programme during the first half of the year until the F1 ducks from the new parent flock came into full production, therefore and as a consequence there was an increase in the number of ducklings sold and a corresponding increase in revenue. Duckling sales generated G\$ 2.08M as compared to G\$0.89M during the year 2003, cull ducks returned \$448,668.00, eggs \$13,274.00 and eggs hatched for farmers \$1,164,410.00.

**The Parent Flock**

The performance of the parent flock of ducks at the end of the first year was not impressive. The birds started laying at 138 days. The average egg production per bird at 240 days was 36.9. Production peaked between November 2003-February 2004 and declined from March to June 2004. The acclimatization process of the birds appears to be a long and slow process. The performance and appearance of the F1 birds are, however, better than those of the parent flock and it is expected that the birds should be in full production by the middle of 2005.

**Duck Production Parameters for 2004**

The production parameters of the duck programme were comparable to those of the last reporting year. Fertility of the hatching eggs was 77.8 % as compared with 74.29% for the previous year, with hatchability being 60.9 % as compared to 65.4% for the last reporting year. The overall mortality percentage of the ducks on the farm was less than 1 percent. The production parameters are presented below.

Fertility Percent

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<b>PERIOD</b>	<b>PEKIN</b>	<b>KUNSHAN</b>	<b>MUSCOVY</b>
Jan –Dec 2004	77.6 %	76.7 %	79.2 %

#### Hatchability Percent

<b>PERIOD</b>	<b>PEKIN</b>	<b>KUNSHAN</b>	<b>MUSCOVY</b>
Jan – Dec 2004	59.7 %	60.94 %	62.19 %

The decline in hatchability was cause for concern because during the reporting year the programme discontinued the use of the old incubators, which were acquired since the inception of the duck programme. Presently ducklings are hatched using a Jamesway Multistage Incubator and Hatchery System.

Recognizing the need to become acquainted with the use of this new technology, a number of studies were developed to determine the cause of the relatively low hatchability levels. It must be acknowledged that using the new incubator required a higher level of management and it was therefore important that the critical components the temperature and humidity required for the successful hatching of duck eggs were correct at all times. Therefore according to the Department of Animal Science of the Oklahoma State University the requirements for the successful hatching of duck eggs were a temperature of 99.5 degrees F (dry bulb) and humidity of between 84-86 degrees F (wet bulb). It was also recommended that the eggs should not be turned after 25 days for the Pekin and Kunshan breeds of ducks and after 31 days for the Muscovy breed type. The recommended operating temperature and humidity for the last three days should be 98.5 and 90-94 degrees F, respectively. The University also suggested that duck eggs hatch better in still air rather than forced air incubators and for still air incubators it is recommended that the temperature be increased 2-3 degrees F.

Therefore the research proposal developed by the Livestock Programme was designed to investigate the effect of additional spraying on the hatchability of duck eggs and to identify the minor adjustments that should be made, when incubating duck eggs in a multistage incubator in order for an increase in the hatchability of the eggs. The study proposed, involved the spraying of eggs with water at various intervals, to ascertain the effect of humidity on the hatchability of duck eggs.

The treatments included the following.

- No additional spraying of the eggs.
- Additional spraying of the eggs from day 7 after the eggs had been placed into the incubator until the eggs were hatched. Spraying done three times per day.
- Additional spraying of the eggs from day 14 after the eggs had been placed into the incubator until the eggs were hatched. Spraying done three times per day.

### **Second Treatment**

- No additional spraying of the eggs.
- Additional spraying of the eggs from day 7 after the eggs had been placed into the incubator until the eggs were hatched. Spraying done one time per day.
- Additional spraying of the eggs from day 7 after the eggs had been placed into the incubator until the eggs were hatched. Spraying done two times per day.
- Additional spraying of the eggs from day 7 after the eggs had been placed into the incubator until the eggs were hatched. Spraying done three times per day.

The preliminary results to date indicate that there are no differences between any of the treatments and no spraying treatment.

## Sheep Production

The sheep production programme continues to be a successful venture, although, the unit is heavily overstocked and the pastures overgrazed. The unit has a flock of in excess of 350 animals; thereby allowing the programme to satisfy the demands of the farming community for breeding animals. As a result of the overall lack of pastures the programme had to resort to strategic or selected mating whereby only certain selected animals were mated. The programme therefore, could have only introduced 84 of the breeding ewes to the rams, because there was not enough pasture to feed the off-springs if more animals were introduced to the breeding males. The programme therefore was only able to sell a total of 60 breeding rams for \$709,700 during the reporting period. In addition, a heavy culling exercise had to be undertaken to reduce the ewe population and attempt to stabilize the flock.

**Table 2: Flock size of sheep at the Livestock Farm, Mon Repos, 2004**

<b>PARAMETERS</b>	<b>OPENING STOCK</b>	<b>CLOSING STOCK</b>
Breeding males	6	05
Breeding females	240	156
Weaned males	3	05
Weaned females	23	71
Male lambs	10	56
Female lambs	18	82
<b>TOTAL</b>	<b>300</b>	<b>375</b>



The production parameters of the unit for the reporting year are highlighted in Table 3.

**Table 3: Production parameters of the sheep production unit, Livestock Farm, Mon Repos, 2004**

Parameters	No of dams giving birth	No of births	No of Lambs/litter	Single births %	Twin births %	Triplets %	Male births %	Female births %
	84	272	1:543	35	55.9	8.5	49.3	50.6

Parameters	Male birth weight	Female birth weight	Average daily gains male	Average daily gains female
	(kg)			
	2.72	2.4	102.49	91.83

### FORAGE PRODUCTION

The forage production programme continues to strive to provide good quality forage by maintaining improved pastures for the grazing animals. In addition, the forage programme was able to maintain a germplasm collection on the farm, which collection was rehabilitated during the year. The rehabilitation exercise formed part of the work activity of a work-study student from the University of Guyana. This collection is kept by the Department to assist in the identification of and to provide the best possible forage for the livestock community as well as providing an alternative forage species for antelope grass. Antelope grass is being classified as a nuisance (weed) particularly by the persons responsible for the maintenance of the drainage and irrigation systems in Guyana. In addition, the programme was used as a teaching laboratory for students from the University of Guyana, the Guyana School of Agriculture and the students from

the secondary schools who were preparing for the Caribbean Examination Council Examination.

### **TECHNOLOGY TRANSFER**

The transfer of technology is another important aspect of the livestock programme, and the methodologies used to ensure that these activities were extended included the hosting of farmers and students on tours to our facilities, mounting and displaying various aspects of the Department's work programme at national exhibitions. In addition, the facilities of the Livestock Department were used as a vehicle for the training of students primarily in the secondary and tertiary educational programmes, and more importantly, the Department also disseminated information by preparing information products on different aspects of livestock production in both print and electronic forms. The tools utilized were fact sheets, radio, television, scientific, farm journals and newspaper articles.

The programme introduced duck rearing to the Amerindian communities of Tapakuma and Capoey in Region 2 and Toco in Region 3; in addition, the programme also conducted on-farm demonstrations in Regions 2 and 3, to assist in extending the technologies of good livestock husbandry to those farming communities.

The department also produced one document for publication during the reporting year, this document was entitled: **Beef Production: An analysis of the requirements for export**. The document indicated the following.

1. There is great scope within the CARICOM Region for market of beef from Guyana. Capturing this market is, however, constrained by the health status of the animals, the sanitary conditions of slaughtering, transport facilities and the availability of livestock.
2. The tremendous expansion in the rice industry may have resulted in the intensification of competition for available land in the coastal regions, and

this may have had deleterious effects on the cattle industry. There is therefore need to explore and develop the interior regions which traditionally were major cattle rearing areas to ease the pressure of over-population on the coast.

3. There was a decline in beef production/availability from 4.6M kg in 1994 to 1.3 M kg in 2003. This decline in production may be attributed to the high price for beef, the health consciousness of the consumer and/or the relatively cheap price of the other substitute meats e.g. chicken and fish.
4. The extraction rate of cattle in Guyana is approximately 6% of the national herd, thus the potential exists for beef from Guyana to substitute for at least 4% or 2 M kg of the imports into the CARICOM Member states.
5. The CARICOM Member states import approximately 60 M kg of beef annually and produce 28 M kg. Eighty-five percent of the beef imported into the region is of the low/medium quality. Hence the absorptive capacity of the target markets is not a constraint.
6. Previous studies undertaken indicated that the best prospects for the export of beef from Guyana are, Trinidad and Tobago, Barbados and Curacao. Local suppliers/butchers indicated that markets were secured in Antigua and Barbuda and Grenada. The State of Roraima in Brazil may also present some opportunities for export.
7. The export market is vital to the sustainability of the beef sector, mainly because of the relatively low prices paid to livestock producers. Beef is sold wholesale on the local market at US\$1.50 per kg; therefore a 160 kg carcass would return total revenue of US\$240.00. This carcass could be sold for US\$500.00 on the export market. Therefore without the ability to export beef there would be no incentive to improve the industry.

8. The CARICOM member states have adopted a policy of sustainable agricultural development and have instituted a number of agreements that positively promote trade among Member states. Tariff and quota systems are in place and the Member states have instituted policies regarding the requirements for food safety, the movement of animals and meat. Import/export documentation is also relatively standard among Member states.
  
9. In order to develop and sustain an export market there is need for the development of a comprehensive Livestock Development Programme, adumbrating strategies for production, health, slaughtering, processing and marketing.
  
10. The beef sector in Guyana is fragmented, the majority of cattle are owned by a collection of small farmers who utilize old production technology and as such production parameters are low. There is therefore need for a firm, entity or group of individuals to seize the opportunity and infuse resources and a fresh perspective into the industry to promote consolidation. This approach may not be taken unless Guyana is allowed to enter the export market for beef.

## V. DEPARTMENT OF POST HARVEST AND AGROPROCESSING

### 1) Completed Projects

The use sorrel as a natural colorant and for improving flavor of locally produced fruit juice/drink blends.

**Abstract** Sorrel, also called Roselle (*Hibiscus sabdariffa* L.) was used in both fresh and dehydrated powdered forms to improve the color and flavor of locally produced fruit juice/drink blends. Boiling the calyxes and dehydrated powdered form in water produced a brilliant red concentrated juice that was tested in this trial to improve the color and flavor of the pineapple drink. Sorrel, in the dehydrated powdered form, besides extending shelf life can also provide consumers with a product that can be utilized throughout the year, in contrast to the fresh form which is only available once per year.

The results of this trial indicate that blending pineapple juice and sorrel in both fresh and dehydrated forms influenced color and flavor of the final product. There was a progressive decrease of brix, red color content and TTA of the sorrel extracts in both fresh and dehydrated forms when the water content was increased. The low sugar content of the sorrel was significantly improved when pineapple juice was added to it. A mixture of fresh and dehydrated sorrel extracts in 1:4 ratio with equal volumes of pineapple juice produced differences in brix, TTA, brix/TTA ratio, color and flavor. The dehydrated form of sorrel resulted in higher brix, brix/TTA ratio and flavor than the fresh form. The TTA and color was, however, slightly lower than that of the fresh form.

In its fresh form, sorrel extracts mixed with water in a 1 to 4 ratio and mixed with pineapple drink using 1 to 1 volume obtained the most favorable ratings in color and flavor producing a brix/TTA ratio of 200, followed by extracts in a 1 to 8 ratio with a brix/TTA ratio of 252. In the powdered form, sorrel extracts mixed with water in a 1 to 2 ratio with a brix/TTA ratio of 221 had the best ratings, followed by extracts in a 1 to 4 ratio with a brix/TTA ratio of 352.

## **The processing of perishables using Solar Dryer Technology.**

**Abstract:** *A trial was established to evaluate the effects of solar drying and solar drying methodologies on local seasonings. Four methodologies which included sun drying, direct solar drying, indirect solar drying and oven drying were used to dry fine leaf thyme. The indirect solar and oven drying techniques resulted in a less pronounced loss of green color and aroma in thyme than in sun and solar direct drying at the end of four hours of drying time. Moisture loss was, however, greater in sun and direct solar drying than in solar indirect and oven drying. The effects on color, aroma and moisture loss was similar for solar indirect and oven drying.*

*The indirect solar drying method was used to dry celery in a second part of the trial. This method showed good effects on color and aroma retention at the end of the drying process.*

*In the final part of the trial, a comparative analysis of drying fine leaf thyme and celery using the indirect solar method, good results were obtained on color and aroma retention. A greater loss of green color was, however, observed in fine leaf thyme. Drying time for fine leaf thyme was four hours with a shorter constant rate period as against celery which took 14 hours and an extended constant rate period. The conversion ratio of fresh to dry product was 4:1 for fine leaf thyme and 8:1 for celery.*

## **Artificial induction of sprouting in Yam**

**Abstract:** *Freshly harvested yam tubers do not sprout immediately, but go through a period of dormancy. To encourage year round production of this crop, technological efforts are required to break this dormancy.*

*Two yam varieties number 1 and number 9 were used in a preliminary trial to evaluate the effectiveness of various treatments including wet bag, wet sawdust, ethephon and control (no treatment). Ethephon at a rate of 8mls/1200 mls achieved the best results in*

*relation to number of days to sprout and number of sprouts per tuber. Number 9 variety had a lower response activity in both number of days to sprout and number of sprouts per tuber than number 1. The use of wet bag and wet sawdust gave better results than the control.*

## **The Development and Evaluation of Banana slices in syrup**

**Abstract :** *The development of this product was conducted in a series of stages, where the result of the first method was incorporated into the second and third methods. Firstly, lemon juice and citric acid at three concentrations were used to reduce enzymatic browning. In the second method, different cultivars of banana were used and in the third method, bananas were sliced directly into citric acid solution with no head space in jars.*

*Sensory evaluations were conducted for colour, flavour and texture to determine acceptability of the product and determine differences between treatments.*

*Statistical analysis indicated that they were no significant differences [ $p>0.05$ ] among treatments in the first method. The second method was unacceptable and in the third method, there was no enzymatic browning after six months. Panellists rated the control the most liked colour. Flavour and texture were moderately liked in the 4% citric acid treatment. Generally, texture was slightly liked in all treatments and the sensory evaluation panel accepted the product.*

### **2) Other Activities**

#### **a) Cultivation of edible mushrooms.**

The mushroom research project benefited from visits by two Chinese teams that conducted a feasibility study on the cultivation of edible mushrooms in Guyana and

assisted in efforts to develop a mushroom industry in Guyana. Emerging from discussions with the first team of Chinese specialists was the design of a mushroom house which was subsequently constructed in the latter part of the year and commissioned on the 28<sup>th</sup> of October 2004 in the presence of the Honorable Minister of Agriculture S. Sawh. The construction of this facility was necessary to confine and centralize the different operations of the cultivation process and to be used as a demonstration outlet which will assist in passing on the technology of mushroom cultivation to the farming community and other interested parties. In addition, it will provide the opportunity to facilitate research projects on edible mushroom cultivation.

A memorandum of understanding was signed between NARI and the second team of Chinese experts for technical cooperation and collaboration in various fields including edible mushroom cultivation.

b) **Construction of a solar dryer**

Using basic materials, an indirect solar drying system was designed to dry perishable produce including seasonings, fruit and vegetables. This prototype dryer was used in a project to preserve seasonings through the dehydration process. A scientific evaluation was made on its effectiveness to maintain color and aroma of the final product. This technology will inevitably assist farmers in extending the shelf life of their produce and also provide an avenue for the manufacturing of value added products. In the year 2005 research work on the drying technology will continue using other perishable crops such as fruits and vegetables.

c) **Exhibitions**

This department took part in a number of the exhibitions for this year [Berbice night, Essequibo night, Guyexpo, World food day]. On display were items produced by the staff of the department and included solar dryers, dehydrated products produced by the solar dryers, fruits in syrup, banana cake, banana raisins and fruit jams. In addition,

there were posters on proper post harvest practices for fruits and vegetables and the growing of mushrooms. These were used as educational tools to propagate and extend technology on the preservation of perishables in the interest of the general public who included farmers, agro-processors, students, consumers and other parties.

d) **Mobile demonstration agro- processing facility.**

The expansion of good relations between Guyana and India was further manifested by the provision of an agro-processing facility from the Government of India to the Government and people of Guyana. In October, the mobile demonstration and processing facility was commissioned by the Honorable Minister of Agriculture. This facility will aid in the development of the agro-processing sector in Guyana by providing appropriate technology to interested parties. It is hoped with the use of this mobile facility that more farmers will take up the challenge to process and preserve their produce and develop value added products.

The facility was taken to various regions of Guyana which included Bath Settlement (World Food Day Activity), Laluni and Parika. The response was very good as farmers and processors witnessed the demonstration on the use of some of the equipment in the facility. It is hoped that farmers and processors will show interest in the use of the technology and move to acquire some of the equipment in the hope of developing a cottage industry.

It is planned to utilize this facility for demonstration purposes in other areas in 2005 and to work with the private sector and other organizations.

e) **Training seminar for Wakanaam farmers.**

A training programme was organized by NGMC with assistance from NARI to sensitize farmers in Wakanaam to post harvest handling and marketing of non traditional products. Staff from the postharvest and agro-processing department contributed by

making presentations on proper pre and postharvest handling practices necessary for the preserving of perishable produce. It is hoped to continue training of farmers , processors and other interested parties in 2005.

f) **Participation in PRCSSP project**

The staff of the postharvest and agroprocessing department participated in a number of committee meetings to assist farmers in the Region 2 and 3 areas in the development of non-traditional crops. Farmers in these areas showed interest in the formation of a farmers' association and requested the establishment of a packhouse and a processing facility. These infrastructure will be used to assist farmers in supplying quality produce and value added products to both local and overseas markets. In addition, a proposal for a training programme was submitted to provide the necessary technological requirements in producing quality produce for the market.

## **VI. SOIL AND WATER MANAGEMENT DEPARTMENT**

### **PROJECT: SOILS INVESTIGATION OF MC RAE'S HOLDINGS, PEARL**

#### **EAST BANK DEMERARA.**

This is a semi-technical Report financed by Ram & Mc Rae Chartered Accountants Professional Services Firm and compiled by NARI. It is intended to provide basic soils information and guidance to land use and management to facilitate planning of a project to develop farming lands within the Pearl area and similar ecosystems.

#### **SUMMARY**

The Soils Investigation and associated survey of the Robert V. M<sup>c</sup> Rae Establishment covered an area of approximately 5 acres. The holdings consist of four sections. These are:

1. The NE section - with productive but un-maintained orchard crops. These crops include tangerine, oranges, grapefruit and coconuts.
2. The NW section - abandoned cow pasture with old cow pen.
3. The top SE section - unused chicken pen.
4. The top SW section - house and residential area.

The land has clay soils that fall within the broad groups commonly referred to as poorly drained Humic Gley. A detailed description would place this soil into the Soil Series Mapping Unit 39, Tuschen Clay. This soil has moderate potential for agricultural development and can be brought in to productive use if efficient drainage, limestone and complete fertilizers are used. Above average management will produce moderate yields of rice, sugarcane, banana, and plantain or ground provision. Special care in drainage is needed to prevent toxic sulphates from rising and injuring the roots of crops.

## 1.0 DESCRIPTION OF THE AREA

### 1.1 General Nature of the Area

#### 1.1.1 Location, Extent and Accessibility

The establishment at Pearl is located on the East Bank of the Demerara River approximately 27 km south of Georgetown between coordinates 0366578 and 0366713 W longitude and 0728410 and 0728618 N latitude. The establishment is approximately 5 acres. Access was by surfaced road (south) along the EBD road and by secondary road east to the site.

#### 1.1.2 Land cover/land use

At the time of field activities, the holdings consist of four sections. These are NE section - with productive but un-kept orchard crops (tangerine, oranges, grapefruit and coconuts); the NW section - abandoned cow pasture; the top SE section - uninhabited chicken pen; and the top SW section - house and residential area.

#### 1.1.3 Geology, Geomorphology and Drainage

Pearl is in the Coastal Plain Region of Guyana. The soils are formed from clays and silts of recent alluvial deposits or alluvial deposits over organic material or organic material of varying depths over old marine sediments and alluvial deposits.

Channels that lead to the Demerara River are present to adequately drain the land. However, drainage pathways on the holding need adequate maintenance to channel water off the land.

#### 1.1.4 Rainfall

The average rainfall is approximately 99 inches (251.1cm) per annum. This rainfall is distributed between two wet seasons and two dry seasons. The normal wet seasons are from November to mid-January and from mid-November through January.

## **2.0 SOILS**

### **2.1 General Comments**

Only one kind-of-soil was identified and mapped within the site. General characteristics of this soil are described in the following subsections. Some reference is made to the genesis with only brief descriptions of general morphology. Indications of potential or limitations for agricultural development are also mentioned. More details of relevant chemical characteristics are, however, discussed in section 3.0. Considerations for agronomic use are expanded in section 4.0.

### **2.2 Field Methodology**

Field mapping operations were executed on the area with soil profile observations being made by auger borings at 25m intervals and wherever soil changes became apparent. Soils were observed and described following some modified conventions of the Soil Survey Manual (USDA-SCS, 1951). Soil mapping data were recorded and soil boundaries demarcated on the basis of profile differences and visible physiographic features.

Soil sampling was done to provide information for the correct classification of the soil and their present nutrient status. Ten samples were collected, five each at two points on the location. These samples were collected at depths 0 - 20cm, 20 - 40cm, 40 - 60 cm, 60 - 80 cm and 80 - 100 cm. All samples collected were sent to the GUYSUCO Laboratory for chemical and physical analyses.

### **2.3 General Characteristics of the Soil**

**Unit 39, Tuschen Clay** is a poorly drained Low Humic Gley soil (Aquic Haplorthents). It may have been developed in river alluvium. The alluvium may have been deposited over fluvio marine sediments. It occurs inland of river levees and near the main swamps of marine origin. It is characterised by poorly drained, very dark greyish-brown silty clay over grey clay subsoil with brownish –

yellow mottles. The lower substratum (below 90 cm or lower) is soft greenish grey clay.

The soil is strongly acid throughout, slowly permeable and susceptible to flooding and has a moderate level of fertility. It has fair pH (4.0 – 4.4), poor base saturation (<50%), poor C/N ratio (>15%), poor phosphorus (<20 ppm), good potassium (>0.5 meq/100ml) and poor in calcium <1 meq/100ml).

**Soil Profile: Tuschen Clay, Site located at Mc Rae holdings, Pearl, East Bank Demerara.**

<b>Horizon</b>	<b>Depth</b>	<b>Description</b>
A <sub>p</sub>	0-20 cm	Dark greyish brown (10YR 4/2) Silty clay; weak, fine, angular blocky structure; friable, sticky and plastic; common fine and medium roots; strongly acid; gradual, wavy boundary.
B <sub>1</sub>	20–40 cm	Grey (10YR 6/1) clay with common, fine and distinct brownish yellow (10YR 6/8) mottles; moderate, medium, subangular blocky structure; friable but firm in places; sticky and plastic; common fine and medium roots; strongly acid; gradual, wavy boundary.
B <sub>2.1</sub>	40–60 cm	Grey (5Y 4/1) clay; weak, fine to medium, subangular blocky structure; firm; plastic and sticky; mottles of brownish yellow (10YR 6/8), few fine roots; strongly acid; clear, wavy boundary.
B <sub>2.2</sub>	60-80	Grey (5GY 4/1 10YR 5/1) silty clay with common, fine, distinct strong brown (7.5YR 6/8) and dark reddish brown (5YR 3/3) mottles which are mainly along root channels; weak, moderate, sub angular blocky structure; firm, plastic and sticky; few fine roots; medium acid; gradual, wavy boundary.
C <sub>1g</sub>	80-100 cm	Greenish grey (5GY 4/1) clay; massive structure; sticky and plastic; some mottles of yellowish brown (10YR 5/8) between organic residues and mineral soil; numerous bits of partially decomposed plant remains; medium acid.

## **3.0 SOILS AND THEIR AGRICULTURAL USE**

### **3.1 General Management Practices**

Most soils require some types of specific management practices such as drainage, irrigation, crop rotation, soil conservation measures, fertilisation, liming, proper tillage, or use of adapted varieties. These characteristics need to be optimised if crops are to produce satisfactory yields.

Each enterprise should be studied with relation to the kinds of soils, the kinds of crops to be grown and the facilities available, e.g. labour. The objective is to choose the type of crop and the management practices that will give optimum results.

### **3.2 Fertilizer and Liming**

The use of this soil for crop production will result in it being slowly depleted of its plant nutrients. Thus, a programme of systematic replacement of plant nutrients in the form of lime and fertilisers should be followed. With these general fertility characteristics being taken into consideration, the specific crop requirements should be determined first. Then based upon any available data from fertilizer experiments and an evaluation of the chemical and physical properties of the soil, the Agricultural Advisor (NARI) can determine the amount of lime, and, or fertilizer to apply. Fertilizer, irrigation, and other management recommendations will influence crop yields that will lead to increases of 20 to 50 percent or more.

The economics of increasing yields with fertilisers must be determined and taken into consideration.

### **3.3 Water control, including drainage and irrigation**

Inadequate water control is at present one of the main limitations to intensive land use and economic crop production. Proximity to the Demerara River, low elevation, and seasonal rainfall distribution made flood control, drainage, and irrigation of importance in any development of this land. The soil in its natural condition is subject to flooding during the rainy season and usually short of water during the dry season. The land, being close to the Demerara River would also need protection from flooding during high tides.

### **3.4 Chemical Problems**

Broadly speaking there are two major problems of chemical nature, which may be encountered at this location. The first problem is than caused by soluble acids i.e. toxic salts originating from hydrolysis of aluminum and iron sulphates. These are toxic to most plants even in very low concentrations. This problem must be controlled before and during cultivation. In addition to the toxicity of acid sulphates these soils have a low fertility status.

The second problem is the low base saturation of the soils, resulting from the high exchangeable aluminium content which is correlated with high soil acidity. In general it can be said that low percent base saturation coupled with low cation exchange capacity usually mean a low fertility status, high lime requirement and the danger of aluminium toxicity.

### **3.5 Tillage**

Physical properties of soils, such as structure, texture, permeability, degree of horizonation and shrinkage on drying, influence the management requirement of a given soil. Most of these factors cannot be easily changed, and so management has to be adjusted to suit each condition.

At this location, texture is a prominent physical property, which cannot be changed except by adding large quantities of materials. However, drainage of this relatively impermeable soil could be improved by arranging drains closer. Also, this soil responds to cultivation (tillage) under favourable moisture conditions. In its moist state it will, however, not support machinery. The surface soil structure, (which influences tilth) may be improved by adding organic matter, by cultivating only under favourable moisture conditions, and in some instances, correcting chemical imbalances of the soil.

### **3.6 Cropping Systems**

Only permanent orchard crops are at this location at present. This land could, however, facilitate mixed farming or a sequence of crops to be planted where possible. This would help in maintaining the organic matter content of the soil and in the control of diseases and pests. Specific crop rotation systems could be planned by the Agricultural Advisor (NARI), taking into consideration the kind of soil, economic conditions including markets and the individual farm under consideration.

Small livestock e.g. pigs, poultry and sheep may also be a consideration.

It is not the intent of this report to recommend specific farm/enterprises. It should be understood, however, that it is the duty and obligation of the Ministry of Agriculture/ NARI to provide technical advice and service to farmers. The Ministry through its Chief Agricultural Officer or NARI will be available to advise on specific farm enterprises from the inception of the farms. This facility should be consulted very early before the project is initiated.

## **4.0 CROP SUITABILITY**

As an aid to the users of this report, the soil of this location has been rated relative to their suitability for the production of certain crops adapted to the area. These ratings are

called Crop Suitability Classes and range from S1 - for the most suitable to Class S4 - for the least suitable.

Crop suitability classes are similar to Land Capability Class but an important difference should be noted. A rating for crop suitability is an evaluation for individual crops whereas for Land Capability it is a grading based on the soil capabilities and limitations for overall crop production. Crop suitability for this area assumes only installation of major or primary drainage and irrigation works.

Each kind of soil has certain chemical and physical characteristics, which affect its response to management and influence crop yields. For example, soils, which are best suited for rice cultivation are free of toxic chemicals, are fine textured, slowly permeable, fertile or responsive to additions of fertilisers and occur in places where favourable water relations can be maintained. Other crops, such as corn and bananas have somewhat different requirements. Because of this, one soil in Land Capability Class I may be well suited for rice (Crop Suitability Class S1) and moderately suited for corn and only moderately suited for rice.

Before using the suitability ratings given, the following points should be understood.

1. It is assumed that the crop could be grown with an “**above average**” level of management, including the application of lime and fertilisers, that is, the level of management that would be practiced by a good farmer. A very high level of management, such as that practiced by NARI and the Sugar Estates is not assumed.
2. It is assumed that the major drainage and irrigation works are installed where necessary.
3. It is assumed that the cost of management necessary to grow the indicated crop on this soil (including the installation of additional drainage and irrigation systems

when required) would be within the economic limits of crop production based on long term price trends. That is, over the long run the value of the crop yields must be expected to exceed the cost of its production.

The soils are graded according to their present (assumed drainage) condition, or that which may be expected to exist for the next three to five years under “**above average**” management. If limitations to crop production are reduced or removed, a revaluation of the crop suitability ratings should be made.

The crop suitability ratings are based on the present level of agricultural technology. As this technology changes so will the crop soil ratings. Although the ratings given are the result of the careful consideration they should not be regarded as infallible. Large-scale expansion of newly introduced crops should be preceded by well-managed field trials.

The list of crops gives only examples of several representative crops. Absence from the list should not be taken as indicating a lack of adapting to local condition. The table below shows four levels of crop suitability, which are defined as follows.

**S1: Well Suited:** With “**above average**” management (see paragraph 1) the crop grows well and would produce relatively high yields. For the crop under consideration the soil has favourable physical characteristics, minimum to low fertility level, or may be only moderately responsive to good management.

**S2: Moderately Suited:** With the same input of management but not necessarily the same management techniques as in S1 (i.e. “**above average**”) the crop would produce moderate yields. The soil may have less favourable physical or chemical characteristics for the crop under consideration, a minimum to low fertility level, or may be only moderately responsive to good management.

**S3: Poorly suited:** With the same amount but not necessarily the same management techniques as in Class S1 (i.e. “**above average**”) little if any production should be expected from the crop under consideration. Response to management is low.

**S4: Not suited.** With the same amount but not necessarily the same management techniques as in Class S1 (i.e. “**above average**”) little if any production should be expected from the crop under consideration.

A rating of S3 for example, for a given crop does not mean that the crop cannot be produced. It does indicate, however, that some unfavourable characteristics such as soil toxicity, low fertility or low permeability would need to be overcome by the addition of very large amounts of lime or fertilisers, or the special treatments. The economics of such corrective measures would need to be evaluated carefully.

## **5.0 Other Considerations**

Project personnel should be encouraged to have a production team permanently on location and have established:

1. An effective liaison with the Ministry of Agriculture/NARI;
2. A store or complex for the bulk acquisition, and storage of seed, fertilizers, amendments, chemicals and other farming requirements and the acquisition of sufficient of these for at least two cropping seasons;
3. Appropriate storage facilities for harvested produce or adequate transportation facilities.

In this report no consideration is being given to marketing and transporting aspects, as these require more detailed investigations.

**PROJECT:** Request for information on ‘Possibilities for Crop Production at Monkey Mountain’

The poor agricultural potential of this location meant that no detailed soil investigation would have been planned following the reconnaissance soil surveys of 1965. If communities are, however, using these lands for their livelihood (with the support of policy makers), every effort should be made to ensure that it is done in a sustainable way.

The general assessment given by the Captain and Council of the area is accurate. The land is indeed rocky and shallow with savannah land occurring on cliffs and escarpments. These are at very high elevations 500 – 1000m and benefit from water flowing down from the upper reaches of the mountain. These waterways are said to flow even during the dry season. The extent of these savannahs is undetermined at this point as they are not considered to be forest land and are therefore not mapped. The fact that some crop production is being conducted in specific areas means that the area lends itself to the possibilities for improved practices. These improvements will come at a cost to those willing to assist in this venture as the land qualities are poor.

To pursue the optimising of agricultural land use in this area, it is recommended that a site visit be arranged, so that the relevant personnel could do a proper assessment of the available resources.

A synoptic view of Monkey Mountain will reveal:

Occurrence:	The land is located in a mountainous region of Guyana.
Physiography:	Plateaus, isolated mesas, ridges and remnant mountains. Altitudes vary from 500- 1000 m.
Geology and parent material:	Granites, gneisses, sandstone and conglomerates.
Vegetation:	Dry evergreen forest in transition to savannah.
Depth:	Generally, very shallow soils.

Colour and texture: The colours vary from brown to yellow to gray. Textures are sand, loam and silty clay with a common gravelly surface.

Drainage: These soils are well drained.

Organic matter: Low.

Reaction: Strongly to extremely acid.

Erosion: Very high erosion potential.

Base saturation and plant nutrients: Low base saturation and very poor plant nutrients.

Productivity and use: These land qualities are very poor owing to steep slopes, shallowness and high erosion potential. These factors limit their use for any type of agriculture.

**PROJECT:** Acquiring Land Title for NARI's holding at Mon Repos, East Coast Demerara.

### **Background**

An ACT of Parliament (ACT No. 19 of 1984) established the National Agricultural Research Institute in 1984. This ACT cited as the National Agricultural Research Institute ACT stated that NARI shall come into operation on such date as may be specified by the Minister by order. Part III, Section 12.3 of this ACT states, "In addition to research facilities provided at its head quarters, the institute may establish research centers at such other places in Guyana as may be determined by the Committee with the approval of the Minister". In keeping with this ACT, NARI gained control and occupied a number of holdings formerly administered by the Ministry of Agriculture. Unfortunately, the Agriculture Research Committee (ARC) - the body, which has among other functions "to supervise and control the functioning and activities of the Institute", has never received Land Titles for these holdings. At present, NARI is facing

challenges from squatters who have occupied parts of these holdings without lawful permission.

### **Introduction**

In an effort to optimise research activities on soil/plant relationships, the Minister of Agriculture in 1985 took a decision to place all lands at Mon Repos (previously occupied by the Ministry of Agriculture) under the Administration and control of NARI. Unfortunately, NARI only had resources to fully occupy accessible lands in the vicinity (North) of its Head Quarters. In 1993 squatters had begun to occupy these lands without permission from NARI. The Ministry of Housing subsequently distributed these lands as house-lots. At the time of regularizing the squatters, the Ministry of Housing promised to clear available but inaccessible lands (South of NARI's Headquarters) as replacement for the research fields converted to house lots. Unfortunately, to date this promise has not been kept. These events have effectively reduced NARI's holdings at Mon Repos, limited the range of soils for experiment on soil/plant relationships, and inhabited possibilities of expansion at this location.

Recently, a number of private sector enterprises (large and small), have indicated an interest in entering into agreements with NARI for joint research/production ventures. These agreements will provide the opportunity for conducting research in a market-oriented environment. To facilitate this process and secure these lands, NARI has embarked on an active program of regularising the ownership of their holdings at Mon Repos.

### **Regularisation Process**

A series of meeting between NARI's representative (David B. Fredericks) and GLSC's representative (Carol Khan) resulted in an Action Plan to provide land titles for NARI's holdings at Mon Repos. The actions decided on included: -

1. GLSC to provide a map, which indicates the fields at Mon Repos.

2. NARI to compare their records with that provided by GLSC for harmonisation and decision-making.
3. A joint visit to the area by representatives from NARI and GLSC to ground truth the harmonised map.
4. GLSC to process land title for NARI's holdings at Mon Repos subsequent to field visit.

### **Recommendation**

The process of NARI obtaining Land Title for the Holdings at Mon Repos is on schedule. It is recommended that: -

- (i) NARI immediately erect signs indicating ownership of the proposed area.
- (ii) NARI immediately take steps to secure - through fencing etc. the proposed area.
- (iii) NARI begin to formulate plans to beneficially occupy the said area.

A joint team of representatives from NARI and GLSC visited NARI's holding at Mon Repos on Thursday 5<sup>th</sup> February 2004. The team included GLSC representatives – Mr. Julian Benons and Mr. Troy Rambajan, and NARI's representatives Mr. David Fredericks and Mr. Sahadeo Paul. During this visit, harmonised map records were verified through field measurements.

NARI has requested that a Land Title be prepared for the 463 acres of land for NARI's Holdings at Mon Repos, in the name of the National Agricultural Research Institute.

FIELD NUMBER	AREA (ACRES)
17	10.2
18 (a & b)	28.1
19	8.8
27	10.8
28	11.8
29	11.6
30	11.5
31	10.3
32	10.8
33	10.7
34	10.4
36	10.7
37	10.8
38	11.7
39	10.9
40	11.2
41	11.1
42	10.0
43	11.8
44	11.4
45	10.6
46	10.0
47	11.0
48	9.8
49	10.2
50	11.4
51	10.7
52	10.7
53	11.4
54	12.2
55	10.7
56	10.9
57	10.5
58	11.0
59	11.2
60	12.0
61	11.6
62	11.5
63	10.8
<b>TOTAL</b>	<b>463.0</b>

**PROJECT:** Digitising of Maps in Soil and Land Use

**OBJECTIVE:** To create digital database on soils and land use for Guyana.

**JUSTIFICATION:** For easy access, combination and manipulation of data sets, it is necessary to have a database, in which all-necessary data and information could be stored. Once a database has been established, running the analysis to assess the effects of proposed changes can progressively refine complex-planning scenarios. Thus decision-makers can propose a number of alternatives plans and interactively assess each one by analysing data and comparing results.

**METHODOLOGY:** The use of Global Positioning System (GPS) to adequately geo-reference points on maps during field surveys.  
: The use of Arc Info software to create database on soil and land maps.

## **Status Report on digitising of Soil Maps**

<b>Soil Maps</b>	<b>Status</b>
1. Atkinson – McKenzie- 3 Sheets	
Sheet 1	Not digitized
Sheet 2	Roads, drains, rivers, soils digitised
Sheet 3	Roads, drains, rivers, soils digitized
2. Canal No2.	Soils, roads, drains digitised
3. Andabo -Taurakuli – Abary	Soils, creeks, rivers digitised
4. Blairmont Bath Sugar Estate	Soils, drains digitised
5. Belfield	Soils, roads, drains digitised
6. Canje - 5 Sheets	
Sheet 1	Boundary, canals, roads, soils, tracks digitised
Sheet 2	Boundary, canals, roads, soils, tracks digitised
Sheet 3	Boundary, canals, roads, soils, tracks digitised
Sheet 4	Boundary, canals, roads, soils, tracks digitised
Sheet 5	Boundary, canals, roads, soils, tracks digitized
7. C.A.S Mon Repos	Soils, fields, roads, drains digitised
8. Cove & John	Soils, drain digitised
9. Craig Soesdyke	Drains, soils digitised
10. Plantation Hope	Soils, drains, roads digitised
11. IFAD	Soils, drains, roads digitised
12. Lancaster Joppa	Soils, roads, tracks digitised
13. Moblissa	Soils, drains digitised
14. MMA - 4 Sheets	
Sheet 1	Creeks, rivers, roads, soils digitised
Sheet 2	Not digitised
Sheet 3	Creeks, rivers, roads, soils digitised
Sheet 4	Creeks, rivers soils digitized
15. Rice Research Station	Soils, roads, canals digitised
16. Skeldon	Soils, roads, drains digitised
17. Yarakabra	Soils, drains, roads digitised
18. Zeelot	Soils, roads, drains digitised

**PROJECT:** Computerizing of Soil and Land Use Survey Reports

**OBJECTIVES:**

- (i) to have easy access to Soil and Land Use Information
- (ii) to quickly produce tables and maps of interpreted information
- (iii) to improve the decision making process.

**JUSTIFICATION:**

For easy access, combination and manipulation of data sets, it is necessary to have a database, in which all-necessary data and information could be stored. Once a database has been established, running the analysis to assess the effects of proposed changes can progressively refine complex-planning scenarios. Thus decision-makers can propose a number of alternative plans and interactively assess each one by analysing data and comparing results.

**METHODOLOGY:**

In the first instance, Soil and Land use reports will be inventoried and inputted into a computer. Reports will be stored in Microsoft Word and Maps in Geographic Information System (GIS) software (Arc Info/Arc View).

Digital copies of Reports will be checked for accuracy before being published on the Internet. Maps will be upgraded through fieldwork using a Global Positioning System (GPS) to add geographic coordinates. These maps will then be digitized to form part of the GIS database.

## **Status Report on the typing and rechecking of Soil Reports**

- (i) Eighty nine reports were rechecked, formatted and compiled on Compact Disc.
- (ii) There are 20 Soil and Land Use Survey reports to be typed, rechecked and formatted for inclusion on the CD. This will constitute a minor sub-project for 2005.

**PROJECT:** Production of User Manual for Arc Info and Arc View

**OBJECTIVE:** To have standard procedures for digitising of maps within the department.

### **JUSTIFICATION:**

The Soil and Land Use Department has from the past suffered from a lack of continuity in data input and retrieval owing to loss/lack of personnel. This project is an effort to create a routine/standard format for use of information system. In the event of a change in staff status (loss/lack) there will be minimal loss of time/productivity during the year.

### **METHODOLGY:**

Methods of data input and retrieval will be documented. from literature review and experiences available to staff. Research Assistants will test these procedures and Technicians associated with this subproject. When necessary, assistance will be sought from similar local institutions.

**STATUS:** This project was 80% completed.

**PROJECT:** Investigating the use of liquid manure in vegetable production

**METHODOLOGY:**

The experiment was a randomized complete block design with four replicates. Each plot was 3m by 4m.

The treatments were as follows:

- Urea applied at 100 kg N/ha
- Urea applied at 100 kg N/ha +liquid manure at 100 kg N/ha
- Urea applied at 50 kg N/ha +liquid manure at 50 kg N/ha
- Liquid manure at 100 kg N/ha
  - a) Liquid manure applied at transplanting, 14 days after transplanting (dat), 21 dat, 42 dat and 60 dat at the rate of 10%, 10%, 20%, 50%, 10% respectively
  - b) Urea applied at 14 and 42 dat.
  - c) The crop used was boulanger and plants were planted 60cm within rows and 90cm between rows

**RESULTS AND DISCUSSION:**

Boulanger yield was highest when the liquid manure was used in combination with the solid inorganic fertilizer at the highest level after six harvests. Fertilizer alone gave the second highest yield. The lowest yield was obtained when the liquid manure alone was used. Overall performance of the plants receiving liquid manure alone was poorest than all the other treatments.

Table 5, shows the effect of the treatments on the yield of boulanger. The experience here seem to suggest that the liquid manure is a poor substitute for urea in the production of boulanger, this was also borne out by Raikes (1997) who also found no differences in yield of corn and soya bean and Pierre–Alain (1998)who found that alfalfa yield was lower when liquid manure was applied. He also found that by increasing the

rate of application of the manure there was an increase in yields. However, N in the liquid manure is very volatile and losses of up to 75% could be experienced within four days of application (Joern and Bickford, 1993) when it is poured onto the surface of the soil as was done here. This can help to explain the low yield obtained when liquid manure alone was used.

**Table 4: Yield of Boulanger as affected by fertiliser treatments**

Treatment	Harvest # (g)						
	1	2	3	4	5	6	Total
1	234ab	206a	394ab	346a	189ab	259ab	1528a
2	485a	-a	421a	381a	524a	185b	1996a
3	247ab	146a	143ab	291a	126b	275a	1228ab
4	-b	147a	131b	126a	58b	25b	487b

Means with the same letters in a column are not significantly different from each other at the 5% level (DMRT)

**PROJECT:** Investigating the Efficacy of four different strains of Rhizobium bacteria on the heavy clay soils

**METHODOLOGY:**

The experiment was a randomized complete block design with four replicates. The treatments were four rejuvenated *Rhizobia* strains (612, Tal 420, 624 and 212), the free living strains found in the field #19 of NARI (control), Mon Repos and Nitrogen (N) at the rate of 50 kg N/ha.

Each plot was 3m by 4m and seeds inoculated and uninoculated were planted 8 cm within rows and 60 cm between rows. Destructive plant sampling was done at six weeks after planting to determine nodule number and dry matter yield. Microscopic

examination of the strains was done at each sampling. Appropriate pest management practices were adopted where and when necessary.

## RESULTS AND DISCUSSION

The results indicate that the largest number of nodules and more effective nodules were found in Strain # 612 however the efficiency of these nodules was not transferred into total dry matter yield and total yield as this strain was among the lowest in dry matter content. The highest dry matter content was found in plants inoculated with the strain # 624. The plants inoculated with this strain also had the most pods/plant and the highest yield (Table 6).

**Table 5: Yield and Yield Components of Cowpea as Affected by Different strains of *Rhizobia***

Treatment	# of Nodules	% Effective Nodules	Plant Dry Matter Content (g)	# pods/ Plant	# seeds/ Pod	100 Seed wt (g)	Yield/ha (kg)
Tal 420	13	75.0	27.1	8	16	17.8	1890.7
624	20	76.7	31.9	11	15	17.4	2382.9
212	11	83.7	31.3	8	17	15.2	1715.6
612	20	86.3	26.0	7	18	18.3	1914.0
Control	14	80.0	20.8	7	18	18.6	1945.2
Fertilized	14	76.7	29.4	9	16	18.7	2235.2

Strain 624 was among those with the least effective nodules but had the highest dry matter content and most pods/plant this validated the data obtained in 2003. The data was used in a presentation made to the Workshop on Sustainable Organic Agricultural Development held in September 2004 at the Ocean View Hotel in Guyana.

**PROJECT:** Demonstration on the use of Drip Irrigation and its effect on the yield of tomato and boulangier

A plot of tomato under drip irrigation was successfully planted and harvested. This technology can be successfully taken to farmers.

**Other Activities:**

Soil samples were collected from Unity.

Soil Maps for Moco Moco and Nappi valleys were produced for the GLSC

In collaboration with the Ministry of Fisheries Crops and Livestock and IICA the Department participated in seminars and workshops on Good Agricultural Practices for farmers in Regions 2, 3,5 and 10.

The department participated in a Workshop on Sustainable Organic Agricultural Development held in September 2004 at the Ocean View Hotel in Guyana Mr. Livan presented a paper entitled “ Some Aspects of Soil Fertility Management on a Coastal Soil of Guyana and Their Implications for Organic Agriculture”

## VII. HORTICULTURE DEPARTMENT

### STAFF

Consultant & Head:	V. Ho-a-Shu <sup>2</sup>	
Research Scientist:	Ms. Alona Sankar <sup>3</sup>	
Research Assistants:	K. Singh <sup>4</sup>	
	Ms. P. Doodnauth <sup>5</sup>	
	Ms. M. Soodeo <sup>6</sup>	
Research Technicians:	Ms. M. Goopcharran <sup>7</sup>	
	C. Jodbir <sup>8</sup>	
	Ms. Devica Singh <sup>9</sup>	
Clerical:	Ms. L. Persaud	
Plant Nursery Supervisors:	Ms. V. Lindore	Bartica
	B. Sahadeo	Benab
	Ms. J. Sutton	Charity
	L. Mendonca	Hosororo
	A. Teckchand	Mon Repos
	I. Singh <sup>10</sup>	Pouderoyen
	Ms. R. Farias	St. Ignatius
	Sookdeo <sup>11</sup>	Timehri
	R. Pearce <sup>12</sup>	Timehri
Other:	Ms. J. Klass	Kairuni Horticultural Station

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<sup>2</sup> Retired December 2004

<sup>3</sup> Appointed August 2004, Resigned October 2004 to Head The Guyana Wildlife Management Authority

<sup>4</sup> Resigned October 2004

<sup>5</sup> Resigned April 2004 to join the Environmental Protection Agency

<sup>6</sup> Appointed November 2004

<sup>7</sup> Transferred to Office of Director, NARI, May 2004

<sup>8</sup> Appointed April 2004, Transferred to Accounts Dept. NARI, August 2004

<sup>9</sup> Appointed September 2004

<sup>10</sup> Appointed March 2004

<sup>11</sup> Left August 2004

<sup>12</sup> Appointed November 2004

## **INTRODUCTION**

The objective of the Department of Horticulture is to engage in work with fruit plants that would result in the overall improvement of production in the fruit sub-sector by:

- a. The provision of improved pest and disease free planting material from selected local germplasm as well as suitable imported new varieties.
- b. The transfer of new appropriate technologies into the plant production processes on the farm.

During 2004, the rapid turnover and shortage of staff precluded the commencement and/or continuation of many trials.

## **SECTION A. RESEARCH AND DEVELOPMENT**

1. **Project Title:** The establishment of germplasm collection blocks and pilot orchards of various fruit cultivars, both foreign and local, at various locations in the country

### **Objectives:**

- a. To establish orchards of fruit cultivars obtained locally and from overseas in different locations of the country.
- b. To compare the suitability of these cultivars for adaptation to local conditions.
- c. To serve as a germplasm source for propagation.

### **Status:**

This is an ongoing project with both local and foreign varieties (mainly from Brazil) and maintenance continued in plots located at Benab, Fort Wellington, Kairuni, Mon Repos

and Timehri. New selections were added as they became available. Towards year-end preparations were made for the planting of some Rambutan selections at Mon Repos.

During the year, fruiting of the introduced CTV tolerant, Volkameriana Lemon and Cleopatra Mandarin rootstock plants continued, with the former at Kairuni, Mon Repos and Timehri, while the latter was only evident at Timehri.

**Project Title:** Exploring various vegetative propagation techniques (Budding, Grafting, Cuttings) on different tropical fruit trees.

**Objective:**

To identify the specific vegetative propagation technique (Budding, Grafting, Cuttings) that will be best for each fruit crop.

**Justification:**

There is an increasing demand for fruits, as fresh fruit and for processing, both locally and for export. With this demand there is corresponding increase in the planting of these fruit crops and the consequent need for more planting material. To maintain genetic integrity as well as to meet this demand for good quality planting material in each crop, identifying a suitable, reliable and rapid vegetative propagation technique becomes important.

**Status:**

This is an ongoing project and during this year a Modified Wedge Grafting technique was developed for Avocado and Mango in which the percentage of successful grafts was greater than with the Standard Wedge grafting.

In the Modified Wedge Grafting Technique (commonly called “Wrap Around”)<sup>13</sup>, besides taping only the scion and rootstock junction, the entire scion is taped leaving only the

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<sup>13</sup> See Addendum by Rube Soria to Propagation Techniques for Fruit Trees by M. Neto and H. Munkley

terminal end exposed. When this is done, there is no need to cover the scion with a plastic bag.

This Modified Wedge Grafting Technique was also successfully used in the propagation of Rambutan where Chip Budding and Marcotting were also successful..

**Project Title:** The production of CTV free plants from clean parent material.

**Objectives:**

- a. To establish rapid multiplication blocks of selected CTV free varieties at different locations of the country to provide CTV free budwood material for propagation.
- b. To provide planting material free from CTV.
- c. To establish the infrastructure to continually conduct serological testing of citrus plants for CTV.

**Status:**

This project is ongoing and required the following steps as outlined in a previous report<sup>14</sup>.

During the year, the majority of plants in the Multiplication Block at Mon Repos succumbed to the mid year flooding.

In August, the Facility for conducting the DTBIA<sup>15</sup> was transferred to the Department of Biotechnology, Plant Genetic Resources and Crop Protection which is now responsible for conducting this assay. At the time of handing over there were 29 CTV free plants.

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<sup>14</sup> See Horticulture Department Annual Report 2003

<sup>15</sup> Direct Tissue Blot Immunoassay

**Project Title:** Influence of Organic and Inorganic fertilisers on growth and yield responses of two varieties of grafted mango. (*Mangifera indica*)

**Objective:**

To determine which source of (N) nitrogen fertilizer is best utilized by Julie and Spice mango as shown by growth and yield responses.

**Status:**

This project, located at NARI, Mon Repos, Field 30, commenced late in 2002 and suffered a setback in 2004 with the loss of 56 plants due to fire. These plants are to be supplied and the trial restarted.

**Project Title:** Yield response of six papaya (*Carica papaya*) varieties to four levels of N fertilizer at three locations.

**Objective:**

To determine the optimal level of nitrogen required for maximum growth and yield in papaya.

**Status:**

This project, located at NARI, Mon Repos, and East Bank Essequibo at St. Lawrence and Naamryck, commenced during 2003 and was terminated during the year. It utilised the hybrid papaya varieties Known You, Red Lady, Sunrise, Tainung 1, Tainung 2 as well as a Local Selection from Charity. The fertiliser applications used were 185, 275 and 365 kg N/ha/yr and a control where no fertiliser was applied.

The hybrid varieties responded positively to the Nitrogen fertilisation with the highest rate of 365 kg/ha/yr giving the highest yield in each variety. The best yielding variety was the Sunrise with Tainung 1 and Red Lady being the next best performers.

**Project Title:** Effect of Timing of N fertilizer application on yield and growth of six varieties of papaya at two locations.

**Objective:**

To determine which of four time intervals used in the application of nitrogen fertilizers would produce the best growth and yield in papaya.

**Status**

This project, located at NARI, Mon Repos, and St. Lawrence, East Bank Essequibo, commenced during 2003 and was terminated during the year. It utilised the hybrid papaya varieties Known You, Red Lady, Sunrise, Tainung 1, Tainung 2 as well as a Local Selection from Charity. A rate of 390 kg N/ha/yr was applied after flowering at two, four, and six weekly intervals.

The application of the N fertiliser at two-week intervals produced the best results, while the outstanding variety was Sunrise. So that the overall best yield was obtained when the N fertiliser was applied at two- weekly intervals to the Sunrise variety, followed by the Known You variety.

**Project Title:** Yield potential of three passion fruit cultivars.

**Objective:**

To determine the yield of three passion fruit (*Passiflora sp.*) cultivars namely Local Yellow, Local Pink and Brazilian Yellow growing on a clay soil at Mon Repos.

**Status:**

This project, located at NARI, Mon Repos, Field 18, first commenced in 2003 but was lost in the mid year floods before any meaningful data could be collected. It was replanted and the trial recommenced late in the year.

**Project Title:** A comparative study between the yield of pruning and non-pruning of three cultivars of Passion Fruit, (*Passiflora* sp.).

**Objective:**

To determine the difference in yield of pruned and unpruned passion fruit vines and the cost effectiveness of the pruning exercise.

**Status:**

This trial located at the Kairuni Horticultural Station commenced late in 2001 and came to an end with the dying back of the vines during 2004, after 22 months of bearing. From the data collected, there was no significant difference in yield between the unpruned and pruned treatments or between the varieties. On this sandy soil, the best yield was obtained from the unpruned local pink variety, which produced a yield equivalent to 5.49 tn/ha/yr.

**Project Title:** Evaluation of the growth and yield of Montserrat and Smooth Cayenne Varieties of Pineapple. (Observation Trial)

**Objective:**

To compare the growth, yield and main agronomic features of the two mentioned varieties.

**Status:**

Some 61 plants of both varieties, generated from tissue culture plantlets, were established at Kairuni late in 2002. Eighteen plants of each variety were marked and so far growth records of plant height, number of leaves and leaf length have been taken. From this data collected to date, there is no indication of any difference in growth of the two varieties.

**Project Title:** The selection and propagation of two phenotypes of Montserrat Variety of Pineapple (Observation Trial).

**Objectives:**

1. To select conical and cylindrical plants of the Montserrat pineapple according to a selection criteria and to use them to propagate new plants that would conform to the selected type.
2. Eventually to produce a pure stand of the cylindrical phenotype of the Montserrat pineapple.

**Status:**

The current trial commenced in 2002 and continued with the planting out of 18 plants generated by tissue culture from “cylindrical type fruit” and 42 from “conical type fruit” at the Kairuni Horticultural Station in 2002. The fruits obtained during the year are re-summarized in Table 7.

**Table 6. Fruits types of Monserrat Pineapple obtained during 2004, Kairuni**

ROW	PARENT TYPE	PLANT NO	HARVEST DATE	TOP DIAM (cm)	BOT DIAM (cm)	DIFF DIAM (cm)	RESULTING PROGENY TYPE
7	Cylindrical	3	27-Jul-04	7.7	9.5	1.8	Conical
7	Cylindrical	4	08-Jul-04	8.0	9.5	1.5	Conical
7	Cylindrical	5	27-Jul-04	6.6	8.5	1.9	Conical
7	Cylindrical	7	27-Jul-04	6.0	7.5	1.5	Conical
7	Cylindrical	15	08-Jul-04	7.7	9.3	1.6	Conical
9	Conical	7	27-Jul-04	3.0	7.3	4.3	Conical
9	Conical	12	08-Jul-04	7.8	8.5	0.7	Conical
10	Conical	1	27-Jul-04	5.3	7.8	2.5	Conical
10	Conical	2	27-Jul-04	3.5	7.0	3.5	Conical
10	Conical	4	27-Jul-04	3.0	7.0	4.0	Conical

According to the criteria set, for the fruit to be cylindrical, there should be no difference between the top and bottom diameters, which was not found in any of the fruits obtained. Also, from the previous year, two fruits from the “cylindrical type fruit” parents produced conical shaped fruits.

At this stage therefore, there is no indication that plants coming from cylindrical type fruit parents would produce cylindrical type fruits.

## **SECTION B. PRODUCTION**

**Project Title:** Plant Nursery Operations

**Objective:**

To propagate quality plants at the various plant nurseries.

**Status:**

*General:*

Routine work continued at all Plant Nurseries. Under the Poor Rural Communities Social Services Programme (PRCSSP) the construction of a new office, which commenced at the Charity Plant Nursery in the previous year, was completed during 2004. At the Pouderoyen Plant Nursery under the same PRCSSP, work was also completed on a new plant and soil shed.

*Production:*

Details of the production at the Plant Nurseries to October 2004 are presented in an overall summary Table 8.

Work was ongoing at the Plant Nurseries and to October 2004, the overall production was 171,909 plants as compared to 160,125 in 2003. However, in actual plant sales, 51,663 plants were sold this year as compared to 83,677 in 2003. This extraordinary

large amount of sales last year was due to an unprecedented demand for plants to establish a farm in the Intermediate Savannahs.

**Table 7: Plant Nurseries – Plant Production up to October for Years 2003/2004**

PLANT NURSERIES	TYPE	2,003	2,004		
		Total P'duction	Sales	Stock	Total P'duction
Bartica	Citrus	2,118	10	463	473
	Avocado, Mango, Cherry	262	37	159	196
	Other Fruit	71	16	56	72
	<b>TOTAL</b>	<b>2,451</b>	<b>63</b>	<b>678</b>	<b>741</b>
Benab	Citrus	9,012	7,572	7,650	15,222
	Avocado, Mango, Cherry	117	50	8	58
	Other Fruit	1,020	824	521	1,345
	<b>TOTAL</b>	<b>10,149</b>	<b>8,446</b>	<b>8,179</b>	<b>16,625</b>
Charity	Citrus	14,249	3,068	14,043	17,111
	Avocado, Mango, Cherry	1,611	382	1,681	2,063
	Other Fruit	3,372	1,199	1,935	3,134
	Ornamentals, Others	346	106	40	146
	<b>TOTAL</b>	<b>19,578</b>	<b>4,755</b>	<b>17,699</b>	<b>22,454</b>
Hosororo	Citrus			684	684
	Avocado, Mango, Cherry	1,246	780	141	921
	Other Fruit	2			0
	Cocoa	8,757		11,368	11,368
	Ornamentals, Shade Trees	500		18	18
	<b>TOTAL</b>	<b>10,505</b>	<b>780</b>	<b>12,211</b>	<b>12,991</b>

Mon Repos	Citrus	32,835	7,333	23,657	30,990
	Avocado, Mango, Cherry	10,217	3,415	3,652	7,067
	Other Fruit	12,961	6,418	5,969	12,387
	Ornamentals, Others	2,101	767	1,273	2,040
	<b>TOTAL</b>	<b>58,114</b>	<b>17,933</b>	<b>34,551</b>	<b>52,484</b>
Pouderoyen	Citrus	8,723	4,339	13,384	17,723
	Avocado, Mango, Cherry	3,401	1,266	2,989	4,255
	Other Fruit	2,389	2,921	1,730	4,651
	Ornamentals, Others	679	515	415	930
	Vegetables		4	13	17
<b>TOTAL</b>	<b>15,192</b>	<b>9,045</b>	<b>18,531</b>	<b>27,576</b>	
St. Ignatius	Citrus	1,546	106	315	421
	Avocado, Mango, Cherry	26	31	786	817
	Other Fruit	177	45	1,433	1,478
	<b>TOTAL</b>	<b>1,749</b>	<b>182</b>	<b>2,534</b>	<b>2,716</b>
Timehri	Citrus	29,984	6,669	17,768	24,437
	Avocado, Mango, Cherry	3,862	1,450	1,933	3,383
	Other Fruit	7,254	2,174	5,420	7,594
	Ornamentals, Others	1,287	166	742	908
	<b>TOTAL</b>	<b>42,387</b>	<b>10,459</b>	<b>25,863</b>	<b>36,322</b>
OVERALL	Citrus	98,467	29,097	77,964	107,061
	Avocado, Mango, Cherry	20,742	7,411	11,349	18,760
	Other Fruit	27,246	13,597	17,064	30,661
	Cocoa	8,757	0	11,368	11,368
	Ornamentals, Others	4,913	1,554	2,488	4,042
	Vegetables	0	4	13	17
<b>OVERALL</b>	<b>TOTAL</b>	<b>160,125</b>	<b>51,663</b>	<b>120,246</b>	<b>171,909</b>

## VIII. HUMAN RESOURCES REPORT

### 1. RECRUITMENT OF STAFF

#### **A Senior Technical**

- |    |                           |   |                    |            |
|----|---------------------------|---|--------------------|------------|
| 1) | Ms. Alona Sankar          | - | Research Scientist | 2004-08-03 |
| 2) | Dr. Ragnauth Chandranauth | - | Research Scientist | 2004-08-09 |
| 3) | Mr. Hisakhana Corbin      | - | Research Assistant | 2004-11-01 |
| 4) | Ms. Monica Sookdeo        | - | Research Assistant | 2004-11-01 |

#### **B Other Technical and Craft Skilled**

- |    |                         |   |                     |            |
|----|-------------------------|---|---------------------|------------|
| 1) | Mr. Brahim Evans-Saffee | - | Research Technician | 2004-03-01 |
| 2) | Ms. Devica Singh        | - | Research Technician | 2004-07-01 |
| 3) | Mr. Yadesh Dhanpaul     | - | Research Technician | 2004-10-05 |

#### **C Clerical and Office Support**

- |    |                     |   |                   |            |
|----|---------------------|---|-------------------|------------|
| 1) | Ms. Melinda Beekham | - | Accounts Clerk 11 | 2004-10-04 |
|----|---------------------|---|-------------------|------------|

#### **D Semi-skilled Operatives and Unskilled**

- |    |                           |   |                 |            |
|----|---------------------------|---|-----------------|------------|
| 1) | Mr. Lalta Persaud         | - | Nursery Foreman | 2004-04-04 |
| 2) | Mr. Richard Pearce        | - | Nursery Foreman | 2004-11-01 |
| 3) | Mr. Latchman Bhola        | - | Nursery Forman  | 2004-03-01 |
| 4) | Mr. Khemraj Singh         | - | Nursery Foreman | 2004-08-12 |
| 5) | Mr. Nehru Persaud         | - | Security Guard  | 2004-02-29 |
| 6) | Mr. Farouk Muntaz         | - | Security Guard  | 2004-05-05 |
| 7) | Mr. Veeramattoo Muthusami | - | Security Guard  | 2004-07-20 |
| 8) | Mr. Gobin Basdeo          | - | Security Guard  | 2004-08-13 |
| 9) | Mr. Surindra Singh        | - | Security Guard  | 2004-03-01 |

10)	Mr. Chetram Suriram	-	Security Guard	2004-08-03
11)	Mr. Rajwattie Ramlagan	-	General Worker	2004-01-19
12)	Mr. Jhavandra Roopnarine	-	General Worker	2004-03-18
13)	Mr. Ammar Persaud	-	General Worker	2004-03-18
14)	Mr. Paul Boodram	-	General Worker	2004-07-03
15)	Mr. Glenrick Lyte	-	General Worker	2004-08-23
16)	Mr. Galand James	-	General Worker	2004-10-01
17)	Mr. Ewart Williams	-	General Worker	2004-11-01

## 2. PROMOTION

### A Other Technical and Craft Skilled

1)	Ms. Grace Easton	-	Snr. Res. Technician	2004-09-01
2)	Ms. Shelley Heath-London	-	Snr. Res. technician	2004-10-01
3)	Ms. Loyce Ifill	-	Snr. Res. Technician	2004-10-01
4)	Ms. Sharon Nicholson	-	Snr. Res. Technician	2004-10-01

### B. Semi-skilled Operatives and Unskilled

1)	Ms. Nicola Frank	-	Asst Plant Nursery Sup.	2004-07-01
2)	Ms. Punadai Roopnarine	-	Asst. Plant Nursery Sup.	2004-07-01
3)	Ms. Julia McAlmon	-	Ass. Plant Nursery Sup.	2004-07-01
4)	Ms. Joan Rodrigues-Klass	-	Foreman	2004-07-01
5)	Mr. Khayam Odhoo	-	Assistant Foreman	2004-01-07

## 3. RESIGNATION

### A Senior Technical

1)	Mr. Lambert Chester	-	Research Scientist	2004-05-10
2)	Ms. Alona Sankar	-	Research Scientist	2004-10-31
3)	Mr. Stephen Rutherford	-	Research Assistant	2004-10-13
4)	Mr. Chetram Kissoonchand	-	Research Assistant	2004-05-05

- |    |                       |   |                    |            |
|----|-----------------------|---|--------------------|------------|
| 5) | Mr. Karan Singh       | - | Research Assistant | 2004-10-03 |
| 6) | Ms. Pratima Doodnauth | - | Research Assistant | 2004-04-03 |
| 7) | Ms. Gaitri Nanku      | - | Research Assistant | 2004-05-02 |
| 8) | Mr. Elton Patram      | - | Research Assistant | 2004-05-02 |

**B Other Technical and Craft-skilled**

- |    |                     |   |                  |            |
|----|---------------------|---|------------------|------------|
| 1) | Mr. Kenneth Garnett | - | Snr. Storekeeper | 2004-07-27 |
|----|---------------------|---|------------------|------------|

**C Clerical and Office Support**

- |    |                     |   |                   |            |
|----|---------------------|---|-------------------|------------|
| 1) | Ms Shazeena Mohamed | - | Accounts Clerk 11 | 2004-05-07 |
|----|---------------------|---|-------------------|------------|

**D Semi-Skilled Operatives and Unskilled**

- |    |                 |   |                     |            |
|----|-----------------|---|---------------------|------------|
| 1. | Mr. Rolston Yaw | - | Security Supervisor | 2004-10-20 |
|----|-----------------|---|---------------------|------------|

**4. TERMINATION OF SERVICE**

**A. Clerical and Office Support**

- |    |                   |   |                 |            |
|----|-------------------|---|-----------------|------------|
| 1) | Mr. Lalta Persaud | - | Nursery Foreman | 2004-10-16 |
|----|-------------------|---|-----------------|------------|

**5. DISMISSAL**

**A. Other Technical and Craft Skilled**

- |    |                   |   |                   |            |
|----|-------------------|---|-------------------|------------|
| 1. | Mr. Brian Siriram | - | Res. Technician 1 | 2004-05-17 |
|----|-------------------|---|-------------------|------------|

**B. Semi-skilled Operative and Unskilled**

- |    |                      |   |                     |            |
|----|----------------------|---|---------------------|------------|
| 1) | Mr. Sookdeo          | - | Nursery Sup/Foreman | 2004-07-18 |
| 2) | Mr. Paul Ramsaywack  | - | Security Guard      | 2004-07-16 |
| 3) | Mr. Salim Budhoo     | - | Security Guard      | 2004-10-22 |
| 4) | Ms. Shonette Heywood | - | General Worker      | 2004-10-26 |

- |    |                     |   |                |            |
|----|---------------------|---|----------------|------------|
| 5) | Mr. Terrence Halley | - | General Worker | 2004-06-14 |
| 6) | Ms. Donna Joseph    | - | General Worker | 2004-10-26 |
| 7) | Mr. Venton Taylor   | - | General Worker | 2004-08-01 |

## 6. TRANSFER

### A Other Technical and Craft Skilled

- |    |                      |   |              |            |
|----|----------------------|---|--------------|------------|
| 1) | Mr. Joseph Gonsalves | - | Farm Manager | 2004-05-24 |
|----|----------------------|---|--------------|------------|

## 7. RETIREMENT

### A Semi-Skilled Operatives and Unskill0ed

- |    |                       |   |                |            |
|----|-----------------------|---|----------------|------------|
| 1) | Mr. Mooklall Ramnauth | - | General Worker | 2004-10-04 |
|----|-----------------------|---|----------------|------------|

## TRAINING

### A. OVERSEAS

#### Short Courses/workshops/Study Tours

#### Short Courses

1. Mr. Ramdeo Seepaul, Research Assistant, participated in a Training Course on “**Building Capacity in Vegetable Production and Water Management**”, held in Antigua and Barbuda, from June 21 to June 25, 2004.
2. Dr. Robin Austin, Research Scientist, participated in a Regional Training Course on “ **Scientific Data Management**”, held in St. Kitts/Nevis, from September 13 to September 22, 2004.

3. Mr. Mohamed Faroze, Research Scientist, participated in a Regional Transformation Programme on “**Commodities Competitiveness Study**”, held in Trinidad and Tobago, from October 03 to October 06 2004.
4. Ms. Michelle Lutchman, Research Assistant, participated in a Training Programme on “**Fertilizer Quality Control**”, held in Faridabad, India, from October 05 to November 08, 2004.
5. Mr. Haris Umadas, Personnel & Industrial Relations Officer, participated in a Training Programme on “**Labour Administrative and Employment Relations in a Global Economy**”, held in Naida, India, from October 11 to October 29, 2004.

#### **A. Workshops**

1. Dr. Patrick Chesney, Research Scientist, participated in a Workshop on “**GIS/GPS for Pest and disease Monitoring and Detection**”, held in Trinidad and Tobago, from September 28 to October 01, 2004.

#### **B. Study Tours**

1. Mr. David Fredericks, Research Scientist, participated in a Study Tour on “**Institutional Capacity Building Activities on Guyana’s Sea Defenses**”, held in the Netherlands, from April 12 to April 21, 2004.

## B. LOCAL

### Short Courses

1. Ms. Nathalie Henry, Senior Library Assistant, participated in a Training Course on “**Basic Library Skills**”, held at the National Library, Guyana, from March 15 to March 26, 2004.
2. Mr. Lambert Chester, Research Scientist and Ms. Roseann Jaundoo, Chief Accountant (ag), participated in a Training Programme on “**Programme Budgeting**”, held at the Public Service management Training Division, Guyana, from April 13 to April 14, 2004.
3. Ms. Ameka Blair, Storekeeper (ag), participated in a Training Programme on “**Procurement and Stores Management**”, held at the Public Service Management Training Division, Guyana, from April 06 to April 07, 2004.
4. Ms. June Eastman, Confidential Secretary, participated in a training programme on “**Personnel Practice and Policy**”, held at the Public Service Management Training Division, Guyana, from May 04 to May 06, 2004.
5. Mr. Haris Umadas, Personnel & Industrial Relations Officer, participated on a training Programme on “**Certificate in Human Resource Management**”, held at the Public Service Management training Division, Guyana, from June 21 to June 25, 2004.
6. Ms. Annette Miller, Secretary, participated in a Training Programme on “**Modules 1, 11 and 111**”, held at the Public Service Management Training Division, Guyana, from July 26 to July 30, 2004; September 07 to September 09, 2004 and October 18 to October 22, 2004, respectively.

## Workshop

1. Mr. Mortimer Livan, and Ms. Grace Parris, both Research Scientists, participated in a Workshop on “**Public Sector Modernization in Guyana**”, held at the Public Service Management Training Division, Guyana, on July 23, 2004.

**Table 8: STAFFING AT NARI – 2004**

Categories	No. of Positions	Positions filled	Positions vacant
Administration	16	10	6
Senior Technical	50	25	25
Other Technical and Craft skilled	70	35	35
Clerical and Office Support	36	16	20
Semi-skilled Operatives and unskilled	304	165	139
<b>TOTAL</b>	<b>476</b>	<b>251</b>	<b>225</b>

**Table 9: Staffing in the Administration Category NARI, 2004**

	Authorized Positions	Positions filled	Vacant Posts
Director	1	1	0
Head-of-Unit	3	2	1
Administrative Manager	1	1	0
Principal Finance Officer	1	0	1
Internal Auditor	1	0	1
Personnel & Industrial Relations Officer	1	1	0
Library/Documantalist	1	0	1
Assistant Librarian	1	0	1
Senior Personnel Assistant	1	1	0
Chief Accountant	1	0	1
Superintendent, General Services	1	1	0
Administrative Assistant	1	1	0
Chief Security Officer	1	1	0
Supervisor, General Services	1	0	1
Deputy Chief Security Officer	1	1	0
TOTAL	16	10	6

**Table 10: Staffing in the Senior Technical Category NARI, 2004**

	Authorized Positions	Positions Filled	Vacant Posts
Senior Research Scientists	8	1	7
Research Scientists	20	12	8
Senior Research Assistants	4	0	4
Research Assistants	18	12	6
TOTAL	50	25	25

**Table 11: Staffing in the Clerical and Office Support Category NARI, 2004**

<b>Category</b>	<b>Authorized Positions</b>	<b>Positions Filled</b>	<b>Vacant Posts</b>
Confidential Secretary	1	1	0
Registry Supervisor	1	1	0
Personnel Assistant	1	0	1
Secretary	4	0	4
Typist/Clerk 1/11	5	3	2
General Clerk	3	2	1
Assistant Accountant	1	1	0
Assistant Accountant (Audit)	1	0	1
Accounts Clerk 111	1	0	1
Accounts Clerk 11	4	3	1
Records Clerk	2	1	1
Audit Clerk	1	1	0
Cartographic Trainee	1	0	1
Expediter 1/11	1	1	0
Telephonist 1/11	1	0	1
Office Attendant	5	2	3
Stores Clerk	1	0	1
Inventory Clerk	2	0	2
<b>TOTAL</b>	<b>36</b>	<b>16</b>	<b>20</b>

Positions Created

**Other Technical and Craft Skilled**

Position Filled

<b>Communication Officer</b>	<b>1</b>
<b>Communication Information Specialist</b>	<b>1</b>
<b>Information Technology Technician</b>	<b>1</b>

**Table 12: Staffing in the other Technical and Craft Skilled category NARI, 2004**

Category	Authorized Positions	Positions Filled	Vacant Posts
Senior Research Technician	5	5	0
Research Technician 11	9	7	2
Research Technician 1	22	10	12
Senior Field Assistant	1	0	1
Farm Manager	1	1	0
Plant Nursery Supervisor	1	0	1
Livestock Farm Supervisor	1	1	0
Senior Electrician	1	0	1
Mechanical Supervisor	1	1	1
Senior Mechanic	1	1	0
Senior Mechanic/Operator	1	0	1
Senior Storekeeper	2	0	2
Auto Electrician	1	0	1
Carpenter	4	2	2
Electrician	2	2	0
Mechanic	4	1	3
Plumber	2	0	2
Senior Library Assistant	1	1	0
Library Assistant	1	1	0
Mechanic Trainee	1	0	1
Senior Welder	1	0	1
Welder	1	1	0
Senior Carpenter	1	0	1
Senior Plumber	1	1	0
Assistant Plumber	1	0	1
Storekeeper	3	1	2
TOTAL	70	35	35

**Table 13: Staffing in the Semi Skilled Operatives and Unskilled Category NARI, 2004**

Category	Authorized Positions	Positions Filled	Vacant Posts
Security Guards	49	39	10
Nurseryman 1	15	5	10
Nurseryman 11	10	4	6
Crop Attendant	4	1	3
Plant Operator	2	0	2
Equipment Operator	7	4	3
Mobile Equipment Operator	9	4	5
Toolroom Attendant	1	0	1
Stores Attendant	2	0	2
Heavy Duty Driver	4	3	1
Heavy Duty Mobile Equipment Operator	1	0	1
Driver/Mechanic	3	0	3
Drivers	6	2	4
Sanitation Workers	8	5	3
Personal Assistant	1	0	1
Senior Field Foreman	4	0	4
Senior Nursery Foreman	1	0	1
Senior Stock Foreman	1	0	1
Field Foreman	5	0	5
Nursery Foreman	5	4	1
Foreman	2	1	1
Stock Foreman	1	0	1
Assistant Foreman	3	3	0
Assistant Nursery Foreman	3	2	1
Laboratory Assistant	4	1	3
Laboratory Attendant	9	7	2
Senior Livestock Attendant	1	0	1
Caretaker	2	2	0
Livestock Attendant	4	2	2
Handyman	2	0	2
Porter	2	1	1
Library Attendant	1	0	1
Security Supervisor	3	0	3
Senior Guard	5	4	1
Security Guard	49	31	18
General Worker	120	79	41
Watchman	4	0	4
TOTAL	304	165	139

**IX: FINANCIAL REPORT:**

**BALANCE SHEET**

**AS AT DECEMBER 31, 2004**

\$ 2003		NOTES	\$	\$
197,668,262	<b>FIXED ASSETS</b>	6		178,282,055
	<b>CURRENT ASSETS</b>			
11,612,936	Stocks		11,665,786	
7,969,967	Debtors		9,285,569	
7,916,106	Short Term Investment	7	8,108,340	
9,089,692	Cash at Bank and on Hand		<u>1,032,147</u>	
36,588,701			30,091,842	
	<b>CREDITOR AND ACCRUALS</b>			
	Amount due within one (1) year			
(5,128,715)	Creditors		<u>(2,361,403)</u>	
<u>31,459,986</u>	<b>NET CURRENT ASSETS</b>			<u>27,730,439</u>
<b>229,128,248</b>				<u>206,012,494</u>
	<b>PROVISION FOR LIABILITIES &amp; CHARGES</b>			
(5,606,815)	Ministry of Works		(5,606,815)	
	Ministry of Finance		<u>-</u>	
<u>(5,606,815)</u>				<u>(5,606,815)</u>
<u>223,521,433</u>	<b>NET TOTAL ASSETS</b>			<u>200,405,679</u>
	<b>FINANCED BY:</b>			
51,897,479	Grant Foreign Sources			51,897,479
210,158,647	Government Contribution	8		218,658,647
935,796	Revaluation of Stock			935,796
<u>(39,470,489)</u>	Accumulated Surplus (Deficit)			<u>(71,086,243)</u>
<u>223,521,433</u>				<u>200,405,679</u>

**STATEMENT OF INCOME AND EXPENDITURE  
FOR THE YEAR ENDED DECEMBER, 31, 2004**

\$ 2003	OPERATING INCOME	NOTES	\$	\$
13,489,790	Income from Agricultural Produce	2		10,696,071
2,638,163	Grant	3		8,661,680
190,102,868	Government Subvention			197,392,597
<u>5,867,563</u>	Miscellaneous Income	4		<u>6,378,882</u>
<u>212,098,384</u>				223,129,230
<b>OPERATING EXPENDITURE</b>				
166,242,686	Employment		166,698,769	
6,339,062	Fuel and Lubricants		6,617,523	
11,093,729	Repairs and Maintenance		8,158,910	
9,836,112	Field Supplies and Services		9,733,657	
24,884,420	Depreciation		27,645,530	
<u>39,431,625</u>	Administrative Costs		<u>35,890,595</u>	
<u>257,827,634</u>				<u>254,744,984</u>
<u>(45,729,250)</u>	Net Surplus/(Deficit)			<u>(31,615,754)</u>

**STATEMENT OF ACCUMULATED SURPLUS/(DEFICIT)**

6,258,761	Accumulated Surplus/(Deficit) as at Jan. 1, 2004	5		(39,470,489)
(45,729,250)	Add Current Year Surplus / (Deficit)			(31,615,754)
<u>(39,470,489)</u>	Accumulated Surplus/(Deficit) as at Dec. 31, 2004			<u>(71,086,243)</u>

**STATEMENT OF SOURCE AND APPLICATION OF FUNDS**

**FOR THE YEAR ENDED DECEMBER, 31, 2004**

\$ 2003		\$	\$
	<b>SOURCE OF FUNDS</b>		
(45,729,250)	Deficit for the year		(31,615,754)
	Add : Adjustments for just items not involving the use of funds :-		
	Loss on Disposal of Fixed Assets	-	
<u>24,884,420</u>	Depreciation	<u>27,645,530</u>	
<u>24,884,420</u>			<u>27,645,530</u>
<u>(20,844,830)</u>			<u>(3,970,224)</u>
	<b>FUNDS FROM OTHER SOURCES</b>		
9,500,000	Government Contribution	8,500,000	
935,796	Revaluation of Stock	-	
<u>15,360,000</u>	Grant Foreign Sources	<u>-</u>	
<u>25,795,796</u>			<u>8,500,000</u>
<u>4,950,966</u>	Total Funds From All Sources		<u>4,529,776</u>
	<b>APPLICATION OF FUNDS</b>		
20,684,024	Ministry of Finance	-	
<u>28,910,298</u>	Purchase of Fixed Assets	<u>8,259,323</u>	
<u>49,594,322</u>			<u>8,259,323</u>
<u>(44,643,356)</u>			<u>(3,729,547)</u>
	<b>INCREASE/DECREASE IN WORKING CAPITAL</b>		
1,296,849	Increase/(Decrease) in Stock	52,850	
(3,791,040)	Increase/(Decrease) in Debtors	1,315,602	
<u>(1,375,883)</u>	(Increase)/Decrease in Creditors	<u>2,767,312</u>	
<u>(3,870,074)</u>			4,135,764
	<b>MOVEMENT IN NET LIQUID FUNDS</b>		
(21,767,846)	Increase/(Decrease) in Short Term Investment	192,234	
<u>(19,005,436)</u>	Increase/(Decrease) in cash at Bank & on Hand	<u>(8,057,545)</u>	
<u>(40,773,282)</u>			<u>(7,865,311)</u>
<u>(44,643,356)</u>			<u>(3,729,547)</u>

## NOTES TO THE ACCOUNTS

### 1 ACCOUNTING POLICIES

#### **(a) Accounting Conventions:-**

These statements have been prepared under the historical cost conventions as modified by the revaluation of assets taken from Central Agriculture Station and Guyana Rice Board; Such assets being valued at the current market price prevailing as at March 01, 1985.

#### **(b) Fixed Assets:-**

Depreciation is calculated on the straight line basis to write off the assets over their useful Lives as follows:-

Buildings  
Motor Vehicles  
Machinery and Equipment  
Laboratory Equipment  
Household Furniture and Fittings  
Library Books

Depreciation is provided following the year of acquisition.

No depreciation is provided on freehold land, capital work-in-progress and livestock.

#### **( c ) Stock:-**

Stocks are valued at lower of cost and net realizable value. In general, cost is determined on a first-in-first-out basis and includes all cost relating to freight, insurance, handling and finance charges.

#### **(d) Loans:-**

Loans are stated net of unearned and uncollected interest.

#### **( e ) Pension Plan:-**

The Institute has established a contributory Pension Scheme for its monthly paid employees. The contributions are held in a trustee administered funds.

#### **( f ) Transferred to NARI:-**

At Cabinet Meeting held on 8th October, 1996 approval was granted with effect from 01st January, 1997 to transfer sections of the Ministry of Agriculture, Crops and Livestock Department to NARI. However, the valuation of the Assets taken over from the Mon Repos Livestock Station, Seed Technology Unit including Kairuni Agricultural Research Station and all Plant Nurseries is not included in the present report.

**2 INCOME FROM AGRICULTURAL PRODUCE**

**This figure is made up as follows:**

	\$
Sale of Plants	6,817,336
Sale of Organic Produce	11,695
Sale of Livestock Produce	3,152,327
Sale of Grain Legumes	245,910
Sale of Vegetables & Seeds	163,670
Sale of Papaw	151,276
Sale of Processed Items	8,080
Sale of Orchard Produce	145,777
	<hr/>
	10,696,071
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**3 GRANTS**

**This figure is made up as follows:**

	\$
International Foundation for Science	2,111,057
Ministry of Agriculture (I N S A P)	2,500,000
Geology & Mines Commission	1,397,123
Guyana School of Agriculture (Water )	78,750
Ministry of Agriculture (Water)	47,250
AMCAR	33,000
Poor Rural Communities Support Services Project	2,000,000
FAO/CARICOM/CARIFORUM/G OF G Italy	494,500
	<hr/>
	8,661,680
	<hr/>

**4 MISCELLANEOUS INCOME**

**This figure is made up as follows:**

	\$
Sale of Acoushi Ant Bait	75,730
Electricity Receivable	2,328,882
Interest Receivable	289,508
Other Income	346,252
Rental of House	825,000
Income from Advertisement	895,170
Sale of Unserviceable Items	16,800
Rental of Equipment	876,290
Sale of Printed Materials	63,250
Accommodation Guest House	655,642
	<hr/>
	6,372,524
	<hr/>

**5 ACCUMULATED DEFICIT AS AT JANUARY 1, 2004**

	\$
Balance brought forward as at January 01, 2004	39,419,339
Add amount inadvertently stated as Purchase Advance	4,800
Add amount inadvertently stated as Debtors	46,350
	<hr/>
	39,470,489
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6. SCHEDULE OF FIXED ASSETS AS AT DECEMBER 31, 2004

COST	BUILDINGS ETC.	MACH. & EQUIP. & MOTOR VEHICLES	FURNITURE & FITTINGS & OFFICE EQUIPMENT	LABORATORY EQUIPMENT	LIBRARY BOOKS	ANIMALS	CONSTRUCTION WORK IN PROGRESS	GRAND TOTAL
AT 2004 - 01 - 01	206,344,259	119,374,420	46,172,537	44,865,167	2,090,071	1,563,131	71,410	420,480,995
ADDITIONS / ACQUISITION	6,125,849	1,120,996	550,490	294,842	71,146	96,000	5,842,284	14,101,607
DISPOSAL / TRANSFERS							(5,842,284)	(5,842,284)
AT 2004 - 12 - 31	212,470,108	120,495,416	46,723,027	45,160,009	2,161,217	1,659,131	71,410	428,740,318
<b>DEPRECIATION</b>						-	-	
AT 2004 - 01 - 01	63,886,202	77,114,734	38,923,958	41,341,083	1,546,756	-	-	222,812,733
DISPOSAL / TRANSFERS								
CHARGED FOR THE YEAR	10,319,633	12,078,920	3,184,318	1,833,143	229,516	-	-	27,645,530
AT 2004 - 12 - 31	74,205,835	89,193,654	42,108,276	43,174,226	1,776,272	-	-	250,458,263
<b>NET BOOK VALUE</b>	138,264,273	31,301,762	4,614,751	1,985,783	384,945	1,659,131	71,410	178,282,055

**7 SHORT TERM INVESTMENT**

**\$**

4-Jul-91 Certificate No. 99221

8,108,340

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8,108,340

**9 GOVERNMENT CONTRIBUTION**

This figures represents Inflows from Government for Capital Works

**\$**

Incorporated Reserves

12,454,472

Govt. Contribution Balance as at Jan. 1, 2004

197,704,175

Add Govt. Contribution during the Year

8,500,000

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\$218,658,647