

# DEPARTMENTAL REPORTS, 2003

## 1. 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. Mr. L. Chester	-	Research Scientist
7. Ms. S. Pooran	-	Research Assistant
8. Ms. M. Lutchman	-	Research Assistant
9. Ms. J. Garnett	-	Research Assistant
10. Mr. R. Adrian	-	Research Assistant
11. Mr. E. Patram	-	Research Assistant
12. Ms. L. Badal	-	Communication Officer
13. Mr. R. Chan	-	Communication Specialist
14. Ms. N. Hutson	-	Information Technology Technician

The Office of the Director had responsibility for the following:

1. Research on 'New' Crop Types
2. Marketing Information Systems
3. Analysis of Farming Systems
4. Organic Agriculture
5. Information, Communication and Agricultural Support Services
6. Intermediate Savannas
7. Seed Technology
8. Training
9. Special Projects

Special projects were executed in the following:

1. Poor Rural Community Support Services Project (PRCSSP)
2. GGMC – Vegetation of a mined out site in Region 10
3. Peanut CRSP project in Region 9.

Staff members from other Departments were integral to 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. RESEARCH ON ‘NEW’ CROP TYPES**

### **(i) CARROTS**

**Project Title:** *Method of improving germination of carrot seed on coarse sand.*

This trial was conducted at Kuru Kuru on the coarse sand prevalent in that area. The aim was to investigate methods of improving germination of carrot. The techniques used were incorporation of organic matter (cow manure) into the soil, covering the soil with jute sacks soaked in water, shading the soil with palm branches and combinations of these three.

Analysis of the results showed that the combination of incorporation of cow manure into the soil and covering the soil with water soaked jute bags improved germination of carrot seed. This combination also resulted in a higher yield than the control treatment.

**Project Title:** *Carrot variety trial*

One trial was conducted at Kuru Kururu on coarse sand and another at Mon Repos Field # 37 on Sandy clay loam soil. The five varieties used were Royal Cross, Tera Cotta, Amazonia, Talena and Natarse Amelioree. The trial at Mon Repos was grown under organic conditions while that at Kuru Kururu was grown with inorganic fertilizer and pesticide use.

Generally, yields were lower at Mon Repos than at Kuru Kururu. This could be attributed to poor germination which resulted in low plant density at Mon Repos. At both sites, the highest yield came from the variety Teracotta which yielded 5.3t/ha at Kuru Kururu and 4.6t/ha at Mon Repos.

### **(iii) PEANUT**

**Project Title:** *Evaluation of peanut varieties at Kairuni*

Four varieties of peanut were evaluated at Kairuni, Soesdyke/Linden Highway. The varieties were Florunner, GN 9482, Basantie and AK 62 (control).

Basantie was the only variety that recorded a higher yield than AK 62. The yield of Basantie was 4.7t/ha while that of AK 62 was 3.5t/ha.

Disease incidence was recorded on a scale of 0 to 9. For the variety AK 62 disease incidence was 5 while for Basantie it was 3. The two other varieties in the study recorded zero disease incidence.

## **2. ANALYSIS OF FARMING SYSTEM**

**Project Title:** *Cost of cultivation and production of pineapple in Guyana 2003*

### **COST OF CULTIVATION AND PRODUCTION**

Cost of cultivation (measured in terms of dollars per unit of land) and cost of production (measured in terms of dollars per unit of output produce) of a commodity provide valuable information on the relative profitability of a commodity and hence form an essential component of extension efforts aimed at motivating and convincing producers to adopt cultivation of a particular crop and therefore induce diversification. An assessment of the cost of cultivation and production is also useful for price policy interventions in the interest of domestic producers, determining competitiveness of specific crops, examining production efficiency and for management of international trade in the highly complex post-functioning of state trading enterprises and trade disputes.

A farmers' survey to obtain data for estimating the cost of cultivation/production of fruits and vegetables in Guyana is in progress. For pineapple, cost of cultivation (dollars per acre and per hectare) and the cost of production (dollars per tonne and per kg) were computed for the Canals Polder area in Region 3.

ITEM	UNIT	RANGE
Cost of cultivation (Cost C3)	Per acre (000 \$)	245.30 – 626.13
	Per ha (000 \$)	605.89 – 1546.54
Net returns	Per acre (000 \$)	657.17 – 847.20
	Per ha (000 \$)	1623.22 – 2092.58
Cost of Production	Per lb (\$)	6.78 – 11.98
	Per kg (\$)	14.92 – 26.35
	Per tonne (\$)	14916.10 – 26353.26

### 3. MARKETING INFORMATION SYSTEM

**Project Title:** *Economic Analysis of prices of non-traditional commodities in Guyana, 2003*

An analysis of wholesale and retail prices of non-traditional commodities for Georgetown for the period 1981 to 2000 was conducted. Compound annual growth rates (CARG) were computed for wholesale and retail prices separately for the period 1981 to 1989 (Period I) and 1990 to 2000 (Period II) to show how prices have moved during these two periods. For these two periods, coefficients of variation (CV) were also computed to determine the extent of intra-year fluctuations in prices. The results showed that for almost all commodities the CARG and the CV, both wholesale and retail prices, were lower during Period II as compared to Period I which indicates a tendency towards stabilization in prices and lower fluctuations between years. The table below shows the range of CARG and CV for different categories of non-traditional crops.

Commodity Group	Prices	CARG (5)		CV %	
		1981 - 1989	1990 - 2000	1981 - 1989	1990 - 2000
Vegetables	Retail	18.75-39.72	7.94-19.40	26.61-74.15	12.74-26.87
	Wholesale	14.67-31.84	8.59-21.33	15.88-63.78	15.63-27.55
Fruits	Retail	23.82-35.34	6.95-20.72	24.65-82.02	10.92-28.82
	Wholesale	20.34-30.92	9.41-22.86	21.26-67.40	12.93-28.13
Provisions	Retail	14.91-26.13	15.23-17.10	21.09-69.23	10.01-25.28
	Wholesale	11.92-25.60	12.99-14.22	23.06-68.35	12.13-30.33
Spices and Seasonings	Retail	18.62-27.51	10.66-17.73	28.62-53.64	14.14-38.34
	Wholesale	18.65-26.56	2.67-21.68	27.96-59.65	13.69-28.72
Coconut	Retail	31.77	15.11	29.88	6.94
	Wholesale	26.47	13.47	35.77	12.20
Blackeye	Retail	21.02*	7.45	39.12	13.79
	Wholesale	28.19*	5.13	39.17	13.26

\*Data on blackeye pertains to the period 1982 – 1989

#### 4. ORGANIC AGRICULTURE

In organic agriculture, emphasis was on cocoa, pineapple and compost making.

##### A. Cocoa

###### (i) Demonstration Plot

One hectare sized cocoa demonstration plots were maintained at Hosororo in Region 1. These demonstration plots were developed to demonstrate the practices involved in organic cocoa production with special emphasis on land preparation, field establishment and soil management.

###### (ii) Cocoa plant production and distribution

- 11,000 + Plant successfully budded;
- 7,000 + plants distributed to farmers (in excess of 30);
- 11,000 + new seedlings sown in December, 2003

## **B. Pineapple**

### **(i) Organic certification**

NARI assisted AMCAR to obtain a Certificate of Conformity for EU Third Country Organic Products from the certifying body ECOCERT SA for an estimated 40t of canned pineapple under article 5.3 of regulations EEC 209291. The Certificate # 323GY0300zle was issued on May 28, 2003 and is valid for 15 months expiring on August 27, 2004. NARI is the recognised agency responsible for the internal control system for organic certification of pineapple in Guyana.

### **(ii) Demonstration plot**

The 0.4 ha organic pineapple demonstration plot at Mainstay (new sand pit area) was maintained through periodic weeding, mulching and liquid manuring. Data were collected on soil chemical properties, nutrient analysis of pineapple D-leaf, mulch, forest litter, weeds and cassava plant parts and pineapple plant height. These data will be analysed at the end of the first pineapple harvest in July 2004 when harvest data will be added to the current data set. Pineapple flowering is expected in Feb-Mar 2004 and fruit harvest in Jun-Jul 2004. Intercrops of cowpea (Minica #4) and bitter cassava planted along with pineapple in December 2002 were harvested during 2003. The harvests were handed over to the farmers of the Mainstay community. The only pest problem observed, a multi-coloured sucking bug, was treated with Neem-X, an organic insecticide obtained and provided by NARI as part of its ongoing support to farmers. A new Knap-Sac sprayer to apply the insecticide was loaned to the farming community by NARI.

### **(iii) Visit of President Jagdeo and Minister Sawh**

On the 31<sup>st</sup> October 2003, President B. Jagdeo and Minister S. Sawh visited the demonstration plot on the way to the official ceremony to open the pineapple processing facility at Mainstay Lake. The President, along with other speakers (Canadian High Commissioner, Director of AMCAR) praised the alliance among NARI, AMCAR and the farmers, which led to the realization of production, certification and launching of organic pineapple. The President expressed the hope that the partnership will continue and that an organic pineapple industry will emerge as a result of the alliance. He also indicated that the pilot project, selected varieties and technologies generated through NARI's research should drive and guide the development of the industry.

**(C) Assessment of local raw materials for composting:**

Composting is a way by which waste materials can be converted to useful by-products. The objective of this study was to determine which composition of materials gave the best compost. Nine bins were set up using cow, sheep and duck manure, composted with grass, Minica #4 and water lettuce over a five-month period. Results indicated that treatments 1 (duck manure & grass) and 8 (cow manure & water lettuce) had an ideal pH of 7 whilst the other treatments had a pH of 6-8 at the end of the composting period. The C:P ratio was lower than expected and ranged from 22:0 in the first month to 80:6 in the fifth month. The C:P ratio increased as the composting time increased. The C:N ratios ranged from 10-12.5 for treatments 2 (duck manure & water lettuce), 3 (duck manure & minica) and 6 (cow manure & minica). The other treatments were below 10% at the end of the composting period. Based on the results of the study, cow manure and Minica #4 are recommended as materials suitable for composting.

**4. INFORMATION, COMMUNICATION AND SUPPORT SERVICES**

**(i) Library and Documentation Centre**

**Objective:** To supply timely, and current information service to researchers and others in the agricultural sector.

**Processing of Materials**

- ❑ Cataloguing of backlog material continued
- ❑ WINISIS system continued to be updated
- ❑ Re-checking of entries in the NARIL database continued with 313 being completed.
- ❑ A proposal of circulation policies and procedures was completed
- ❑ Books received totaled 49
- ❑ Journals and institutional publications received totaled 602
- ❑ FAO documents received totaled 66

## **Reference & Information Dissemination**

- ❑ Persons made use of the CD-ROMS and the Internet for bibliographic searches
- ❑ Book titles were done throughout the year and distributed to the relevant personnel

## **Sharing of resources with Agricultural Information Services/Systems**

- ❑ Free publications from sister institutions were received from FAO, CTA, ICRISAT, IIMI, and AVRDC.
- ❑ Ms. Karen Kowlessar of IAST received an updated version of the items in the NARIL database for uploading to the INSAT website.
- ❑ NARI 2002 Annual reports were distributed to the relevant libraries

### **(ii) Communications**

During 2003 the unit was actively involved in video recording, newspaper article production, school tours, photography, booklet and leaflet layout production and exhibitions.

### **Exhibitions:**

The unit meaningfully participated in the following national activities:

- Caribbean Agricultural and Industrial Exhibition and Fair
- Launching of Agriculture Month 2003
- World Food day
- Guyana Nite
- Essequibo Nite
- Linden Nite

### **School tours:**

Three hundred and eleven students and 28 accompanying teachers from Regions 3, 4, 5, and 6 visited NARI's facilities in 2003. Of the nine schools accommodated eight were CXC and SBA classes while one visit was from the Le Premiere Academy, a nursery school in Georgetown.

The main areas of interest continue to be crop protection and budding and grafting even though four of the schools requested visits to the Livestock farm.

### **(iii) Information Technology**

The following tasks were accomplished by the Information Technology Unit for the year 2003:

- a) Routine maintenance of computers and peripherals.
- b) Maintenance of NARI's website.
- c) Converting ten of 120 of the Soil Reports of the Soil Survey Department from Microsoft Word to Adobe PageMaker 6.5.
- d) Creation of the First Edition of the "Compilation of Soil Reports" CD.

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

1. Four IBM Think Centres with Pentium 4 including four IBM 15" monitors. These were distributed to the following departments:
  - Accounts
  - Administrative Manager
  - Agronomy
  - Post Harvest
2. Four Hp Deskjet 3600 printers. These were distributed to the following departments:
  - Agronomy
  - Biotechnology, Plant Protection and Plant Genetic Resources
  - Post Harvest
  - PRCSSP
3. One Benq LCD 15" monitor. This was given to the Director.
4. Four APC 500 UPS. These were distributed to the following departments:
  - Agronomy
  - Dr. Mathur
  - Post Harvest
  - Office of the Director.
5. One APC 750 UPS. This was kept by the I. T. Unit

6. Two Iomega 250mb Zip drives. One was given to the Horticulture Department and the other kept by the I. T. Unit.

#### **(iv) Soils Laboratory**

During 2003, the Chemistry Laboratory provided analytical services to farmers, N.A.R.I. researchers, Guyana Geology and Mines Commission (G.G.M.C.), University of Guyana Students and Guyana Rice Development Board (G.R.D.B.).

#### **Sample Status**

One thousand and six samples were received in 2003. Of these, 861 were soil samples. Researchers brought 354 samples, 235 were from various agencies and 272 from farmers. However, from this lot only 310 soil samples were completely analysed and six analyses done on the other 551 soil samples.

One hundred thirty-five plant tissue samples were received and analysed in 2003. These samples were from researchers of N.A.R.I. and other agencies. The determinations done were nitrogen (N), and phosphorus (P).

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

## **6. INTERMEDIATE SAVANNAHS**

### **Ebini Operations**

#### **Germplasm**

A germplasm plot is being maintained. Included in the collection are nine mung bean, four peanut, one pigeon pea, one soybean, three sorghum, one maize, fourteen cowpea and four rice accessions. On the advice of Dr. Kharb, this plot was cultivated only during the May/June season.

## **Sheep and Goat**

Production continued to be hampered by deaths. Animals died as a result of various infections and attack by wild animals. It must be noted that not even one visit was made to Ebini by a veterinary officer during the year. There is a need for the animals to be checked at least on a quarterly basis to ensure that good health is maintained. Repair of pens also posed a problem because of lack of a power saw to acquire material.

Mineral supply and various animal health products continue to be essential for sheep and goat production in Ebini. At least one ram is still required to facilitate the three groups of animals and prevent in breeding.

Sheep count at the end of the year was eighty-two females (an increase of sixteen from the previous year) two rams (same as the previous year), 22 weaner males (increase of 17 over the previous year) and seven lambs. There were 26 deaths during the year, of which 21 were lambs.

Goats have increased from 12 in 2002 to a total of 23 in 2003. The count stands at one ram, six adult females, six weaner females, five weaner rams and five kids (three males and two females).

## **Orchard crops**

Orchard crops continued to be maintained. Among those being maintained were rough lemon, guava, West Indian cherry, dwarf cashew and dwarf golden apple. Some passion fruit and a small amount of dried sorrel were delivered to the Accounts Department for sale.

Pineapple plants produced only a few small fruits. They are in need of fertilizer. During the year another two thousand suckers were planted. There continued to be problem of individuals removing dwarf golden apple plants from the nursery area. A concerted effort is being made to end this problem.

Maintenance of this orchard requires continuous brush cutting and circle weeding of trees and it is thought that a motorized weeder can greatly assist in the maintenance of this orchard especially since the labour pool is getting smaller.

It is expected that citrus seedlings with rough lemon root stock, passion fruit; dwarf cashew and guava seedlings can be made available during the next year to farmers in the river community.

### **Seed/grain production**

Production of Cowpea (Minica 4, California 5), sorghum and maize were the major focus. There is, however, a need to have the inputs adequately supplied at the critical times.

During the year sorghum and maize suffered as a result of not having fertilizer available when it was required, however, we were able to harvest enough sorghum to have seeds for the May/June, 2004 season and grains available to feed sheep and goats. The same can be said for maize. Approximately five hectares of maize and three hectares of sorghum were planted during the May/June season 2003, but yields were poor as a result of lateness of fertilizer compounded by a weed problem.

Minica 4 and California 5 production was somewhat affected by weeds and as a result production was moved to other plots.

Approximately 350 kg of California 5 grains were made available for sale at the Trade Fair. Approximately 360 kg of Minica #4, 45 kg of pigeon pea and approximately 520 kg of various cowpea accessions were also delivered to the Accounts Department for sale. Twenty kilograms of Basanti and 35 kg of AK62 peanut were also delivered to the Farm Manager for drying then to the trade fair.

#### **A) Aerial Photo-Interpretation**

The study above was conducted by Mr. Harold Ramdin. A summary of his findings is given below:

The four discrete savannah land areas under study, were the Wiruni, Tacama/Ituni, Kibilibiri/Eberoabo left bank Berbice River, and Ebini/Kimbria/Torani, right bank Berbice River. The four savannah land areas are located within coordinates 57° 30' to 58° 15' west longitude and

5°00 to 5°45' north latitude. These four savannah land areas form part of the "Intermediate Savannahs" areas, which are located in the north-eastern part of Guyana.

Government has placed much importance on the development of the Intermediate Savannahs. It is offering incentives e.g duty free concessions on essential machinery to prospective investors and land leases up to fifty years are granted. The present savannah land areas are open lands, that is, they consist of natural xeromorphic grasses and stunted vegetative shrubs, which would permit easy, and in-expensive land clearing and field preparation. The areas consist of moderately well to well drained soils which would reduce the needs for artificial drainage. The topography of the area is undulating and could accommodate minimum tillage and large-scale cultivation for orchard crops and pasture grasses. Soil conservation measures must, however, become an integral part for all farming operations.

The interpreter used the process of aerial photo-interpretation to determine the location and to estimate the acreages of savannah lands in the four savannahs listed in paragraph one. Aerial photographs of the area were flown and produced by the Royal Air Force (RAF) in 1950 and 1952, scale 1:60,000; and by Terra Surveys, a Canadian Guyana Mapping Company (CGM) in 1967 and 1970, scale 1:40,000. Basemap sheets, scale 1:50,000, were produced by the Directorate of Overseas Surveys for the Lands and Surveys Commission. Some of the photographs were of poor quality.

A reconnaissance, and then a systematic study of several ground features, in the aerial photographs, were undertaken. Some objects were identified by their shape, size and pattern, tone or hue, texture, shadows and their associations. Variations in tone were major contributions in this interpretation. The tonal differences depended on the amount of light that is reflected by the object. The amount of light reflected depends on the nature and surface of the object, angle of reflection, and angle of exposure to the sun. Some other elements, which took prominence in the interpretative process, were shape, contrast and sharpness.

The mechanism employed to execute this programme, was an interpretation of the related physical elements observed in the aerial photographs. **Firstly**, a reconnaissance was undertaken to recognize and identify the major geomorphic features, **secondly**, a closer and systematic examination was

made of the differentiating features of various elements and their patterns, and **thirdly**, to craft a legend, which had to be adjusted and re-adjusted, until a complete adjustment was acceptable. Tonal variations of images, in the aerial photographs, were used intensively. The three main separations in the above exercise are the savannah lands, woodlands, forested areas and drainage systems. It became essential to separate the savannah lands having different growth density of shrubs e.g thin density, medium density and thick density. This knowledge, would sensitize the developer, in the process of land preparation and land development, to the kinds of machinery to be used.

The table below gives an abbreviated summary of acreages of brown sand and other vegetation in the four areas.

Areas	Total Acreages	Brown Sands sqv. Lands			Other Vegetation acres
		Acres	Hectares	Sq. Mls.	
(i) Wiruni	71639	29639	11995	46	42000
(ii) Tacama/Ituni	272665	76692	31037	120	176091
(iii) Kibilibiri/Eberoabo	175970	51996	21030	81	124004
(iv) Ebini/Kimbia/Torani	183539	51533	20855	80	111898
<b>Total</b>	703813	209860	84929	328	453993

Total acreages for I, II, III, IV savannahs land areas = 703818 acres, 28429 ha, 1099 sq. mls; of brown sand = 209830 acres, 84917 ha, 328 sq. mls; of white sands = 19882 acres, 8046 ha, 31 sq. mls; of forests, and woodlands = 453992 acres, 183728 ha, 709 sq. mls.

The soils of the Intermediate Savannahs land areas are vulnerable to erosion. Their positions in the soils-cape, their textural and structural characteristics and the climatic conditions over them all play important roles to enhance erosion. The systems of land preparation, development and management would be different from those in the coastal areas and therefore would require modified management systems to suit the environment.

There is enormous potential for agricultural development in the Intermediate Savannahs, but the technology is intricate. The area occurs in undulating/rolling topography with slopes ranging from 3 to 15-17 %. There are numerous gully systems which form a vast network in the entire savannah landscape. The area has few large creeks/rivers with fast flowing good quality water. Subsurface water is not too deep and has desirable qualities for irrigation and livestock.

The savannah lands occur on sloping topography and consist of excessively drained, well and moderately well drained soils having desirable texture but weak structural characteristics. The soils, generally speaking, are sands over loamy sands, loamy sands over sandy loam, sandy loam over sandy clay loam and sandy clay loam over sandy clay. They are low in organic matter, low in cation exchange capacity and low in water holding capacity. They are also very strongly acid and low in plant nutrients. They occur in an ecosystem where rainfall occurs as “flash floods”. Erosion would occur, firstly as sheet erosion, then followed by rill erosion, and eventually lead to gully erosion. Soil conservation measures must be compulsory in all farming systems. Systems to maintain organic matter in the soils are also important. The soils are well and moderately well suited for orchard crops (all citrus) annuals as black eye peas, red beans, peanuts, pasture grasses and beef cattle. A high level of management would be required and must include uncompromising conservation measures in all field operations.

## **B) Visit By Japan Overseas Plantation Centre for Pulpwood (JOPP)**

NARI and the Guyana Forestry Commission facilitated a visit by a six member team from JOPP during November 2<sup>nd</sup> to November 8<sup>th</sup>, 2003.

JOPP was interested in making substantial investments in developing industrial plantations in the savannahs to provide raw materials for pulp and paper production.

Visits were made to several locations in the savannahs. Soil samples together with the relevant literature were supplied to the team. A response is currently being awaited.

### **C. Technical Support and Provision of Planting Material:**

NARI continues to provide technical support and planting material to investors in the Savannahs. In excess of 30,000 fruit plants were made available. This has resulted in increased orchard acreages in the savannahs. Further, the Paulownia plot established by Georgia Caribbean was also maintained.

### **7. SEED TECHNOLOGY**

**Project :** *Cowpea Germplasm Evaluation Trial*

(O. Homenauth, R. Kharb and L. Jagbir)

**Results :** The eleven accessions of 'blackeyed' cowpea received from California (USA) were evaluated at the NARI, Mon Repos research farm during September – November, 2003 for different qualitative and quantitative characteristics. Each genotype was replicated twice and accommodated in a three row (60cm apart) plot.

A substantial amount of variability was found among genotypes for both the qualitative and quantitative characters. The morphological characters like leaflet size; pigmentation on stem, pedicel and unripe pod; mature pod and seed size and colour were found most distinguishable which can be useful in varietal identification and seed certification. Among quantitative characters maximum variation was observed for seed yield followed by number of pods per plant and minimum for maturity and seed dimensions. The characters pods/plant, seed length and test weight were found significantly and positively correlated with seed yield. These characters can be useful in selection of genotypes/plants with high seed yield potential.

On the basis of mean values of quantitative characters, three genotypes (NC-1, NC-3, NC-4) were found promising. The genotype NC-2, though a poor yielder due to poor germination and plant stand was found promising for many other desirable characters. All these promising genotypes will be evaluated in a replicated seed yield trial in the next season.

**Project :** *A Survey on Vegetable Seed Marketing in Guyana.*

(R. Kharb and O. Homenauth)

**Results:** The agro-climatic conditions in Guyana are suitable for cultivation of a wide range of vegetable crops. Vegetables are of considerable importance both for domestic markets and exports. During the triennium 1999 – 2001, an average 302.3 tonnes of fresh produce of about one dozen vegetables were exported. This quantity accounted for 9.3 per cent of the total export of the non-traditional agricultural commodities. Propagation of vegetables is done mostly by seeds. The seed is a basic and crucial input governing the production of vegetables. Vegetable growers either use their own saved seed or mostly depend on outside agencies for meeting their requirements. Therefore, a survey was conducted with the objective of determining the kinds/varieties of seed available in the market and the prices being paid for these. The data on wholesale prices were collected from the seed dealers of Georgetown and Parika.

The seeds of more than seventy varieties/hybrids of about thirty vegetable crops are presently marketed by different seed dealers and their agents. Large variations were observed in market seed prices influenced by several factors mainly due to variety/ hybrid, package size, container type, dealers, seed producing company (brand name) and their combinations. For example, the market prices of tomato variety ‘Calypso’ ranged between G\$21000 – 30000 per kg whereas the prices for tomato hybrid ‘Challenger’ ranged from G\$180,000 to 240,000 per kg. Similarly in case of boulanger, the seed prices ranged for ‘Black Beauty’ variety (G\$10,000 – 18,000 per kg) and for ‘Epic’ hybrid seed (G\$176,000 – 184,800 per kg). The hybrid seed costs 10-12 times more than the seed of any open-pollinated variety of a particular crop. So, one should initially decide and select a suitable variety or hybrid for cultivation, based on what the market demands are.

As the quantity of seed in a packet/container increased, the prices were proportionately lowered, in some crops considerably. Thus, a substantial amount can be saved by purchasing heavier seed packages. Likewise, farmers can spend 20-50 per cent less money on purchase of heavier seed packets for most of the crops. The packaging material of the container also affects seed prices to some extent. The prices of 100g seed packet of cucumber variety ‘Chipper’ varied from G\$700(BON), G\$975(NM), G\$1000(SIM) to G\$1100(PS) due to brand name of seed producing company. The prices of 100g seed packet of watermelon variety ‘Charleston Gray’ were almost

doubled (G\$865BON; G\$1650SIM). This point should also be considered while purchasing seed of particular variety. The hybrid seeds of some crops were sold by number of seeds, not by weight, which would also increase the cost-price of the seed material.

Considerable differences were observed in the market prices of seeds at the level of dealers/sub-dealers/agents. From dealer to dealer, the prices of 20g seed packet of boulangier varieties 'Black Beauty' and 'Long Purple' ranged between G\$200-325 (50-60% higher) and G\$260-525 (50-100% higher), respectively. Even in case of 100g seed packet, the variation in prices was 39-63 per cent. Similarly, variations in prices were also found in other crops. So, in the presence of such a large variation in the seed prices of each crop at dealers' level, the seed should be bought after thorough enquiring and comparing the market prices for that particular crop variety. The hybrid seeds of some crops were also sold by number of seeds and not by weight. This practice would increase the cost-price of the seed material.

Presence of large number of varieties/hybrids (mostly untested and recommended), large variations in market seed prices and unawareness of farmers to use of quality seed of improved varieties makes it a difficult task to procure good quality seed of the choice variety at reasonable prices. Hence some points were suggested to assist farmers in procuring good quality seed of a genuine variety at comparatively cheaper rates. The majority of vegetable seeds are imported in the country. There should be proper records of import of seed or any propagating material and these must be imported with permission or license from the government. Otherwise, it may cause problems in coming years in the agricultural sector of the country. Thus, there is urgent need to develop seed rules and regulations.

## 8. TRAINING

The major training activities conducted in 2003 are shown below:

No.	Date	Training Course	Location	Target
1.	March 5-7	Development of the Peanut Industry in the Rupununi	Lethem, Region 9	Peanut farmers in Region 9
2.	May 02	Growing of Carrots	Kuru Kururu, Region 4	Farmers of Kuru Kururu & Laluni
3.	May 13	Principles & Practices of Organic Agriculture	Mainstay/Whyaka, Region 2	Pineapple farmers
4.	June 10-13, 2003	Introductory Soil – basic principles of Soil Management	Mon Repos	Staff of GGMC & NARI
5.	June 23-27	Pest Management Training Course	Mon Repos	Extension agents, agricultural field technicians and educators
6.	Sept. 5	Refreshner and advanced training in organic cocoa production.	Hosororo, Region 1	Cocoa farmers of Region 1
7.	Oct. 15	Organic Pineapple products	Mainstay/Whyaka, Region 2	Pineapple farmers
8.	Oct. 28-29	Improved fruit and vegetable production	Linden, Region 10	Farmers of Region 10

## 9. SPECIAL PROJECTS

### (A) Management of Soursop wasp, *Bephrata maculicollis*

Evolution of several strategies for the management of the soursop wasp, *Bephrata maculicollis* was conducted by Dr. L.Munroe at Mr. Damion Da Silva's farm at Parika. The justification for and the status of this project are summarized below. Further work will be initiated in 2004.

**Justification:**

Annoa fruits, especially soursop, are attacked by the soursop wasp, which bores into fruits and later enters the seeds. Fruits eventually become riddled with holes and secondary infestation occurs causing them to rot. The problem is acute under an intensive production system, thus making commercial production of the crop extremely difficult. Chemical pesticides are not effective in controlling the pest, protecting fruits against attack therefore seems to be the best approach in tackling the problem. A combination of such methods, used in an integrated manner is proposed. Such a strategy should ensure the marketability of fruits without compromising consumers' health.

**Status:**

Of the three methods proposed isolating individual fruits with paper bags, spraying fruits with neem solution and pheromone traps, only the first one was applied. This fruit trial ran from August to November 2003, and was intended to acquire some baseline information, which was not garnered from the literature review.

The data gathered from the study showed that isolation with paper bags did improve marketability of fruits.

Fruits selected for isolation were based on size, 5-7 cm long, the absence of visible holes, and insects and other blemishes on the surfaces: their ages were unknown.

One hundred and twenty five fruits and 15 flowers were isolated; no flower developed into fruit. Holes caused by the wasps were seen in 8.8% of fruits, and 12 %, although not having holes, were heavily infested with the pink mealybug. Rotting fruits amounted to 3.2% of the total, while only 0.8% of the fruits failed to develop after isolation.

The skin of isolated fruits was paler green and softer in texture than those not isolated.

Bags had to be replaced at least once during fruit development; all became undone at the pasted seams. Some were damage due either to branches brushing against them when they were wet, or birds alighting on or picking them also when they were wet.

The pasted seal of bags therefore needed to be reinforced with tape during the life of the project.

Among the various elements of the project which need refining are:

- a) The best age at which to isolate fruits, and
- b) The age at which it is safe to remove bags so that colour could be improved and the skin toughened up.

### **(B) Revegetation of a mined out site in Linden**

A collaborative research project between NARI and GGMC was initiated with the objective of revegetating approximately six hectares of mined out areas, in Linden, with plant species that have economic importance.

A cadastral survey was done in the project area. Seven contour lines, approximately 30 meters apart, were demarcated in an area of approximately 4 ha. Limestone in the form of low grade rock phosphate was applied in a 1-meter swath along the contour lines. Vetivier grass was planted along the contour lines and on two of the gullies.

The pasture was planted with *B. humidicola* (obtained from Moblissa). Limes and Paulownia were also planted. These are currently being evaluated.

### **(C) Poor Rural Community Support Services Project (PRCSSP)**

A summary of the results of the completed projects undertaken with the PRCSSP is given below.

#### **1. Varietal evaluation of seven varieties of sweet corn**

A number of sweet corn varieties were recently introduced in to Guyana. There is need to identify varieties which are high yielding, adapted to local environment and resistant to major pests and diseases. Trials were initiated to identify varieties with the above characteristics. The varieties evaluated were Breeder's choice, Silver Queen, Early Sunglow, Honey and Cream, Java, Golden Bentham and F1 Hybrid. The highest yielding varieties were Golden Bentham and Java, which yielded 20.9 and 18.5 t/ha, respectively.

**2. Yield response of Sweet Corn to four levels of nitrogen fertilizer on Pegasse soil, Region 3**

A trial was conducted to determine the yield response of two varieties of sweet corn (F1 Hybrid and Golden Bentham) to four levels of nitrogen. The varieties were identified from previous studies conducted. The experiment was a 2X4 factorial conducted according to a complete randomized block design with three replicates at two farm sites. Urea was used as the source of nitrogen at 0, 50, 100 and 150 kg N/ha. Results indicated that there were significant differences ( $P=0.05$ ) in yields. A nitrogen rate 150 kg/ha achieved the highest agronomic yield of 25.4 t/ha.

**3. Response of Cauliflower to five levels of nitrogen fertilizer on Pegasse soil, Region 3**

Cauliflower is a new crop type that has been recently introduced into Guyana from previous evaluations, it has shown good adaptability to the local environment and resistance to pest and diseases. The variety recommended for use is Maya. This trial investigated the effect of five levels of nitrogen on the yield of the variety Maya. The five treatments were arranged according to randomized complete block design. The nitrogen levels were 0, 80, 160, 240 and 320 kg/ha. The results indicated that there were significant differences ( $P=0.05$ ) among the treatments. However, no significant differences were observed between the two higher levels of nitrogen, which had yields of 9.20 and 9.38 t/ha respectively. The recommended rate for maximum agronomic yield is 240 kg/ha.

**4. Varietal evaluation of eight varieties of cabbage.**

Evaluation of cabbage varieties was done to select suitable varieties for large-scale production in Guyana. These varieties must be resistant to major pest and diseases and suitable for local conditions. Trials were conducted on eight varieties of cabbage namely Rustica, Salvation (local), Sahel, Tropica Cross, Tete Noire, Copenhagen, Santa and Alta. The highest yielding varieties were Sahel, Rustica and Tropica Cross with yields of 21.4, 19.4 and 16.3 t/ha, respectively. The highest yield from the local variety was 17.9 t/ha.

## 5. Demonstration on the use of inoculum with Minica IV

Inoculum is a soil enhancer, which contains bacteria that are used to fix atmospheric nitrogen into the soil. It is produced locally, however, it is not widely used. It works best with leguminous crops thus reducing the amount of nitrogen fertilizer required by plants. Trials were conducted on two farms for demonstration purposes. Seeds were treated with inoculum and others with no inoculum. Results indicated that yields were higher for seeds treated with inoculum (19.2 and 41.4 t/ha respectively).

## 2. AGRONOMY DEPARTMENT

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

**Project Officers:** Mr. E. Ralph  
Ms. G. Parris<sup>1</sup>  
Mr. C. Kissoonchand  
Ms. A. Peters  
Mr. R. Seepaul<sup>2</sup>

**Project Technicians:** Ms. R. Cato  
Ms. C. Cort  
Ms. K. Benjamin<sup>3</sup>

### INTRODUCTION:

When the National Agricultural Research Institute was reorganized in 2003, the Agronomy Department was charged with research and development of the following:

- ✓ Root and Tuber Crops - cassava, sweet potato, yam, eddo and plantain
- ✓ Vegetables ochro, bora, boulangier, tomato, pepper, vine crops and leafy vegetables

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<sup>1</sup> Transferred to Post Harvest and Agroprocessing Department, NARI, 2003, October 08

<sup>2</sup> Joined the Agronomy Department, 2003, October 01

<sup>3</sup> Resigned from NARI, 2003, July 21

- ✓ Grain Legumes - cowpea, peanut, soybean and pigeon pea
- ✓ Development of management systems

During 2003, the department worked in all four areas.

The commodities dealt with were sweet potato, tomato, sweet pepper, brounager, cabbage, bora, ochro, cauliflower and broccoli. Activities were related to crop improvement, crop management, seed production and information dissemination.

## 1. CROP IMPROVEMENT

**Project Title:** *Influence of soil type and fertility on plant growth and yield of nine sweet potato varieties.*

This trial was planted on a farmer's plot at Parika/Salem, in November 2002 and harvested in March 2003. The varieties were Dilip Singh, Muntaz Pink Skin, Muntaz White Skin, Conway Purple Stem, Kuru Kuru, Terry, Tapato, Orlando and Carmichael White potato. Yields were generally low because of problems with drainage but the cultivar Terry appeared the most adaptable to the conditions giving the highest yield of 3.3 t/ha.

**Project Title:** *Varietal evaluation of new varieties of tomato.*

The purpose of this study was to identify varieties of tomato with high yield, good horticultural characteristics and resistance/tolerance to the main pests and diseases in Guyana. Eight varieties from the USA and Technisem Seed Company were compared to the recently introduced Alafua Winner. The varieties were Caracoli, Calinago, Tima, Tropimech, F<sub>1</sub> Sumo, Rio Grande, Burpee's hybrid and Better boy.

Calinago produced a higher yield (63.5 t/ha) than the control Alafua Winner (48.3 t/ha). The two other promising varieties identified were Tropimech with a yield of 40.5 t/ha and Burpee's hybrid with a yield of 40.2 t/ha. Burpee's hybrid produced large fruit (70g), Tropimech medium fruit (50.4g) and Calinago and Alafua Winner small fruit of 27.4 g and 30.3 g respectively.

**Project Title:** *Sweet pepper evaluation*

Five cultivars of sweet pepper obtained from Technisem were transplanted 42 days after sowing. These cultivars were Capela, Stella, F<sub>1</sub>Nobili, Yolo Wonder with California Wonder as the local check; a very small number of seeds of the cv Stella was provided.

Cv Stella provided the highest yield of fresh fruit at 4,126 kg/ha; F<sub>1</sub>Nobili produced 3,301 kg/ha; Capella 2,698 kg/ha; Yolo Wonder with 2,125 kg/ha and California Wonder the lowest yield with 1,959 kg/ha. F<sub>1</sub>Nobili however, had the highest fruit weight of 43.9 g; California Wonder 39g; Stella 35g; Yolo Wonder 30.7g and Capella 29.1g. Generally, high yields were associated with higher number of fruits per plant. Mean plant height ranged from 34.6 cm (Yolo Wonder) to 59.4 cm (Stella).

**Project Title:** *Evaluation of introduced varieties of ochro*

The objective was to identify improved ochro varieties with high yield and good horticultural characteristics.

Five varieties were compared with the newly introduced Clemson Spineless and Santa Cruz.

The varieties were Indiana, Volta, Mexicana, North and South Hybrid and Red Velvet. Yields of Indiana (18.2 t/ha), Mexicana (16.3 t/ha) and North and South Hybrid (13 t/ha) were higher than those of Clemson Spineless (10 t/ha) and Santa Cruz (9.6 t/ha). Indiana also produced the greatest number of fruits.

**Project Title:** *Evaluation of Cauliflower varieties*

Evaluation of the varieties Farmer's Extra Early, Maya, New Snow and Snow Flower were completed. Farmer's Extra Early, New Snow and Snow Flower all attained 50 % head initiation and first harvest within 50 days after transplanting (DAT). Maya was a later maturing variety with 50% of plants forming heads at 70 DAT.

Farmer's Extra Early produced the smallest curds and the lowest yields; Snow Flower and New Snow produced the largest heads yielding 4.9 t/ha and 2.7 t/ha respectively. Maya produced a poor marketable yield of 0.7 t/ha. Much of the crop showed visible signs of phosphate deficiency and it is possible that the low yields were a consequence of low phosphate mobility in the soil.

**Project Title:** *Evaluation of Broccoli Varieties*

Nine varieties of broccoli were established and all varieties except Italian Green and Titleist produced heads. Early Value produced heads the earliest with Green King and Green King No 2 producing heads the latest. Green King No 2 and Early Value produced the largest heads giving yields of 1.7 t/ha respectively. Distinct differences in the quality of heads were observed among varieties.

After the main head had been harvested, many varieties produced side shoots. Early Value produced by far the largest number of side shoots per head, and this yield (2.0 t/ha) made a significant addition to that produced by the main head. Other varieties only produced a small yield of side shoots.

## **2. TECHNOLOGY DEVELOPMENT**

**Project Title:** *Factors affecting germination of carrot on coarse sand.*

This trial was conducted at Kuru Kururu. Three techniques were evaluated to improve germination of carrot. These were: incorporation of cow manure into the soil, covering the soil with jute bags soaked in water and shading the soil with palm branches. Measurements of soil temperature indicated that addition of cow manure or shading the soil with palm branches lowered the

temperature by 1<sup>0</sup>C while covering the plots with jute sacks lowered the temperature by 2<sup>0</sup>C. A combination of all three methods lowered soil temperature by 4<sup>0</sup>C. Incorporating cow manure in the soil resulted in more rapid germination than either of the other treatments but had no effect on the final number of plants germinating.

**Project Title:** *Identification of Gemini Virus in tomato*

It has been observed, over the past three years, that a virus has been adversely affecting tomato from the transplanting stage to the flowering stage. Yield reduction has been estimated to be more than 30%.

The ELISA test was used to determine whether Gemini virus was present in tomato plants collected from different areas of Guyana's coastland. The test found that the virus was present in the plant stems, leaves, flowers, seeds of fresh fruits and stored seed. No infection was identified in the juice of the tomato.

A management strategy needs to be developed to control the spread of the virus.

**Project Title:** *Influence of plant density on yield of a new tomato variety - Alafua Winner*

This trial was conducted to determine the plant spacing that would give maximum yield. The data showed that there was no significant difference between the control and any other treatment. Since a lower plant density gave a similar yield to the control, the use of this plant density would result in lower production cost.

**Project Title:** *Determination of the most appropriate potting mixture and soil treatment for seed germination, seedling growth and fungal growth.*

Seven potting mixtures and six soil treatments were evaluated. The data indicated that best results were obtained from the potting mixture with the composition of four parts compost, two parts cattle manure, one part soil and one part sand. The most suitable soil treatment was when the potting mixture was treated with the fungicide Banrot one week prior to sowing of seed.

**Project Title:** *The effect of nitrogen fertilizer on yield of cabbage*

Four levels of nitrogen fertilizer were used on cabbage to determine the appropriate level that would maximize yield on Onverwagt clay soil. The results showed that the nitrogen level of 120 kg/ha was the most suitable level for cabbage production on Onverwagt clay.

**Project Title:** *The effect of potassium fertilizer on the yield of cabbage*

Four levels of potassium fertilizer were evaluated. The yield when potassium was applied was significantly higher than yield when no potassium was applied. There was, however, no significant difference between the yield at 80 kg/ha potassium and the yield at either of the higher levels.

*Project Title: The influence of organic and inorganic nitrogen fertilizer on yield of cauliflower.*

One level of inorganic nitrogen fertilizer and three organic fertilizers were compared with a control (no fertilizer). The yield from the use of the inorganic fertilizer was higher than that of the control and each of the organic fertilizers. It was observed, however, that the organic fertilizers produced fruit of better quality (longer shelf life and better cooking quality).

**Project Title:** *Sheltered Cultivation*

Cauliflower seedlings (variety Farmers Extra Early) were transplanted four - five weeks after sowing into seedbeds. There was some incidence of apparent black rot. Flowering commenced 40 days after transplanting (dat). One hundred and fifty-five heads (75%) weighing 20.4 kg were harvested; 17 heads (8%) were stolen over one weekend. Mean weight of heads was 131g while the largest head weighed 258g. There was a one-day flood of the crop that prompted the premature harvest of 70 heads; subsequent harvests were made which gave the apparent indication that the period of flood did not greatly affect production.

Broccoli was also cultivated under the shelter but complete harvesting was not achieved mainly because of heavy “stem borer” infestation and wilting symptoms. First harvest occurred 58 dat with

the crop being terminated 14 days after the first harvest. Twenty-four heads were harvested weighing 1594g; the mean head weight was 66g.

### **3. SEED PRODUCTION**

Seed was produced of selected vegetables to ensure that quality seed of locally adapted varieties reach farmers. The department produced 2,760g ochro, 16.7 kg bora, 202g tomato and 1.7 kg boulanger seed.

### **4. INFORMATION DISSEMINATION**

Fact sheets were prepared for tomato, boulanger, cabbage, ochro, sweet potato and pepper.

Production manuals were prepared for tomato, sweet potato and chives.

### **TRIALS IN PROGRESS AT THE END OF 2003**

1. Evaluation of boulanger varieties.
2. Varietal observation of cowpea varieties.

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

**Head of Department:** Dr. Patrick Chesney

**Project Officers:** Mr. Cleveland Paul  
Ms. Kaye McAllister  
Mr. Evan Willabus  
Ms. Charissa Wilson \*

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\* Joined staff on 1<sup>st</sup> October 2003.

**Project Technicians:** Mr. Ramphal Mohabir  
Ms. Amanda Connell-Chester  
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Ms. Loyce Ifill  
Ms. Sharon Nicholson  
Ms. Natalie Miller-Bressette  
Ms. Noellie Moses

**Non-technical Staff:** Ms. Sheila Kellman  
Ms. Sarjudai Singh  
Ms. Lorraine Gordon  
Ms. Lovern 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, characterise, evaluate, multiply and document selected crop germplasm, and
2. to generate information for improved management of crop pests and diseases.

During 2003, research projects were conducted in the areas of biotechnology, plant genetic resources and crop protection.

### **1. BIOTECHNOLOGY (Plant Tissue Culture Laboratory)**

**Project Title:** Ex-situ characterisation, conservation, and multiplication of selected crop germplasm

#### **Objectives:**

1. to make available to researchers and for sale farmers 2500 disease-free plantain and pineapple plants each;
2. to maintain in *in-vitro* storage, four important food crops for crop improvement and for safety duplication.

## **Micropropagation**

In 2003, some 8,434 plantain var. Creole and pineapple var. Montserrat plants were micropropagated exceeding the target set and in the process marking the highest annual plant production since 1992, when some 16,341 plants were produced. Then, sweet potato, cassava, plantain and pineapple were micropropagated. Multiplication of sweet potato and cassava was discontinued in 1995. In 2003, about twice as many plantain than pineapple plants were produced owing to a higher demand for the former. Demand for plants in 2003 was not met. All plants produced were weaned from cultures initiated in 2002. Explants were initiated in 2003.

The absence of plantain var. Creole and pineapple var. Montserrat germplasm collections at NARI necessitated collection of explants from farmers' fields at Salem, East Bank Essequibo. This area is considered to be relatively free of pineapple and plantain diseases of quarantine importance. Pineapple mother plants were selected using strict selection criteria. During logistical problems, mother plants of plantain were not selected to strict criteria; the source farmer provided material based on descriptions provided. All explants were subjected to health tests at NARI before excision of growing point for *in-vitro* initiation. These cultures will yield plants for sale in 2004.

Given the internal quarantine restriction on the movement of *Musa* spp. as well as an increase in market opportunities for plantain in the Caribbean region, an increase in the demand for micropropagated plantain in 2004 is anticipated. In 2003, there were requests for large numbers of both plantain and pineapple plants for supply immediately on demand or within one month. To meet an increasing demand for micropropagated plants the Laboratory is working towards:

- ❑ an immediate improvement in the reliability of supply of controlled atmosphere in the culture rooms and,
- ❑ a new supply of all chemicals used in formulation of media and plant nutrient solution.

## ***In vitro* conservation**

A total of 19 accessions of germplasm of cassava, sweet potato, yam and pineapple was conserved *in vitro* on reduced growth media which were refined in 2002 to provide storage for a period of six months. A list of all accessions maintained in the *in-vitro* collection is presented in Table 1. These accessions are maintained for the commodity improvement research programmes of NARI.

Changes to the 2002 list of accessions during 2003 include losses of four cassava accessions, two sweet potato accessions (John Thomas Dundee, Wild Potato), one yam accession (Bell); transfer to multiplication media of one sweet potato accession (Vanilla) and addition of two cassava accessions (3 months, Uncle Mac) to the collection.

**Table 1. Accessions held in the in-vitro active genebank, Mon Repos, 2003.**

CROP	ACCESSION NAME
Sweet Potato (n=15)	Jamaica #1, Warruni White Stem, Rodrigues, Black Rock, Korean #1, English Potato, Orlando #1, Black potato, Springer, Iarena, Strong man, White Stem, Viola, Maputa, Tapato
Yam (n=2)	Costa Rica, Long Yam
Cassava (n=2)	3 Months, Uncle Mac
Pineapple (n=2)	Montserrat, Perola

In November 2003, four Moko (*Ralstonia solanacearum*) resistant lines of banana *in vitro* cultures were received from the International Network for the Improvement of Banana and Plantain (INIBAP), Belgium for the Department of Agronomy. The Plant Genetic Resources Coordinating Unit (PGR-CU) is the NARI office responsible for receiving and processing all acquired germplasm prior to release to the acquiring party. As part of the process, the following lines of banana were placed on suitable multiplication media after a health test in the Plant Pathology Laboratory.

The lines were:

ITC.0506 FHIA-03

ITC.1418 FHIA-25

ITC.0504 FHIA-01

ITC.1344 CRBP-39

## 2. PLANT GENETIC RESOURCES

**Project Title:** Updating state of plant genetic resources in Guyana

**Objective:**

To update the Guyana country report on the state of PGR for food and agriculture

The Guyana country report was not updated due to the lack of funds. Contrary to the expectations of NARI and the International Plant Genetic Resources Institute (IPGRI), the Food and Agriculture Organisation of the United Nations (FAO) did not provide the funds and relevant training to update the Guyana report. In Guyana, NARI is the focal point for PGR for food and agriculture.

**Project Title:** *Collaborative research agreements: organising the plant genetic resources (PGR) management capabilities*

**Objective:**

To pursue with strategic partners joint plant exploration and management of PGR for food and agriculture in Guyana

Collaborative research agreements drafted between NARI, IPGRI and the United States Department of Agriculture (USDA) in 2001 for joint food plant exploration in the hinterland regions of Guyana, as well as the complementary conservation of cassava germplasm in Region 9 were not finalised. The problem has been identified as the still unresolved issue of access to genetic resources and a benefit sharing agreement that is agreeable to all concerned parties. There is, however, institutional realignment towards an imminent resolution. In the latter half of 2003, the Environmental Protection Agency (EPA) convened a sub-committee under the National Biodiversity Advisory Committee to address the issues of access to genetic resources and benefit sharing. NARI maintained contact with both IPGRI and USDA to keep alive the idea of collaborative research agreements. Guyana stands to benefit tremendously from the implementation of these agreements. Yam and cassava field nurseries were maintained and sweet potato catalogue completed.

**Project Title:** *Institutionalising plant genetic resources management in Guyana*

In 2003, the long awaited Plant Genetic Resources Coordinating Unit (PGR-CU) was created to:

- Manage all NARI's germplasm collections;
- Manage a centralised documentation system (including data analysis);

- Supply raw materials for NARI's other research programmes initially on specific crops such as tomato, pepper, brouillon, bora, sweet potato, yam, cassava, West Indian cherry, avocado, mango, coconut, pineapple and passion fruit.
- Spearhead the establishment of a country-wide system for plant genetic resource management; NARI is the national focal point for PGR management for food and agriculture.

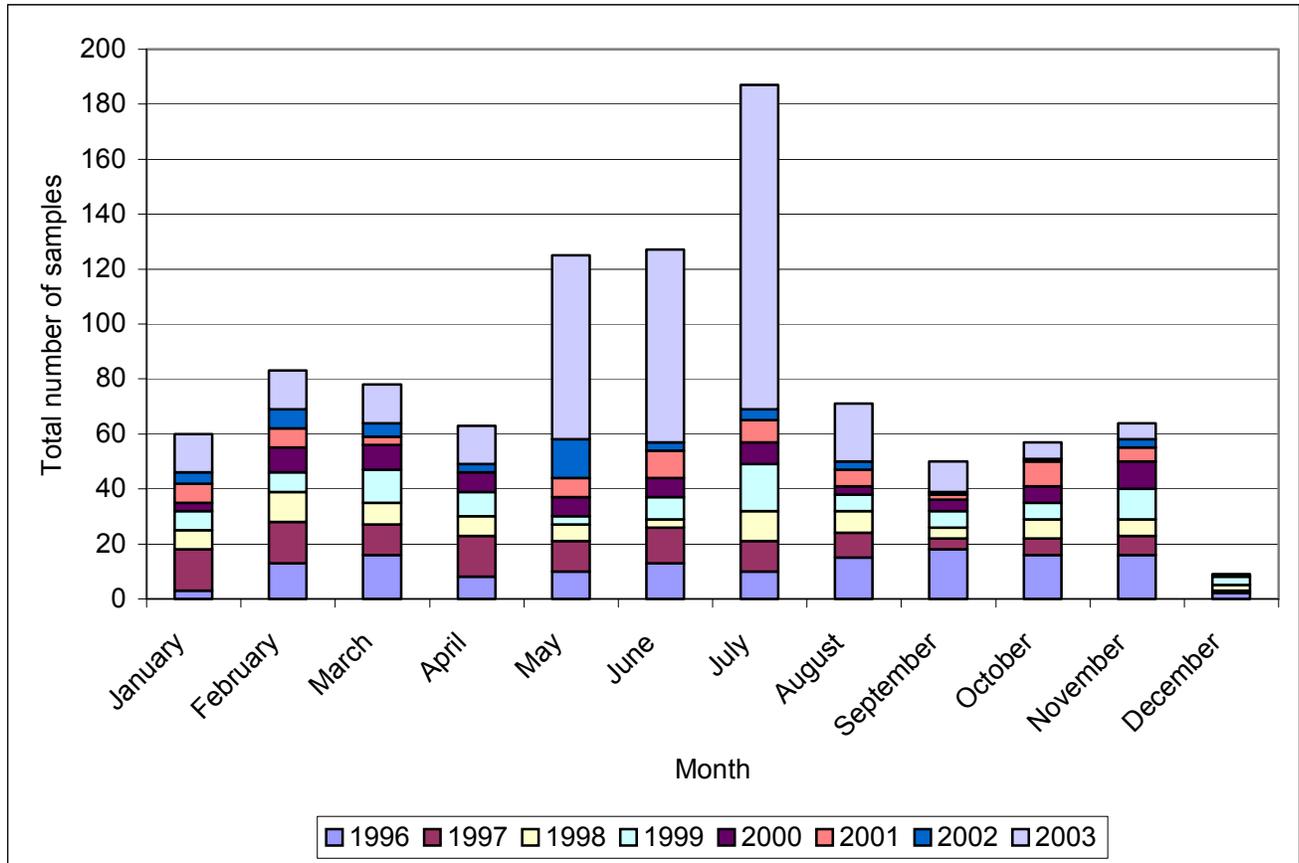
Formation of the PGR-CU fulfils the principal recommendation of the USDA/IPGRI Scientific Mission to Guyana in 2001 to assist in the development of Guyana's capability to manage its PGR for food and agriculture. PGR-CU has started operations and is progressing well. The importance of managing PGR for food and agriculture cannot be over-emphasised. The thrust of the NARI medium-term SRDA establishes a market oriented approach to research. This thrust requires that a systematic crop breeding programme is set up to improve the quality of crops in Guyana given the wide genetic variability present in several crop species in the various growing environments. Such a programme is best placed within a plant genetic resources system to manage germplasm in an integrated way for the particular end use, value added, export oriented production.

### **3. CROP PROTECTION**

**Project Title:** *Information for improved management of crop pests and diseases*

#### **Insect pest, disease and weed reference services**

The Crop Protection Service processed about 500 plant disease samples submitted by or on behalf of mostly non-traditional crop farmers; some rice disease specimens were also processed. Most of the samples originated from farms on the Coastal Plains. The most demanding period for processing of disease samples in 2003 was May-July, which coincides with the main rainy and cropping season in Guyana (Figure 1).



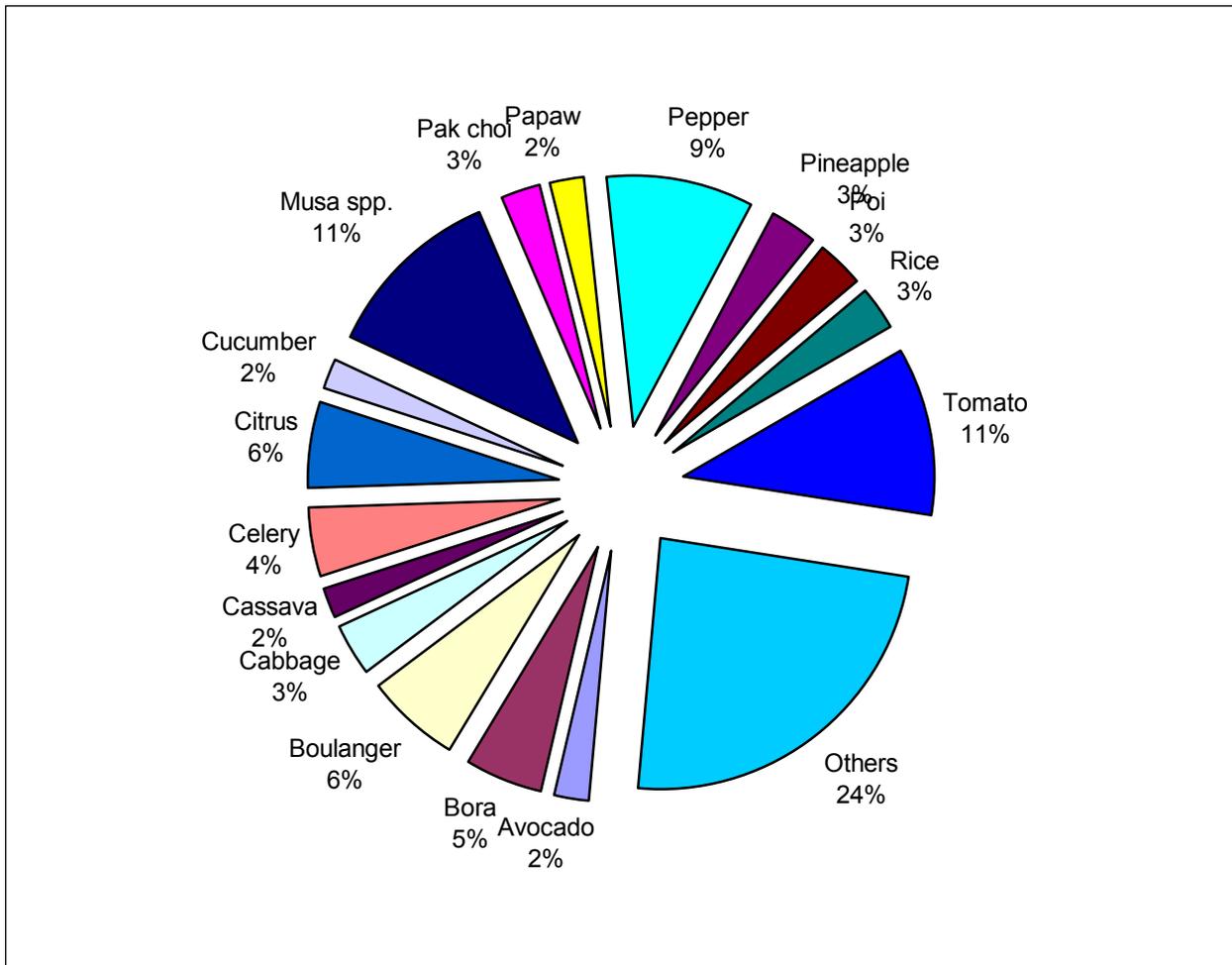
**Figure 1.** Distribution of plant disease samples submitted to NARI Plant Pathology Laboratory for the period 1996-2003

The least number of samples was processed in December. Omitting data for 2003, which showed heightened laboratory activity, and for the month of December, a relatively steady number of samples was processed monthly. Analysis of data for the period 1996-2003 revealed that 42 different diseases/pathogens were identified from 55 crop plant disease specimens (Table 2).

**Table 2.** Organisms isolated from crop plant disease specimens submitted to NARI Plant Pathology Laboratory in 2003.

<b>Disease</b>	<b>Pathogen</b>	<b>Crops mostly affected</b>
Alternaria leaf spot	<i>Alternaria</i> spp.	Tomato
Anthraxnose	<i>Colletotrichum</i> spp.	Pepper, bora
Ashy stem blight	<i>Macrophomina</i> spp.	Bora
Aspergillus blight	<i>Aspergillus</i> spp.	Peanut
Bacterial wilt	<i>Rolstonia solanacearum</i>	Tomato
Black rot	<i>Xanthomonas campestris</i>	Cabbage
Blossom end rot	Physiological disease	Tomato
Brown eye spot	<i>Cercospora</i> spp.	Rice
Cercospora leaf spot	<i>Cercospora</i> spp.	Celery
Collar rot	<i>Sclerotium rolfsii</i>	Pepper
Curvularia leaf spot	<i>Curvularia</i> spp.	Rice, celery
Dry root rot	<i>Macrophomina phaseolina</i>	Peanut
Early blight	<i>Alternaria solani</i>	Toamto
Fruit rot	<i>Phomopsis vexans</i>	Boulangier, tomato
Fusarium wilt	<i>Fusarium</i> spp.	Pepper, boulangier, tomato
Greasy spot	<i>Mycospharella horri</i>	Citrus
Heart rot	<i>Erwinia</i> spp.	Cabbage, pak choi
Helminthosporium leaf spot	<i>Helminthosporium</i> spp.	Rice
Internal brown spot		Pineapple
Moko disease	<i>Rolstonia solanacearum</i>	Plantain, banana
Mosaic virus	Virus	Bora
Nigrospora leaf spot	<i>Nigrospora</i> spp.	
Phytophthora rot	<i>Phytophthora</i> spp.	Boulangier
Powdery mildew	<i>Leveillula taurica</i>	Bora
Red spot virus	Virus	Poi
Root knot disease	Root knot nematodes	Most vegetable crops
Rust	<i>Erysiphe polygoni</i>	Bora
Scab	<i>Elsinoe fawcetti</i>	Citrus
Seedling damping off	<i>Phythium</i> spp.	Most vegetable crops
Sigatoka leaf spot	<i>Mycospharella musicola</i>	Plantain, banana
Soft rot	<i>Erwinia carotovora</i>	Cabbage, pak choi
Sooty mould	<i>Capnodium</i> spp.	Boulangier, mango, citrus
Southern blight	<i>Sclerotium rolfsii</i>	Pepper
Target spot	<i>Corenespora cassicola</i>	Bora
Viral infection	Viruses	Bora, pepper
	<i>Pestalodeopsis</i>	Pineapple
Rhizopus rot	<i>Rhizopus</i> spp.	Boulangier, pepper, tomato
	<i>Penicillium</i> spp.	
Postharvest rot	<i>Botryodiplodia theobromae</i>	Cassava
	<i>Phoma</i> spp.	Pumpkin
Choanophora rot	<i>Choanophora</i> spp.	Squash, pumpkin
Verticillium wilt	<i>Verticillium</i> spp.	

There were 31 fungal pathogens, six bacterial pathogens, three viral cases, one nematode and one physiological case. Sixteen crops accounted for more than 75% of the samples processed over the period; 39 crops accounted for the other 25%. The more commonly occurring crop plant disease samples came from tomato, pepper, *Musa* spp., citrus, boulangier and bora which together accounted for approximately 50% of the crop samples processed (Figure 2).



**Figure 2.** Distribution of crop types analysed for diseases at NARI Plant Pathology Laboratory.

A small number of insect pests (fruit fly, pink mealy bug) and weeds was processed for identification (data not presented). The insect pest, disease and weed reference service, offered free of cost, is an important service to farmers and researchers as it assists in the formulation of appropriate management strategies for effective pest management. This service was assisted with the compiling of species lists of weeds (50 families), insects (6 orders; 1111 species) and fungi in the NARI collections.

### **Pest management field guide**

A manuscript on identification and management of common insect pests, diseases and weeds of Solanaceous crops in Guyana was prepared. As seen from data presented above, tomato, pepper and boudin, members of the plant family Solanaceae, ranked high on the list of crop plants processed for diseases. As such, this manual, when completed, will serve as an important reference guide to farmers, researchers and extension agents.

### **Pest management training**

Early in the year, the Crop Protection Service trained two research staff from the Guyana Rice Development Board (GRDB) in general laboratory techniques for plant disease diagnosis. With this training, the GRDB acquired the capability to monitor pest problems affecting rice, an important agricultural commodity of Guyana. The 3% of samples processed by the NARI Plant Pathology Laboratory will now be handled by GRDB once they can operationalise their own plant protection service.

The Crop Protection Service trained 20 Technicians in modern pest management techniques as part of its ongoing programme to provide quality training to pest management practitioners. For the first time at NARI, the course manual was packaged in CD ROM format for distribution to participants and for sale to the general public. Pest management practitioners trained by NARI service were drawn from the entire farming community in Guyana including the traditional (rice, sugar) and non-traditional (other crops) sub-sectors.

## **4. PLANT TISSUE CULTURE & CROP PROTECTION**

**Project Title:** *Integrated Pest Management (IPM)*

### **Integrated Pest Management (IPM)**

Just over 3000 packets of bait for the control of the Acoushi ants (leaf cutting ants) were produced. To date, more than 50% have been sold mainly to the hinterland farming communities where the Acoushi ant is the major threat to food security.

The national organic production drive received a boost with the commencement of research on plants with biopesticidal properties that could be used for the control of pest problems in organic farming. Some 14 native plant species were established in field and laboratory. Laboratory testing scheduled to commence during the second half of 2003 did not materialise and will now be carried out in 2004. The results of this research will offer safe alternatives to chemical pest control and also, extend the scope of organic farming in Guyana.

### **Literature Cited**

George, E.F. (1996) Plant Propagation by Tissue Culture. Part 2. In Practice. Exergetics Ltd., Great Britain.

## **4. HORTICULTURE DEPARTMENT**

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

#### **ABSTRACTS OF COMPLETED RESEARCH PROJECTS**

#### **Yield response of mature West Indian Cherry (*Malpighia puniceifolia*) grown on heavy clay soils to various levels of NPK fertilizers**

Pratima Doodnauth<sup>1</sup> and V. Ho-a-Shu<sup>2</sup>

This trial was conducted to determine the optimal levels of NPK fertilizers that would result in increases in yield and quality of cherry juice from cherry grown on the clay soils of Guyana. Three levels of Nitrogen (0, 37 and 75 kg/ha) and Potassium (0, 75 and 150 kg/ha) and two levels of Phosphate fertilizer (0 and 75 kg/ha) were incorporated into the soil twice annually, just prior to the rainy season. Urea was used as the source of N, Muriate of Potash as the source of K and Triple

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<sup>1</sup> Research Assistant, Hort., NARI

<sup>2</sup> Head, Horticulture, NAI

Super Phosphate (TSP) as the source of P. Yield data, Brix, pH, and Total Titratable Acids were the parameters measured. Based on yield data, the best treatment contained 37 kg/ha N and 75 kg/ha K producing a total yield of 4.5 tons/ha/annum, followed by the treatment, which contained 75 kg/ha of both N and P and 150 kg/ha K that produced a total yield of 3.8 tons/ha/annum. The third best treatment contained 37 kg/ha N and 150 kg/ha K, which gave a yield equivalent to 3.7 tons/ha/annum. Further, fertilizer had no effect on the Brix, pH and TTA.

### **Breaking Dormancy in Golden Apple Seeds (*Spondias cytherea*. Sonn)**

Sabrina Singh<sup>3</sup>, Karan Singh<sup>1</sup> and V. Ho-a-Shu<sup>2</sup>

Observations showed that Golden Apple seeds took a long time to germinate often resulting in the seeds rotting before germination. An experiment was thus conducted to determine whether dormancy breaking treatments of mechanical scarification, dry heat, hot water, gibberellic acid with and without scarification, and leaching could effectively break dormancy of dwarf and regular Golden Apple seeds. Observations on the germination of seedlings in each treatment were made every two days and continued for 85 days after treatment. Of all the treatments, the dry heat treatment was successful in breaking dormancy in the dwarf the golden apple seeds resulting in enhanced germination of seed. None of the treatments appeared to have any effect on the regular golden apple seeds suggesting that there is no dormancy in the regular golden apple seeds.

### **Evaluation of Organic Plant Extracts to Control Anthracnose in *Carica papaya***

Elizabeth Bhola<sup>3</sup>, Karan Singh<sup>1</sup> and V. Ho-a-Shu

Extracts of Eucalyptus (*Eucalyptus camaldulensis*), Tulsie (*Ocimum cacumlin*), Vetiver (*Vetiveria zizanioides*) and Sijan (*Moringa oleifera*) were compared with the synthetic fungicide, Mertect for their fungicidal activity against *Colletotrichum gloeosporioides* on papaya fruits. Five parameters were used to evaluate the effectiveness of these plant extracts: percentage of infection, number of infected sites, rate of infection, brix and shelf life. Results showed that all plant extracts exhibited

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<sup>3</sup> Final Year Student U.G.

<sup>1</sup> Research Assistant, Horticulture, NARI

varying levels of control of papaya anthracnose. Mertect, Sijan and Eucalyptus were not significantly different in their ability to control the percentage of infection, number of infected sites, rate of infection and shelf life. These treatments were the most effective in controlling papaya anthracnose. It was also found that Vetiver and Tulsie were not significantly different in their ability to control papaya anthracnose. However, these extracts were not as effective as Eucalyptus and Sijan. Fruits treated with Mertect, Sijan and Eucalyptus resulted in longer shelf life, however fruits treated with Eucalyptus resulted in a lower brix. Based on these results it was found that Sijan and Eucalyptus are good alternatives to the synthetic fungicide, Mertect.

### **The testing of imported hybrid and local varieties of papaya (*Carica papaya*) for resistance to Papaya Ring Spot Virus (PRSV-P)**

Nishal Ramnarine<sup>3</sup>, K. Singh and V. Ho-a-Shu

Papaya Ring Spot Virus (PRSV-P) is the most important disease of papaya (*Carica papaya*) worldwide. It is a micro parasite that is transmitted by an insect vector from host to host. PRSV-P was never recognised in Guyana until the introduction of hybrid varieties of papaya around 1998 and the first PRSV-P outbreak was subsequently observed in 2002. As a consequence of the susceptibility of these hybrid varieties, focus is now being placed on local varieties with resistance/tolerance to the PRSV-P. In this experiment local and hybrid varieties of papaya were inoculated with PRSV-P and later tested for the presence of the virus using Double Antibody Sandwich Enzyme Linked Immunosorbent Assay (DAS ELISA). It was found that all the varieties tested, with the exception of one local variety from the Charity area, were infected with the virus.

## **2. ONGOING PROJECTS**

**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.*

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<sup>3</sup> Final Year Student, U.G

## **Status**

This is an ongoing project and maintenance of both local and foreign varieties (mainly from Brazil) continued in plots located at Benab, Fort Wellington, Kairuni, Mon Repos and Timehri. New selections were added as they became available. Towards the end of 2003 preparations were made for the planting of some Rambutan selections at Mon Repos.

For the first time in Guyana, the introduced CTV tolerant, Cleopatra Mandarin rootstock plants, bore fruit at Timehri. The other introduced CTV tolerant Volkameriana rootstock plants, that started fruiting in 2000, continued to fruit at Kairuni, Mon Repos and Timehri.

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

## **Status**

This project is ongoing and required the following steps:

**a) The introduction of suitable CTV resistant/tolerant rootstock material.**

With the exception of Rough Lemon and some Rangpur Lime, Guyana possessed no other CTV resistant rootstock material. Commencing in 1998 therefore, the introduction of suitable CTV resistant rootstock material comprising Carrizo Citrange, Cleopatra Mandarin, Swingle Citrumelo and Volkameriana Lemon was achieved by the importation of certified seed from Trinidad, then California, USA and finally from the Agricultural Research Council in South Africa in 2000 and 2001.

**b) The introduction of suitable CTV Free Budwood material.**

Commencing in 1998, this was achieved by the importation of certified budwood of known commercial varieties from Trinidad, then California, USA. The importation of budwood ceased in 1999.

**c) The establishment of “mother plants” of CTV resistant/tolerant rootstock at various locations.**

This is necessary to provide a local source of CTV resistant rootstock seed material, avoiding future importation. The establishment of these seedlings commenced in 1998/99 and continued into 2002, primarily at Mon Repos, Timehri and Kairuni.

The Volkameriana Lemon commenced fruiting at Timehri in 2000, while fruiting at Mon Repos and Kairuni commenced in 2002. Also fruiting of the Cleopatra Mandarin commenced at Timehri during 2002.

**d) The budding of CTV Free Budwood on suitable Rootstock material.**

This commenced in 1998 with the originally imported budwood material and then continued over the years with material generated from the original introductions.

**e) The preservation of Selected Budded CTV Free Plants in Screened Houses.**

Avoiding continuous importation of CTV free budwood, requires the establishment of a local source of CTV free mother plants which could be used to establish and/or re-supply plants as they become infected in the multiplication blocks.

However, Tristeza disease is transmitted by several species of aphids present in Guyana. Consequently, to assist in keeping plants CTV free for as long a time as possible, it is necessary to protect the plants from aphid attack by growing them in a suitable facility screened to exclude insects.

Appropriate CTV free plants were therefore selected as “mother plants” in 1998 and kept in a temporary screened facility in the plant nursery area until 2001 when the surviving 20 mother plants were transferred to the new screen house facility.

These plants have now outgrown this facility and to keep these plants for a longer period a field screen facility is necessary. In this type of facility, contemplated for 2004, the screen is constructed in the field permitting the plants to grow in the field instead of in large pots.

**f) The establishment of selected budded CTV free plants in “multiplication blocks”.**

To provide CTV free budwood material, it is necessary to establish a high density planting of CTV free material as far as possible in isolated blocks, normally referred to as “multiplication blocks”.

Establishment of multiplication blocks commenced at Mon Repos and Timehri in 1998/99 and is ongoing. To date, some 500 and another 100 plants were established at Mon Repos and Timehri respectively. Regrettably, the plants at Mon Repos are not progressing as anticipated with the plants displaying disappointingly slow growth and high mortality. Several more of these plants were lost at Mon Repos with the floods in late December.

Furthermore, these multiplication blocks are now heavily infected with Tristeza and are to be replanted when new sites are identified.

**g) Routine serological testing of plants in the screen house and multiplication blocks for CTV.**

This is a procedure called DTBIA<sup>4</sup> requiring special antibody chemicals and was not set up at NARI requiring samples for testing to be sent abroad, mainly Trinidad. After a somewhat lengthy consultation and review, the correct antibody for the DTBIA was sourced and the DTBIA procedure was successfully conducted at NARI during the year. By the use of duplicate samples, the results were verified by analysis in Trinidad.

**h) Production of CTV free budded plants on resistant rootstocks to establish germplasm orchards.**

This started in 1999 with the establishment of germplasm plots at Mon Repos, Timehri and Kairuni and is ongoing with the supplying of appropriate plants as they become available.

**i) Production of CTV Free budded plants on resistant rootstocks for general use.**

Only a limited amount was achieved as the emphasis was on the establishment of the germplasm blocks at Mon Repos and Kairuni.

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<sup>4</sup> Direct Tissue Blot Immunoassay

**Project Title:** *The evaluation of baited flytraps for the control of fruit fly (Anastrepha sp.) in guava (Psidium guajava).*

The objectives of this trial were to evaluate the degree of fruit fly control achieved by the use of baited McPhail type flytraps and to monitor and identify the fruit fly population in guava by trapping.

It was conducted at the Kairuni Horticultural Station.

During the period of trapping from September 2002 to September 2003, two species of fruit flies were recorded: *Anastrepha striata* and *Anastrepha serpentin*, with the latter being more predominant than the other. A total of 408 *A. serpentin* flies were trapped compared to 148 of *A. striata*.

The number of flies trapped peaked during the months when fruit were present, however, some flies were still trapped during the months when no fruits were in season. Additionally, rainfall did not appear to have any direct impact on fruiting or the amount of flies trapped.

Over the duration of the experiment, there has been a decrease in the number of flies caught. From the period of September to December 2002, a total of 360 flies was caught as compared to 57 during the period of July to December 2003. During both of these periods the fruiting was at its highest.

The average damage score for the fruits collected during the first month of the exercise was 2.7 and the score for the last month was 1.2. Therefore, there was a reduction in the number of larvae found in the fruits.

In order to assess other means of controlling the guava fruit fly, one plot was sprayed with Neem insecticide whereas the other half was not. The average damage score figures for the fruits in this area were similar to those in other areas where traps were present, as such it appears that either trapping or spraying the ground with an insecticide was equally effective. However, this trial was only conducted on few guava trees and over a limited time frame and needs to be repeated on a much larger scale for a longer period of time, for a more definite recommendation to be made.

Whether baited traps could effectively control the fruit fly in guava remain undetermined and a repeat trial with many more trees over a longer period is recommended.

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

This project, located at Field 30, NARI, Mon Repos commenced late in 2002 and is continuing. Data collected so far showed that after field planting, Julie mango produced the first flush of flowers at eight-nine months, while Spice mango produced flowers at 15-16 months. Indications are that in both mango types, the trees are restricted to two flushes per year, coinciding with production of new leaves and flowers. None of the treatments used seemed to have produced any difference on plant growth so far, but the controls are shorter than all treated plants.

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

This project, located at NARI, Mon Repos, and St. Lawrence and Naamryck, East Bank Essequibo commenced during the year and is continuing using the hybrid papaya varieties Known You, Red Lady, Sunrise, Tainung 1, Tainung 2 as well as a local selection from Charity, Pomeroun

From the data so far collected from the fields, indications are that the highest rate of 248 Kg N/ ha every three months produced the most vigorous plants in all varieties used. The plants of all varieties treated at this rate, flowered earlier, retained more flowers on the plants and produced more fruits per flush when compared with the other treatments.

The plants in the untreated control plots displayed stunted growth, chlorotic appearance and in some cases eventually death. It should also be noted that the local Charity cultivars used produced over 50 per cent male trees.

**Project Title:** *Timing of nitrogen fertilizer application on yield and growth of six varieties of papaya (carica papaya) at two locations.*

This project, located at NARI, Mon Repos, and St. Lawrence, East Bank Essequibo, commenced during the year and is continuing using the hybrid papaya varieties Known You, Red Lady, Sunrise, Tainung 1, Tainung 2 as well as a local selection from Charity, Pomeroun. A rate of 390 kg N/yr/ha is being applied after flowering at two, four, and six weekly intervals.

From the data so far collected from the fields, indications are that none of the varieties showed any difference in growth in response to any of the treatments. The plants in the no treatment control, however, were stunted and chlorotic.

**Project Title:** *Response of three passion fruit (Passiflora sp) cultivars to four levels of nitrogen.*

The aim of this study was to determine the optimal level of nitrogen for the best growth and yield in passion fruit. The trial is located at Hague, West Coast Demerara. It commenced during 2002 and is continuing using the Brazilian Yellow, Local Yellow and Local Pink passion fruit cultivars. From the data collected so far, indications are that flowering is continuous whenever there is steady irrigation. The treatment with the highest rate of 285 kg N/ha/yr, regardless of cultivar, produced more vigorous plants carrying more fruits with the unit weight of these fruits being greater than those from the other treatments. Further indications are that the control treatment showed more flower drop and poor fruit set.

**Project Title:** *Timing of Nitrogen application on yield and growth of two cultivars of passion fruit (Passiflora sp.).*

This project, located at Naamryck, East Coast Essequibo commenced during the year and is continuing using the Brazilian Yellow and Local Yellow passion fruit cultivars. A rate of 190 kg N/yr/ha is being applied after flowering at two, four, and six weekly intervals.

From the data collected so far indications are that all the plants from all the treatments are performing better than the control, but no difference is being shown between treatments.

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

This trial, located at the Kairuni Horticultural Station, commenced late in 2001 and is continuing. From the data collected so far, irrespective of cultivar there is no difference in yield between the pruned and unpruned passion fruit, growing in the sandy soil.

**Project Title:** *Observation of the growth and yield of Montserrat and Smooth Cayenne varieties of Pineapple.*

### **Objectives**

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

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, there is no indication of any difference in growth of the two varieties.

### **OTHER PROJECTS IN PROGRESS DURING 2003**

- (1) Influence of organic and inorganic fertilizer on growth and yield response of three varieties of papaya on pegasse soil.
- (2) Yield potential of three passion fruit cultivars.
- (3) The selection and propagation of two phenotypes of Montserrat variety of pineapple.

## **SECTION B. PRODUCTION**

### **3. PLANT NURSERIES**

**Project Title:** *Plant Nursery Operations*

#### **Objective**

To propagate quality plants at the various plant nurseries.

#### **Achievements**

##### *General*

Routine work continued at all Plant Nurseries. Under the Poor Rural Communities Support Services Programme (PRCSSP), the construction of a new office commenced at the Charity Plant Nursery. At the Pouderoyen Plant Nursery under the same PRCSSP, work also commenced on a new plant and soil shed.

##### *Production:*

Details of the production at the plant nurseries are presented in an overall summary (Table 3).

There was just over 5 % increase in the overall production in 2003 with 171,355 plants as compared to 162,801 in 2002. However, in actual plant sales, there was an increase of over 80% where 91,333 plants were sold this year as compared to 48,827 in 2002. This was attributed to an unprecedented large number of plants being sold to an enterprise in the Intermediate Savannahs.

**Table 3: Plant Nurseries – Plant Production for Years 2002 and 2003**

PLANT NURSERY	PLANT TYPE	2002		2003	
		Total Production	Sales	Stock	Total Production
Bartica	Citrus	3,259	292	1,705	1,997
	Avocado, Mango, Cherry	289	13	262	275
	Other Fruit	73	13	71	84
	<b>TOTAL</b>	<b>3621</b>	<b>318</b>	<b>2,038</b>	<b>2,356</b>
Benab	Citrus	6,419	4,703	4,209	8,912
	Avocado, Mango, Cherry	66	108	494	602
	Other Fruit	1,187	655	356	1,011
	<b>TOTAL</b>	<b>7,672</b>	<b>5,466</b>	<b>5,059</b>	<b>10,525</b>
Charity	Citrus	17,483	10,481	3,549	14,030
	Avocado, Mango, Cherry	1,952	908	679	1,587
	Other Fruit	2,315	2,216	2,582	4,798
	Ornamentals, Others	249	215	130	345
	<b>TOTAL</b>	<b>21,999</b>	<b>13,820</b>	<b>6,940</b>	<b>20,760</b>
Hosororo	Avocado, Mango, Cherry	267		1,372	1,372
	Other Fruit	10		2	2
	Cocoa	14,327		11,430	11,430
	Ornamentals, Others	693		350	350
	<b>TOTAL</b>	<b>15,297</b>		<b>13,154</b>	<b>13,154</b>
Mon Repos	Citrus	27,855	14,888	21,830	36,718
	Avocado, Mango, Cherry	6,545	5,019	5,479	10,498
	Other Fruit	10,872	8,392	4,640	13,032
	Ornamentals, Others	2,936	650	1,451	2,101
	<b>TOTAL</b>	<b>48,208</b>	<b>28,949</b>	<b>33,400</b>	<b>62,349</b>
Pouderoyen	Citrus	13,257	7,516	1,054	8,570
	Avocado, Mango, Cherry	2,910	2,480	1,007	3,487
	Other Fruit	1,294	1,797	1,239	3,036
	Ornamentals, Others	507	432	587	1,019
	Vegetables	410	0	0	0
	<b>TOTAL</b>	<b>18,378</b>	<b>12,225</b>	<b>3,887</b>	<b>16,112</b>
St. Ignatius	Citrus		42	1,687	1,729
	Avocado, Mango, Cherry		3	21	24
	Other Fruit		26	150	176
	<b>TOTAL</b>		<b>71</b>	<b>1,858</b>	<b>1,929</b>
Timehri	Citrus	30,740	20,924	9,804	30,728
	Avocado, Mango, Cherry	3,814	2,469	1,663	4,132
	Other Fruit	11,819	6,649	1,396	8,045
	Ornamentals, Others	1,253	442	823	1,265
	<b>TOTAL</b>	<b>47,626</b>	<b>30,484</b>	<b>13,686</b>	<b>44,170</b>
TOTAL	Citrus	99,013	58,846	43,838	102,684
	Avocado, Mango, Cherry	15,843	11,000	10,977	21,977
	Other Fruit	27,570	19,748	10,436	30,184
	Cocoa	14,327	0	11,430	11,430
	Ornamentals, Others	5,638	1,739	3,341	5,080
	Vegetables	410	0	0	0
	<b>TOTAL</b>	<b>162,391</b>	<b>91,333</b>	<b>80,022</b>	<b>171,355</b>

## **SECTION C. MISCELLANEOUS**

### **4. VISITORS**

#### **4.1. Malaysian Rambutan Expert**

Through the Malaysian Technical Cooperation Programme and facilitated by the Guyana Ministry of Foreign Trade and International Economic Co-operation, Mr. Tan Hoe Hing, Assistant Director from the Fruit Division, Department of Agriculture in Malaysia visited Guyana from July 30 to August 5, 2003 to advise on the development of the Rambutan industry in Guyana.

Mr. Tan Hoe Hing was able to bring with him seeds and scion material of improved varieties recommended for commercial propagation in Malaysia. The seed material was sown at the Mon Repos Plant Nursery to be used as rootstock plants, while the scion material was used by Mr. Tan Hoe Hing in a demonstration of patch budding, commonly used in Malaysia for Rambutan budding. Unfortunately the budding was not successful.

During his stay in Guyana, Mr. Tan Hoe Hing was able to visit some farms growing Rambutan at Hauraruni, Timehri and the Canal No. 1 Polder area. Additionally, to further acquaint himself with local conditions and agricultural commodities, visits were made to NARI's Horticultural Station at Kairuni, the Plant Nurseries at Mon Repos and Timehri, the Sophia Packing House and to the local markets at Bourda and Parika.

Apart from visiting farms and making on site recommendations, Mr. Hing also made two lecture presentations on the growing of Rambutan at the National Agricultural Research Institute (NARI) to potential growers, NARI personnel and other interested parties.

Arising out of this visit, which stimulated much interest by growers, the Institute hopes to obtain, from Malaysia, a supply of planting material of improved varieties.

## 5. LIVESTOCK DEPARTMENT

Head of Department: Mr. R. N. Cumberbatch

Project Officers: Dr. R. Austin  
Mr. J. F. Q. Solomon

Farm Supervisor: Mr. J. Gonsalves

### INTRODUCTION

The Livestock Department was hindered by a number of problems during the reporting year. In addition to the drastic decline in duck production caused mainly by a marked reduction in the number of eggs collected, there was a marked reduction in the availability of pastures as a result of the extended dry conditions experienced during the reporting year. Coupled with the fact that the sheep pastures are overstocked, the dry conditions only served to highlight the extent of the poor management practice currently employed in this programme.

The Livestock Farm activities remained the main focal point of the Livestock department of the National Agricultural Research Institute. In 2003, these activities included duck breeding, duckling production, sheep breeding and forage production. These projects were designed mainly to provide services to the farming community and by so doing provide quality breeding animals. In spite of the numerous problems experienced, the department was able to provide in excess of 12,000 ducklings and 93 breeding rams to the farming community. The department also generated G\$3.4M in revenue during the reporting year.

The forage production programme successfully maintained the forage germplasm collection, which was established and also expanded its collection.

The transfer of technology was another important aspect of the Livestock Department, apart from officers of the Department making farm visits, establishing duck production facilities in Regions 2

and 3 and assisting in improving the management systems of pastures, the Livestock Farm was used as a teaching laboratory by various groups which included both farmers and students.

### **The Duck Unit**

The highlights of the duck programme was the acquisition of 395 (315 females and 80 males) parent stock Peking breed ducklings to augment the department's breeding project. The introduction of the new bloodline would assist the programme in meeting the high demand for ducklings from the farming community. In addition the Department successfully developed two breed types of Muscovy ducks, the NARI SOLO WHITE MUSCOVY and the ROBIN BLUE NARI MUSCOVY. The problem pertaining to low levels of egg production, reported in the highlights of 2002, continued to plague the duck programme, and as a consequence there was a reduction in the number of ducklings sold and a corresponding reduction in revenue.

The importation of the new batch of parent flock ducklings from the United States of America, would ensure that the Department returns to full production in the coming year.

In spite of the limited number of ducklings hatched, however, the Department was able to introduce duck rearing and production to the Amerindian communities of Region 2. The benefits of this outreach programme were as follows:

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

### **Breed Development**

The development of two new strains of Muscovy ducks, THE NARI SOLO WHITE MUSCOVY and the ROBIN BLUE NARI MUSCOVY ensured that the livestock department continued its tradition of ensuring that the farming community is continually provided with improved technology and products from the Institute. A synopsis of the growth characteristics and descriptors of the NARI SOLO WHITE MUSCOVY are as follows.

## **GROWTH CHARACTERISTICS OF NARI SOLO WHITE MUSCOVY**

**ADULT DRAKE** 3.4 kg (112 DAYS)      **YOUNG DRAKE** 2.3 kg (56 DAYS)

**ADULT HEN** 2.1 kg (112 DAYS)      **YOUNG HEN** 1.4 kg (56 DAYS)

### **CARCASS PERCENTAGES:**

**DRAKE** 75.1%

**HEN** 77.0%

### **FEED CONVERSION:**

**DRAKE** 2.3 kg feed/ kg live weight.

**HEN** 2.6 kg feed/ kg live weight.

The duck attains a market weight of 2.3kg for drakes and 1.4 kg for hens at 56 days old on commercial feeds. The important feature of the NARI SOLO WHITE MUSCOVY is the absence of the pin feathers after slaughter hence the appearance of a clean bird that does not require “roasting” to remove the pin feathers prior to cooking.

## **DESCRIPTOR LIST FOR NARI SOLO WHITE MUSCOVY**

### **PHENOTYPIC CHARACTERISTICS (EXTERNAL FEATURES)**

**HEAD:** Medium in females and large in males, face and side of head covered with caruncles.

**NECK:** Medium length and arched.

**PLUMAGE:** Completely white.

**BODY:** Long and broad in males, females of medium length and width.

**CARCASS:** Cream in colour similar to that of the broiler chicken.

**BREAST:** Broad in males and medium in females.

**BILL:** Medium width, cream to pinkish in colour.

**EYES:** Medium size, slightly over-arched socket and brown in colour.

**WINGS:** Fairly long and stout.

**BACK:** Long and broad in males, females medium length and narrow.

**TAIL:** Fairly long in both sexes with stiff plumage.

**LEGS AND FEET:** Lower thighs medium length, stout shanks medium length and small feet, toes straight, connected by web(number of toes or claws 8)

Data are still being tabulated on the growth and other parameters of the ROBIN BLUE NARI MUSCOVY, but from the preliminary investigations of the growth and other parameters, they are as impressive as those of the NARI SOLO WHITE MUSCOVY.

DUCK PRODUCTION PARAMETERS FOR 2003

Table 4 shows monthly egg production. Towards the middle of the latter half of the year, there was a decline in egg production from the breeding flock, resulting not only in a short fall of hatching eggs but also in a short fall in duckling production and revenue.

**Table 4:** *Egg Production at the Livestock Farm. Mon Repos, 2003*

PERIOD	F1			PARENT STOCK			F2		TOTAL
	Pekin	Kunshan	Muscovy	Pekin	Kunshan	Muscovy	Pekin	Kunshan	
16 Dec-15 Jan	3086	226	906		-	38			4256
16 Jan-15 Feb	1570	360	742		-	90			2762
16 Feb-15 Mar	1226	360	634		-	104			2324
16 Mar-15 Apr	1712	425	1175		-	88			3400
16 Apr-15 May	1359	287	1538		-	100			3284
16 May-15 Jun	2091	423	2213		-	155			4882
16 Jun-15 Jul	1857	237	1415		-	102			3611
16 Jul-15 Aug	1439	230	1622		-	91			3382
16 Aug-15 Sep	2096	585	1196		-	125			4002
16 Sep-15 Oct	1634	763	1395		-	84			3876
16 Oct-15 Nov	1047	760	1369	143	-	97			3416
16 Nov-15 Dec	1195	873	1430	1038	-	110			4646
16 Dec-15 Jan	767	538	689	726	-	57			2777
<b>TOTAL</b>	<b>21079</b>	<b>6067</b>	<b>16324</b>	<b>1907</b>	<b>-</b>	<b>1241</b>			<b>46616</b>

Duckling sales generated G\$ 0.9M as compared to G\$2.8 M during the year 2002.

## Sheep Production

The sheep production programme has proven to be a rather successful venture. The unit has a flock of in excess of 300 animals; thereby enabling the programme to satisfy the demands of the farming community for breeding animals. The programme was able to sell 93 breeding rams, for a total of \$1,228,670.

The sheep programme continued to develop low cost rations and utilized poultry (duck) litter in the form of a molasses/energy block, as its principal supplemental feed source for the year. This supplement enabled the weaned flock to average growth rates of in excess of 100g/day. In addition, because of the prolonged dry period experienced during the year the programme introduced the feeding of hay to the flock in order to supplement their roughage requirements.

The production parameters continue to be impressive, for example, the average overall mortality was 15%, the average birth weight of the lambs was 2.7kg, the average weaning weight was 12.1kg at 90 days, the average selling weight of the male rams was 26 kg at six months of age and the lambing percentage was in excess of 150%.

At the beginning of the reporting year there were 284 animals the breakdown of which is reported in Table 5. There were 300 animals at the end of the reporting period. The overall lambing % was 147.

**Table 5: Flock size of sheep at the Livestock Farm, Mon Repos, 2003**

<b>PARAMETERS</b>	<b>OPENING STOCK</b>	<b>CLOSING STOCK</b>
Breeding males	6	6
Breeding females	140	240
Weaned males	31	3
Weaned females	22	23
Male lambs	47	10
Female lambs	38	18
<b>TOTAL</b>	<b>284</b>	<b>300</b>

The highlight of the sheep production programme was the collation of the production parameters generated on the farm during the period 2000-2003. These parameters are compiled in a research document entitled. “The production parameters of the Barbados Blackbelly and Crossbred sheep in a controlled semi-intensive system”.

*A synopsis of the parameters is as follows:*

The sheep used were the Barbados Black Belly and the Crossbred breed of sheep. All data were obtained from the comprehensive record keeping systems, at the farm, from January 2000 to July 2003. The production data obtained were superior to those of previous studies conducted in Guyana and compared favourably to other studies in the Americas and the Caribbean.

The data showed that there were no differences in liveweight gains of the two breed types, when comparisons were made for sex, at different time intervals. The data also indicated that the age of animals giving birth was between one and five years. There were no differences in birth weights among sexes at the different age ranges. No differences were detected, between the two breed types, in relation to the average daily gains at pre and post-weaning stages. The males, however, had higher weight gains than the females at both stages of growth. The percentage single births was significantly higher for the crossbred sheep than for Barbados Black Belly. The Barbados Blackbelly, however, had a significantly higher percentage of twin births. The percentage single births was higher for dams between one and three years old but decreased for dams aged three years to above five years. The frequency of twin births was higher in older dams. The pre-weaning mortality of lambs was higher than post-weaning mortality.

## **FORAGE PRODUCTION**

The forage production programme continued to strive to provide good quality forage for the animals by maintaining improved pastures. Despite the prolonged dry period the project maintained its collection of improved forage species in a germplasm collection on the Livestock Farm. This collection is maintained in order to identify and provide the best forage for the livestock community. It is also hoped that it could provide an alternative to antelope grass which is being deemed a nuisance (weed) particularly by persons responsible for maintenance of drainage and irrigation systems. In addition the forage production project was used as a teaching laboratory for

students of the University of Guyana, the Guyana School of Agriculture and students of Secondary Schools who were preparing for the Caribbean Examination Council Examination.

The forage project also produced both silage and hay to assist in feeding the stock during the dry months of the year.

The Livestock Department was also involved in the development of a management strategy for the grazing of antelope grass. This work was undertaken to assist in the identification of grazing management systems to be employed for the bull fattening study which will be included in the 2004 programme of work.

The study was conducted at the St. Stanislaus College Farm. It first began on 2002, October 03 and samples were taken weekly until 2003, February 03. Then the study recommenced in 2003, June 04 and samples were again taken weekly until 2003, October 29. It was concluded that the forage production, from the pastures on the Farm, is capable of supporting 7 au/ha (annual units/ha) providing that adequate moisture is available to the pastures. It was observed, however, that in order for the farm to continuously support such a high stocking rate, it may be necessary that irrigation be provided during the dry season. Provision of irrigation would ensure an adequate supply of forage during the dry season. Since there is a difficulty in providing irrigation at present, it may be necessary to adjust, downwards, the stocking rate of the farm to ensure an adequate supply of forage throughout the year.

## **TECHNOLOGY TRANSFER**

The transfer of technology is another important aspect of the Livestock Department's work. The methodologies used included the hosting of farmers and students on tours to our facilities, mounting and displaying various aspects of the Department's programme of work at National exhibitions. In addition, the facilities of the Livestock Department were used to train students who were primarily in the Secondary and Tertiary study programmes.

The Department also disseminated information by preparing information products in both print and electronic forms on different aspects of Livestock production. The tools used were fact sheets, scientific, farm journals and newspaper articles and radio and television programmes.

On farm demonstrations were conducted, in Regions 2 and 3, to assist in extending technologies of good livestock husbandry to those farming communities.

The Department also produced a manuscript entitled "Understanding Pastures". This document outlined the three types of pastures found in Guyana. It also provided descriptions (with photographs) of recommended pasture grasses and legumes. Fertilizer requirements, grazing management systems and conservation of forage were also dealt with.

## **5. POST HARVEST AND AGRO-PROCESSING DEPARTMENT**

### **i) Post-harvest fungicidal treatment of fresh cassava tubers**

M.S.A. Faroze and B. Dinanauth

Investigations were conducted on the response to fungicide application (Mertect) on fresh cassava tubers var. Uncle Mac in the control of fungal diseases. Four levels of treatment including rates at 1 ml/l, 2 ml/l, 3 ml/l and a control were used on tubers preceding storage under ambient conditions. Quality characteristics including vascular discoloration, cooking quality, decay conditions, sap exudation and shelf life were assessed during storage. Good results were obtained in the 2ml/litre and 3ml/litre rates of application with tubers storing well up to 18 days. Tubers in the control suffered deterioration after four days as well as a marked reduction in cooking quality. Sap exudation, a consumer indication of freshness of tubers was the highest in tubers treated with 2ml/l and 3ml/l application rates.

**ii) Preparation of fruit juice/drinks blends from Pineapple, Carambola and Passion fruit.**

Imran Khan and Bridgemohan Denanauth

This project was initiated to determine the most favorable fruit juice mixtures that can be used for the production of a fruit juice or drink using brix-acid ratio as a mathematical and objective assessment for the measurement of flavor and taste. For this project, three fruit juices were used which included pineapple, carambola and passion fruit. The fruit juices were mixed in specific combinations and the brix- acid ratio for each was calculated. The mixtures were then diluted and sugar added. The mixtures that received the highest scores in the taste tests were used to identify a range in the brix- acid values that is most appealing to consumers.

The results of the trial indicated that the fruit juice and drink mixtures with a brix-acid ratio within the range 39 - 89 and 159 - 178 respectively, received the best approval ratings in organoleptic tests. Passion fruit/pineapple/carambola received the highest ratings for both juice and drink. Good results were also obtained for passion fruit/pineapple and pineapple/carambola for juice and drink respectively.

**iii) Evaluation of post harvest treatment applications for the control of anthracnose on papaya (*Carica papaya*).**

M.S.A. Faroze and B. Denanauth

Three post harvest treatment applications were administered to papaya (*Carica papaya*) at the color break stage for the control of anthracnose. The treatments included a double hot water application, a cold thiabendazole fungicidal dip and a hot water and fungicide combination dip. Infection on fruits in the control was initiated after four days with the highest severity compared to the fruits from the other treatments. The combined hot water and fungicide dip was the most successful with fruits experiencing a shelf life of 14 days and having the lowest severity. There were no changes in brix and TTA in fruits treated with hot water but a slight increase in brix was observed in untreated fruits and those treated with the cold fungicidal dip during storage. Ripening and good color development seemed to be affected by the hot water treatments compared to the control and cold fungicidal dip.

**iv) The use of Banana fruit as a base for conversion to value added products**

M.S.A. Faroze and B. Denanauth

Local varieties of the banana fruit “apple” and “sweet fig” were assessed for conversion to “banana flour” and “banana raisin” respectively. The apple variety at the mature green stage showed good potential for conversion to flour as a raw material for the eventual production of bakery products such as cakes. The “sweet fig” variety at the ripe, but firm stage displayed excellent characteristics in the manufacture of banana raisins. The banana flour and banana raisins were used in this trial to test their suitability as replacements for wheaten flour and imported raisins respectively in the production of cakes. Organoleptic tests and consumer response indicate strong approval for the products.

**6. SOILS AND WATER MANAGEMENT DEPARTMENT**

**Head of Department:** Mr. M. Livan

**Project Officers:** Mr. D Fredericks  
Mr. S. Rutherford  
Ms. G. Nanku

**Research Technicians:** Mr. S. Paul  
Ms. G. Todd

**Support Staff:** Myrtle Joseph

**1. SOILS AND LAND USE SURVEY**

There were two major activities this year. This included routine computerization of existing data on Soil and land use and the production of User Manual for Arc Info and Arc View.

Achievements this year were constrained by insufficient equipment (computer hardware and software) and manpower.

**Project 1:** Computerizing of soil and land use survey reports

**Objectives:**

- 1) To have easy access to information on soil and land use
- 2) To quickly produce tables and maps of interpreted information.
- 3) To improve the decision-making process

**Outputs:**

Eight-nine Soil and land use survey reports were targeted for completion. All reports were rechecked, formatted and compiled on a compact disc (CD).

Twenty-five CDs with the label “Soil Resource Inventories of Guyana 1<sup>st</sup> Edition 2003. A compilation of Soil and Land Use Survey Reports for Guyana” were produced. This publication was put on sale at NARI during the month of October. These CDs provide easy assess of soil information to users.

**Project 2:** Production of user manual of Arc Info and Arc View

**Objective:**

To have standard procedures for digitizing of maps within the department.

**Outputs:**

ARC Info Manual is 80% completed. This project had been put on hold so as to accommodate a speedy completion of Project 1.

**Project 3:** Soil Survey of the Robert V. McRae Establishment, Pearl

**Objectives:**

- 1) To conduct a soil investigation and identify the different kinds of soils.
- 2) To recommend the most appropriate agricultural land use

**Status:**

Finalisation of the First Draft of this report awaits the analytical results from the Soil Chemistry Division of Guysuco.

**2. SOIL MANAGEMENT**

**Project Title:** *Investigating the use of liquid manure in vegetable production.*

The objective of this study was to determine the quantity and frequency of application of liquid manure for economic yield of brouillon. There were four treatments using liquid fertilizer, solid inorganic fertilizer and combinations of these. There were six harvests. Yield was highest with the combination of liquid manure and inorganic fertilizer at the highest level. Inorganic fertilizer alone gave the second highest yield. The lowest yield was obtained when liquid manure alone was used.

**Project Title:** *Evaluating the efficiency of different strains of Rhizobia on nodulation and nitrogen use by cowpea on clay soil.*

This trial aimed to identify the most effective Rhizobia strains for cowpea production on the coastal clay soils of Guyana. The treatments were four re-juvenated Rhizobia strains which were 612, Tal 420, 624, and 212, the free living strains found in Field 19 of NARI, Mon Repos and Nitrogen at the rate of 50kg/ha. The data indicated that the highest dry matter content was found in plants inoculated with Strain # 624. The plants inoculated with this strain also had the greatest number of pods per plant and the highest yield. The largest number of nodules and the more effective nodules were found in plants inoculated with Strain # 612. The efficacy of these nodules, however, were not translated into total dry matter yield since plants inoculated with this strain were among the lowest in dry matter.

**Project Title:** *The effect of liming on the growth of tomato on a coastal clay soil.*

This study sought to determine the effect of limestone application on the growth and yield of tomato. It also aimed to reduce the incidence of blossom end rot on tomato by increasing the calcium level in the soil. The treatments involved the application of limestone at different rates and times and by different methods. Irrigation was also applied at different times. The limestone was applied in the form of low grade rock phosphate.

The results showed that plants which received limestone at the rates of 4500 kg/ha applied one month before planting and watered thrice weekly had the highest yield. The lowest yield was obtained from plants which received 4500 kg/ha incorporated in the soil one month before planting and watered once per week. The lowest yields were associated with all treatments that involved incorporation of limestone into the soil or application of limestone immediately before planting. Incidences of blossom and rot were also observed in these treatments.

#### **OTHER ACTIVITIES**

1. A proposal for collaboration between GGMC and NARI was presented to the GGMC National Conference on Mining in August, 2003.
2. The Department participated in the Caribbean Week of Agriculture, held at the Sophia Exhibition Centre, from 8<sup>th</sup> to 12<sup>th</sup> October 2003. Displays were mounted on:
  - Drip irrigation
  - Liquid fertilizer
  - Soil survey services provided by NARI
  - Soil and land use reports on compact disc.
3. Mr. M. Livan, Head of Department, was a resource person for Ministry of Fisheries, Crops and Livestock/IICA sponsored training courses on “Good Agricultural Practices” for farmers of Bath, West Coast Berbice and Canal No. 2, West Bank Demerara and Farm Walks at Cotton Field, West Coast Berbice.

## HUMAN RESOURCE REPORT

### 1. RECRUITMENT OF STAFF

#### (a) Administration

- 1) Mr. Haris Umadas - Personnel and Industrial Relations Officer -2003-09-15

#### (b) Senior Technical

- 1) Ms. Rajkumarie Sookraj - Research Assistant - 2003-03-03  
2) Mr. Imran Khan - Research Assistant - 2003-10-01  
3) Ms. Charissa Wilson - Research Assistant - 2003-10-01  
4) Mr. Ramdeo Seepaul - Research Assistant - 2001-10-01  
5) Mr. Kawal Jainarain - Research Assistant - 2003-10-06

#### (c) Clerical and Office Support

- 1) Mr. Wayne Melville - Accounts Clerk 11 -2003-09-15  
2) Ms. Kellisa Fanfair - Accounts Clerk 11 -2003-10-01

#### (d) Semi-Skilled Operatives and Unskilled

- 1) Mr. Glendon Rodrigues - General Worker- 2003-02-10  
2) Mr. Lancelot Hernandez - General Worker- 2003-02-01  
3) Mr. Junior Joseph - General Worker- 2003-03-31  
4) Mr. Paul Ramsaywack - Security Guard- 2003-04-01  
5) Mr. Salim Budhoo - Security Guard- 2003-04-01  
6) Mr. Gangaram Raghbir - Security Guard- 2003-04-01  
7) Mr. Shahendra Singh - Security Guard- 2003-04-01  
8) Mr. Nandesar - Security Guard- 2003-06-01  
9) Mr. Andre Watts - Security Guard- 2003-06-01  
10) Mr. Harry Ram - Security Guard- 2003-06-01  
11) Mr. Satyanand Narayan - Security Guard- 2003-07-02

12)	Mr. Goopcharran	-	Security Guard-	2003-08-01
13)	Mr. Frederick E. Daly	-	Security Guard-	2003-10-20
14)	Mr. Deoraj Narine	-	Security Guard-	2003-11-19
15)	Mr. Azad Bacchus	-	General Worker-	2003-11-24
16)	Ms. Rhonda Culley	-	General Worker-	2003-07-28
17)	Ms. Ann Paulino	-	General Worker-	2003-12-01
18)	Ms. Vimla Surdial	-	General Worker-	2003-11-04

## 2. PROMOTION

### a) Administration

1) Ms. Holda Poonai - Administrative/Finance Manager -2003-09-15

### b) Senior Technical

1) Ms. Nathalie Henry - Snr. Library Assistant 2003-01-10

### c) Clerical and Office Support

1) Ms. June Andries-Eastman - Confidential Sec. 2003-03-24

### d) Semi-Skilled Operatives and Unskilled

1) Mr. Davindra Sawh - Security Guard 2003-09-01

## 3. RESIGNATION

### a) Administration

1) Mr. Zainul Khan - Administrative Manager - 2003-08-04

2) Ms. Diane Britton-George - Personnel and Industrial Relations Officer - 2003-07-21

### b) Other Technical and Craft Skilled

1) Ms. Karen Benjamin - Research Technician 1 - 2003-07-21

### c) Clerical and Office Support

1) Mr. Ian Seegobin - Accounts Clerk 11 2003-08-30

d) **Semi-Skilled Operatives and Unskilled**

1)	Ms. Onika Shepherd	-	General Worker	2003-07-01
2)	Ms. Lucille Stephens	-	Security Guard	2003-03-01
3)	Ms. Esther King	-	General Worker	2003-08-10
4)	Ms. Godawry Needhee	-	Foreman	2003-12-01

4. **TERMINATION OF CONTRACT**

a) **Other Technical and Craft Skilled**

1)	Mr. Vishnu Beharry	-	Mechanical Supervisor -	2003-07-01
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5. **TERMINATION OF SERVICE**

a) **Senior Technical**

1)	Ms. Rajkumarie Sookraj	-	Research Assistant	- 2003-10-21
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b) **Semi-Skilled Operative and Unskilled**

1)	Mr. Victor Jones	-	Security Guard	2003-04-27
2)	Mr. Husman Ally	-	Security Guard	2003-04-27
3)	Mr. Roy Cottom	-	Security Guard	2003-03-27
4)	Mr. Edward Desouza	-	Security Guard	2003-04-27
5)	Mr. Samuel Yearwood	-	Security Guard	2003-04-27
6)	Ms. Ramdularie	-	General Worker	2003-07-01
7)	Mr. Seepaul	-	General Worker	2003-07-01
8)	Mr. Victorine Gouveia	-	Security Guard	2003-07-01
9)	Ms. Carmen Phillips	-	Security Guard	2003-07-01`
10)	Mr. Neville Morris	-	Security Guard	2003-07-01
11)	Mr. Patrick Thomas	-	Security Supervisor	2003-07-01
12)	Mr. Vincent Gordon	-	Security Supervisor	2003-07-01
13)	Ms. Cecelia Ross	-	Security Guard	2003-07-01
14)	Ms. Patricia Durant	-	Sanitation Worker	2003-07-01
15)	Mr. Oswald Sears	-	Snr. Stock Foreman	2003-07-01
16)	Mr. Khemraj	-	Security Guard	2003-07-01
17)	Mr. Peters Hares	-	Mob Equipment Operator	-2003-08-01

6. **DEATH**

a) **Semi-Skilled Operative and Unskilled**

1)	Mr. Leyland Wright	-	General Worker	2003-03-21
2)	Ms. Dolly Grandison	-	Security Guard	2003-10-06
3)	Ms. Anjanie Ramdhani	-	General Worker	2003-10-27

7. **DISMISSAL**

a) **Senior Technical**

1)	Mr. Dalchan Lakhan	-	Research Assistant	2003-07-01
2)	Mr. Kawal Jainarain	-	Research Assistant	2003-10-08

b) **Semi-Skilled Operatives and Unskilled**

1)	Ms. Cheryl Profitt	-	General Worker	2003-02-25
2)	Ms. Malsha Stephens	-	General Worker	2003-03-29
3)	Mr. Curtis Patoir	-	General Worker	2003-06-02
4)	Mr. Rameshchandra Singh	-	Driver	2003-06-21
5)	Mr. Satyanand Narayan	-	General Worker	2003-07-08
6)	Mr. Antonio Ignatius	-	General Worker	2003-08-10
7)	Mr. Vidyanand Parmanand	-	General Worker	2003-08-18
8)	Mr. Ishwar Mukhram	-	General Worker	2003-09-13

8. **TRANSFER**

a) **Semi-Skilled Operative and Unskilled**

1)	Mr. Sookdeo	-	Foreman/Technician	2003-11-10
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9. **TRAINING**

a) **Overseas**

**Short Courses/Workshops/Seminars/Meetings/Study Tours/Conferences**

**Short Courses**

- 1) Ms. Samantha Pooran , Research Assistant, participated in a Training Programme on “**Strategies for Sustainable Agriculture and Rural Development**” held in Hyderabad, India, from January 16 to February 26, 2003.

### Workshops

1. Dr. Patrick Chesney, Research Scientist, participated in a Workshop on “**The Use of Geographic Information Tools for the Analyses of Biodiversity Data**”, held in Cali, Colombia, from March 10 to March 14, 2003.
2. Ms. Pratima Doodnauth, Research Assistant and Ms. Shelley Heath-London, Research Technician 11, participated in a workshop on “**Management of the Citrus Black Fly**”, held in Trinidad and Tobago, from March 24 to March 28, 2003.
3. Mr. David Fredericks, Research Scientist participated in a workshop on “**International Timber Organization (ITTO) guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forest**”, held in Ghana from July 21 to 25, 2003.
4. Mr. Juan Solomon, Research Assistant participated in the “**Regional Small Ruminant Workshop**”, held in Barbados on September 26, 2003

### Seminars

1. Mr. Nigel Cumberbatch, Senior Research Scientist, and Mr. Lambert Chester, Research Scientist, participated in the “**International Seminar Savantee**”, held in Brazil, from October 17 to October 24, 2003.

### **LOCAL**

#### Short Courses

Ms. Michelle Lutchman, Research Assistant and Ms. Rajkumarie Sookraj, Research Assistant, participated in a Training Course on “**Developing and Implementing a Laboratory Management System, Meeting the Requirements of the ISO 17025 Standard, ‘General requirements for the competence of testing and calibration Laboratories**”, held in Guyana, from April 09 to April 12, 2003.

Table 6 shows the total number of staff members of the Institute in 2003. More than 55 percent of the total positions were filled compared to 61 percent in 2002. As in 2002, the largest decrease was in the semi-skilled, unskilled category. There were also decreases in the Administration, Other technical and Craft skilled and Clerical and office support categories. There was an increase in the Senior Technical category

**TABLE 6: Staffing At NARI - 2003**

<b>Categories</b>	<b>No. of Positions</b>	<b>Positions Filled</b>	<b>Positions Vacant</b>
Administration	16	10	6
Senior Technical	50	30	20
Other Technical & Craft Skilled	70	36	34
Clerical & Office Support	36	16	20
Semi-skilled Operative & Unskilled	304	173	131
<b>TOTAL</b>	<b>476</b>	<b>265</b>	<b>211</b>

**TABLE 7: Staffing In The Administration Category, NARI, 2003**

<b>Categories</b>	<b>Authorised Positions</b>	<b>Positions Filled</b>	<b>Vacant Posts</b>
Director	1	1	0
Head-of-Unit	3	2	1
Admin/Finance Manager	1	1	0
Internal Auditor	1	0	1
P&IRO	1	1	0
Librarian/Documentalist	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
<b>TOTAL</b>	<b>16</b>	<b>10</b>	<b>6</b>

**TABLE 8: Staffing In The Senior Technical Category, NARI, 2003**

<b>Categories</b>	<b>Authorised Positions</b>	<b>Positions Filled</b>	<b>Vacant Posts</b>
Senior Research Scientist	8	1	7
Research Scientist	20	12	8
Senior Research Assistant	4	0	4
Research Assistant	18	17	1
<b>TOTAL</b>	<b>50</b>	<b>30</b>	<b>20</b>

**TABLE 9: Staffing In The Other Clerical And Office Support Category, NARI, 2003**

<b>Categories</b>	<b>Authorised 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
Accounts Clerk 111	1	0	1
Assistant Accountant	1	1	0
Assistant Accountant (Audit)	1	0	1
Accounts Clerk 11	4	3	1
Inventory Clerk	2	0	2
Records Clerk	2	1	1
Audit Clerk	1	0	1
Caratographic Trainee	1	0	1
Expediter 1/11	1	1	0
Telephonist 1/11	1	1	0
Office Attendants	5	2	3
Stores Clerk	1	0	1
<b>TOTAL</b>	<b>36</b>	<b>16</b>	<b>20</b>

**TABLE 10: Staffing In The Other Technical And Craft Skilled Category, NARI, 2003**

<b>Categories</b>	<b>Authorised Positions</b>	<b>Positions Filled</b>	<b>Vacant Posts</b>
Senior Research Technician	5	2	3
Research Technician 11	9	9	0
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	0	1
Senior Mechanic	1	1	0
Senior Mechanic/Operator	1	1	0
Senior Storekeeper	2	1	1
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
<b>TOTAL</b>	<b>70</b>	<b>36</b>	<b>34</b>

**POSITIONS CREATED****Other Technical And Craft Skilled****Positions Filled**

Communication Officer	1
Communication Information Specialist	1
Information Technology Technician	1

**TABLE 11: Staffing In The Semi-Skilled And Unskilled Category, NARI, 2003**

<b>Categories</b>	<b>Authorised Positions</b>	<b>Positions Filled</b>	<b>Vacant Posts</b>
Security Guard	49	34	15
Nurseryman 1	15	6	9
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
Driver	6	2	4
Sanitation Worker	8	5	3
Personal Assistant	1	1	0
Senior Field Foreman	4	0	4
Senior Nursery Foreman	1	0	1
Senior Stock Foreman	1	0	1
Field Foreman	5	1	4
Nursery Foreman	5	3	2
Foreman	2	0	2
Stock Foreman	1	0	1
Assistant Foreman	3	2	1
Assistant Nursery Foreman	3	2	1
Laboratory Assistant	4	1	3
Laboratory Attendant	9	8	1
Senior Livestock Attendant	1	0	1
Caretaker	2	2	0
Livestock Attendant	4	2	2
Handyman	2	1	1
Porter	2	1	1
Library Attendant	1	0	1
Security Supervisor	3	1	2
Senior Guard	5	3	2
General Worker	120	82	38
Watchman	4	0	4
<b>TOTAL</b>	<b>304</b>	<b>173</b>	<b>131</b>