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LIST OF ABBREVIATIONS

BrCA	-	Brown Citrus Aphid
CTV	-	Citrus Tristeza Virus
ELISA	-	Enzyme Linked Immuno Sorbent Assay
GGMC	-	Guyana Geology & Mines Commission
IICA	-	International Institute for Cooperation in Agriculture
IITA	-	International Institute for Tropical Agriculture
IPM	-	Integrated Pest Management
ISTA	-	International Seed Testing Association
LIDCO	-	Livestock Development Company
MFCL	-	Ministry of Fisheries, Crops & Livestock
MHOCSA	-	Mabaruma/Hosororo Cocoa Growers Association
MMA	-	Mahaica Mahaicony Abary
NARI	-	National Agricultural Research Institute
NGMC	-	'New' Guyana Marketing Corporation
PRCSP	-	Poor Rural Communities Support Services Project
SRDA	-	Strategic Research & Development Agenda
USA	-	United States of America

I. OFFICE OF THE DIRECTOR

1. Dr. Oudho Homenauth - Director
2. Ms. M. Pooran - Confidential Secretary
3. Dr. R. S. Kharb - Seed Expert, ITEC Programme
4. Dr. L. Munroe - Head of Unit
5. Ms. S. Pooran - Research Assistant
6. Ms. M. Lutchman - Research Assistant
7. Mr. R. Adrian - Research Assistant
8. Ms. L. Badal - Communication Officer
9. Mr. R. Chan - Communication Specialist
10. Mr. C. Warui - VSO Volunteer
11. Ms. N. Hutson - Information Technology Technician
12. Ms. N. Miller - Senior Library Assistant
13. Mr. K. Singh - Research Technician, Black Bush Polder
14. Mr. J. Gonsalves - Farm Manager, St. Ignatius
15. Mr. F. Benjamin - Senior Research Technician, Ebini

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

1. Research on 'New' Crop Types;
2. Organic Agriculture;
3. Information Communication Technology & Agricultural Support Services;
4. Intermediate Savannahs;
5. Special Projects; and
6. Seed Technology

Special projects were executed in the following:

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

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

1.0 RESEARCH ON ‘NEW’ CROP TYPES

(a) CARROT

Project Title:

Multi-Locational Trial of Carrot (New Kuroda) at Laluni and St. Cuthbert’s Mission

Previous studies had indicated that the carrot variety New Kuroda was high-yielding and well adapted to local conditions. Trials with this variety were initiated on farmers’ fields at Laluni and St. Cuthbert’s Mission to validate previous results. At both locations, the soils were sandy and well-drained. Limestone (1500 kg/ha) and TSP (100kg/ha) were applied pre-plant. At harvesting, marketable yields of 1.6 and 2 t/ha were obtained at St. Cuthbert’s Mission and Laluni, respectively. Root lengths ranged from 150 to 340 mm whilst the root diameters were between 25 and 45 mm. The yields obtained from these trials were lower than those previously reported. The lower yields obtained were due mainly to the prevalence of black rot disease which resulted in the loss of many plants. Future studies will be initiated to address this problem.

Project Title:

Carrot Varietal Trial at Guyana School of Agriculture Farm, Mon Repos

Four carrot varieties, New Kuroda, Louxor, Ramses and Carandai were evaluated for yield and other plant characteristics. These evaluations were conducted on a sandy clay loam soil at the Guyana School of Agriculture farm. Louxor gave the highest marketable yield of 3 t/ha. Ramses yielded 2t/ha, Carandai 1.8 t/ha while New Kuroda gave the lowest yield of 1.6 t/ha. Good germination percentage and crop stand were recorded for all four varieties. Brix readings showed that Ramses and Carandai contained higher sugar content (12% each) as compared to New Kuroda (9%) and Louxor (11%). Black rot (*Alternaria radicina*) disease was prevalent on Ramses as compared to the other varieties. All four varieties are highly tolerant to Late Leaf Blight *Alternaria dauci* and heat stress. No serious insect problems were noted. Number of days to Maturity was 95/100 days. The roots had tapered

shape and colour range from deep orange to red orange and length/diameter range from 16-18 cm /4.5-6 mm.

(b) SWEET CORN

Project Title:

The influence of planting density on the yield and growth of sweet corn

This experiment was conducted to investigate the response of two sweet corn varieties to changes in plant population with the aim of maximizing yield. The experiment was carried out at Clarence Suklall's Farm in Naamryck on a pegasse soil. Treatments included two planting distances (10" and 15" within rows) and two sweet corn varieties (Java and Honey Jean) in a randomized complete block design with three replications. The results indicated that planting Honey Jean 10" within rows and 16" between rows gave a yield of 53.34 mt/ha as compared to Java which produced 39.99 mt/ha at the same planting density. A higher planting density resulted in significant increases in the yield, regardless of the variety.

(c) OCHRO

Project Title: Ochro varietal evaluation

The objectives of this trial were to evaluate improved varieties of ochro for the fresh market that are high yielding and have good horticultural characteristics as well as to widen the number of varieties presently produced. The trial was carried out at the National Agricultural Research Institute's Plant Research and Nursery facility at Lesbeholden, Black Bush Polder on a clay loam soil. Four varieties were selected for evaluation (three improved varieties: Clemson Spineless, Indiana Gombo and Volta and Santa Cruz as the local check variety). The experiment consisted of four varieties with three replications in a randomized complete block design. Santa Cruz, Volta, Indiana Gombo and Clemson Spineless produced 23310, 23310, 18962 and 13986 kg/acre, respectively. Based on the results, Santa Cruz and Volta are suitable for cultivation within this area, the choice of variety being dependent on market forces.

(d) PEANUT

Project Title: Peanut response to rate and timing of Gypsum application

Low yield (600 kg/ha) of peanut is a major impediment facing the industry. One of the factors associated with low yield is the high percentage of wind nuts obtained, especially on sandy soils. In order to investigate this problem, trials were initiated with the use of gypsum as the source of calcium. It is well known that gypsum provides the calcium needed for peg formation and development of the kernel within the pod. Experiments were conducted at Kairuni on the Linden-Soesdyke Highway to determine peanut response to rate and timing of gypsum application. The peanut variety used was the Guyana Jumbo. The levels of gypsum used were 0, 400, 600 and 800 kg/ha. Application was done at 10, 30 and 50% flowering. Results showed that yield responses were greater for the earlier timing (10 and 30% flowering) of gypsum application and the higher rates of gypsum application: Gypsum as a source of calcium is recommended to maximize peanut yields on sandy soils. The recommended rate is 600 kg/ha at 10 and 30% flowering.

(e) TOMATO

Project Title:

The Influence of nitrogen fertilizer application on the growth and yield of tomato (var. Heatmaster)

The objectives of this experiment were to study the effect of different rates of nitrogen (N) fertilizer application on the growth and yield of fresh market tomato (var. Heatmaster) as well as to determine the optimal nitrogen fertilizer rate that would result in maximum yield. This trial was conducted at the National Agricultural Research Institute's Plant Research and Nursery facility at Lesbeholden at Black Bush Polder on a clay loam soil. The trial consisted of four treatments (0,60,120,180 kg N/ha) in a randomized complete block design with three replications. Based on the results, the marginal response to the increments of fertilizer application indicated that 60 kg N/ha is the most profitable level of fertilizer use, producing maximum yields. At this rate, the Heatmaster produced 121.8 mt fresh fruit per hectare. Higher levels of nitrogen application resulted in decreasing returns at this location.

2.0 TECHNOLOGY DEVELOPMENT

Project Title:

The Influence of Axillary Bud Deshooting on the Production of Tomato (var. F₁ Mongol)

Tomato is an important vegetable crop in Guyana with approximately 104 ha of tomato grown annually with an average annual production of 1442 mt (2002-2003). Farmers always seek to increase their yields by different management practices and cultural techniques such as optimal planting density, mulching, staking, liming, fertiliser application based on soil tests, timely pest control strategies and adequate irrigation. Research has shown that two-stem pruning in tomato yielded 56.2 t/ha while no pruning yielded 43.49 t/ha, a 22 % increase in yield (Udin 1995). In a similar trial, Aung (1999) found that two stem pruning increased yield by 9%, from 36.5 to 40.2 t/ha for no pruning and two stem respectively. This research was therefore planned to investigate the effects of stem pruning on the growth and yield of tomato as well as to determine the optimal pruning technique to attain maximum yield.

The trial was conducted at the Clarence Suklall's Farm, Naamryk from May - August 2005. The trial consisted of four treatments (no pruning, 2 stem pruning, 3 stem pruning and 4 stem pruning) in a randomised complete block design with three replications. Seedlings were transplanted 60 cm between rows and 40 cm within rows. Urea was applied at 180 kg/ha in three splits 30% at transplanting, 40% at flowering, 30% at fruit set, while 80 kg/ha triple super phosphate was applied at transplanting and 120 kg/ha muriate of potash was applied in two splits, 50% at transplanting and 50% at flowering. Each treatment consisted of three beds with 20 plants each. Initially, the plants were pruned to achieve the number of stems required, after which weekly removal of the axillary shoots was conducted.

Five weekly harvests were made with 12 plants sampled from each treatment. However, the plants sampled for the pruned treatments did not conform to the number of stems required so the data presented in Table 1 would not be totally accurate. Instead of comparing the effects of the different stem pruning treatments with each other, they can be combined and

the mean compared with the no pruning treatment which will give an indication of the effects of weekly axillary buds deshooting on the yield of tomato (Table 2).

Table -1: *The Effect of Stem Pruning on Tomato Yield, Naamryk 2005*

	Fruit Number	Fruit Weight Per Plant (kg)	Average Weight Per Fruit (g)	Yield (mt/ha)
No Pruning	45.8	3.1	67.1	113.9
2 Stem Pruning	30.3	2.0	65.5	75.4
3 Stem Pruning	40.6	2.6	64.8	97.3
4 Stem Pruning	43.6	2.9	67.3	108.7

The combination of all three pruning treatments referred to as axillary bud removal indicated that no pruning yielded 17.6 mt/ha more than the pruned treatments.

Table -2: *The Effect of Axillary Bud Deshooting on Tomato Yield, Naamryck, 2005*

	Fruit Number	Fruit Weight Per Plant (kg)	Average Weight Per Fruit (g)	Yield (mt/ha)
No Pruning	45.8	3.1	67.1	113.9
Axiallry Bud Removal	38.2	2.5	65.9	93.8

Pruning necessitates weekly monitoring to remove new shoots, thereby adding a cost to production. Based on the results, F1 Mongol did not respond favourably to the pruning treatments and it was not economical since it resulted in significantly lower yields (Table 2).

This trial should be repeated in different locations using different varieties to determine the true effectiveness of the pruning techniques.

Project Title: Response of Poi (*Basella alba L.*) to spacing

Poi (*Basella alba L.*) is a popular leafy vegetable grown in Guyana. There is a dearth of information on the production parameters of this crop, and farmers have no consistent spacing for growing the crop. Hence, two trials were done to ascertain the effect of plant spacing on the yield, and to generate information on the yield parameters for this short-

lived perennial crop. Trials were conducted in 2004 and 2005 on a typical ochraquilt (Onverwagt clay – series 41d) at the National Agricultural Research Institute, Mon Repos, East Coast Demerara. Spacings of 8, 10 and 12 inches between plants were done in at least 6 replicates. Results showed that 10-inch spacing is preferred, average leaf weight at harvest varied from 6 to 15g with the heaviest weights occurring in the 1st harvest. However, the number of leaves harvested per plant was lowest in the 1st harvest. From transplanting to the 1st harvesting was less than 50 days, with a 10-14 day period between harvests. Optimum irrigation is critical to reducing the harvest period. A plant can produce between 0.25kg to 0.31kg of leaves of marketable size. It is recommended that farmers adopt a uniform plant spacing in order to optimize yield and maximize inputs.

Project Title: Update on new active ingredients for Ant Bait

Testing of bait matrix acceptability was done using the various matrices impregnated at the lowest insecticide levels. It was presumed that if the baits were acceptable at this level then they would be acceptable at other higher insecticide levels.

The various matrices (broken rice, cassava bread, sago and farine) were spread along the ants trails in the night usually after dark (19:00hrs) and observations done for about an hour or two to monitor preference, which was rated on the scale of 1 to 5. The final visual rating based on the amounts taken was done in the morning after the ants had made their choices overnight.

Test Sites	B. Rice	C. Bread	Farine	Sago
Mainstay	2	3	1	4
Timehri	3	2	1	4
Rupununi	2	3	1	4
Average	2	3	1	4

Rates (1-5)

1 Most acceptable

5 Least acceptable

Insecticides acceptability

Observations conducted at Mainstay, Timehri and Rupununi indicate that insecticide levels at 0.1% were giving immediate mortality on contact and nests treated with that level showed dead ants at the exit hole. This level will be excluded in the next series of tests, and more work will be done on the 0.01 and 0.001% levels, at Timehri and or Mainstay, to observe the various insecticide preferences. Mainstay has the advantage of having a higher ant pressure than Timehri hence its suitability for preference tests on insecticides.

Project Title:

Investigation of scratching moth outbreak in Essequibo by L. Munroe

A field visit was made to the Essequibo Coast to investigate the occurrence of a moth that was causing severe skin irritations to residents from Charity to Anna Regina. The outbreak of this particular insect seemed to occur in cycles of probably two to three decades. Essentially, the duration of an outbreak would be dependant on climatic condition; the incident investigated seemed to have been in its third generation.

The insect was initially identified is *Psychophasma crosa* H. Sat (Lepidoptera: Arctiidae) which was first recorded in Guyana in October 1922 at Weri – werai – kuru Creek, Essequibo River. However, from a subsequent examination of the insect, it was determined to be *Hylesia metabus* (Cramer) (Lepidoptera: Saturniidae).

Recommendation made at the time:

Trapping:

1. Use one bright light (preferably a fluorescent tube) on the outside and place a tub filled with water containing some detergent just below the light. (Moths adhering to the building may be sprayed with a solution of any pyrethroid, e.g. Fastac, Karate, etc., using 6-10 cc per litre of water).

Spraying:

2. Fendona 6% SC is recommended for indoor use, e.g. schools, health centres, if the need arises; the recommended dosage is 5cc per litre of water.

3. Spot spraying of infested vegetation, as was the situation in Dartmouth, may be done using Fastac or Karate at a rate of 6-10 cc per litre of water.

3.0 ORGANIC AGRICULTURE

(i) Cocoa Production 2005

1. Mr. L. Wilson was employed by NARI as a Technician to strengthen the capacity building and give support to the MHOCGA.
2. A total of 45 cocoa farms were inspected in the Mabaruma/Hosororo district by Soils Association Certifying Ltd and NARI. Twenty one cocoa farms (133.70 ha) were certified as organic, 10 farms (28.78 ha) were certified as conversion and 14 farms (41.4ha) certified as non organic. In August of 2005 MHOCGA was granted license to export cocoa bean.
3. The MHOCGA held its general election to elect new office bearers and Mr. Edward James was elected as the Chairman along with five new executive members.
4. Cocoa bean production for the year was as follows:
 - a) Wet bean collected - 1,790 lbs
 - b) Dried beans in bond - 660 lbs
 - c) Dried bean in stock - 1,581 lbs
 - d) Storage pest damage - 681 lbs
 - e) Placed on local market - 900 lbs
5. A total of 1,790 cocoa seedlings was distributed to farmers in the Mabaruma/Hosororo region.

(ii) Organic Pineapple Production 2005

1. NARI launched organic pineapple projects in three Amerindian Communities in the Essequibo Region during the month of September 2005. These communities were Mainstay-Whyaka, Tapacuma and Capoey, located approximately within 16-32 km west of the town of Anna Regina on the Essequibo Coast.
2. Contracts of Agreements were signed on 14th and 21st of September 2005, between Village Captains of the three Amerindian Communities and the Director of National Agricultural

Research Institute. The agreement is to ensure that both parties work in mutual understanding and adhere to the protocols of organic farming. Each community will be receiving a total sum of G\$ 261,600 for the establishment and maintenance of a 2 hectare organic pineapple plot. The first payments amounting to the sum of \$ G 120,000 for plot preparation were made to Captains of the three Communities at the signing of the agreement.

3. All three communities made steady progress in 2005 on the first phase of plot preparation, cleaning and sourcing planting materials. NARI will continue to monitor and evaluate all activities undertaken at these sites in ensuring that farmers follow the principles of organic farming.

4.0 EBINI UNIT

Orchard Crops:

The orchard crops received routine maintenance, however in addition to maintaining the fruit orchard, fruits were harvested and sold to the riverian community and citrus fruits were also shipped to Mon Repos for sale. The orchard crop programme also made dried sorrel available for sale. The following is a listing of the plant types in the orchards.

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

Grapefruit	0.25 ha	Citrus orchard	Maintenance
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Agro-forestry Research Trial

A study was undertaken to increase the yields of maize and cowpea and improve pasture performance on the infertile soils of the Intermediate Savannahs, by replacing chemical inputs with tree mulch. The justification for the study hinges on the thought that by using acid tolerant, fast growing, nitrogen-fixing trees together with open row crops the nutrient needs of the crops could be met. The correct application of this technology could lead to increased crop yields, reduced fertilizer use and enhanced tropical ecosystem health. Three fast growing, nitrogen fixing plants, *Gliricida sepium*, *Acacia mangium* and *Leucaena leucocephala* were planted, the growth rate observed is quite encouraging. The preliminary observations indicate there has been a good take of most of the plants, particularly the Glyricida plants; observations also show that the Glyricida plants appear to be better adapted than those of the Leucaena and Acacia plants. This study however suffered a major setback when the plot was completely burnt by a fast moving and raging bush fire during the month of December. The limited resources that were on the station could have done very little to prevent such an occurrence.

Seed and grain production

The seed and grain programme is one of the main activities of the Ebini Unit, however this activity has always been hindered by the lack of inputs; the untimely supply of inputs, the lack of fertilizer, fuel, chemicals and the unavailability of machinery to effect land preparation. However, despite the aforementioned problems the programme was able to produce 3000kg of Minica 4 seed. In spite of the numerous problems the following crops were planted during the reporting year.

Accessions	Acreage
Cowpea Minica 4	7.0 ha
Cowpea CP91A6	1.5 ha
Cowpea CP91x1	0.50 ha

Germplasm maintenance:

The crop germplasm plot was also maintained during the reporting year. The crops planted in the collection included mung bean, sorghum, maize, cowpea, pigeon pea and peanut. In addition the unit also received 28 sweet potato accessions, which have been planted at a new site earmarked for germplasm maintenance.

In the 2005 planting season the following were planted in the germplasm collection.

Plant Type	Number of lines/accessions/varieties
Mung bean	5 lines
Peanut	4 accessions
Sorghum	3 lines
Maize	1 line
Cowpea	7 accessions
Pigeon pea	1 line
Sweet potato	28 accessions
Iron and clay forage legume	1 accession
Alyce clover	1 accession
Forage legume	1 accession
Forage sorghum	1 accession
Forage millet	1 accession

Livestock programme

The small ruminant programme, particularly the sheep programme, instituted a multiple sire breeding system mainly in an effort to increase the flock size. This all year breeding programme has resulted in an increase of the flock size. In addition, the animals were allowed to graze extensively, rather than being restricted to grazing the enclosed pastures. Mineral was also provided ad libitum. This unit has established a comprehensive record keeping system to facilitate selection in an effort to establish the elite flock. In addition a creep feeding programme has been instituted for the lambs to assist in improving the weaning weights.

The Ebini small ruminant programme transferred 28 breeding rams to the Mon Repos Unit during the reporting year; these animals were sold to the farming community as breeding males. The flock count showed the following: -

Animal Class	Opening Stock	Closing Stock
Breeding males	3	2
Breeding females	83	102
Weaned males	27	30
Weaned females	45	25
Male lambs	9	-
Female lambs	12	-
Total	179	159

The goat unit has a total of 29 animals and in spite of the small number of animals this unit was able to sell four breeding bucks during the year.

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

Animal Class	Opening Stock	Closing Stock
Breeding males	1	-
Breeding females	19	23
Weaned males	7	3
Weaned females	-	
Male kids	2	3
Female kids	2	3
Total	31	32

The Livestock programme also **rescued/acquired** the remaining 48 beef cattle, owned by the Livestock Development Company, in February 2004. These animals were abandoned by LIDCO and would have faced certain death from neglect, if they were not managed and cared for by the

Livestock Programme of NARI. The Institute has been able to reduce the calf mortality by the establishment of a management system which included feeding of the calves and providing mineral ad-libitum. The herd count at the end of 2005 was 78 animals, including the calves, and all of these animals were in excellent condition.

5.0 INFORMATION TECHNOLOGY & AGRICULTURAL SUPPORT SERVICES;

5.1 Information Technology

The following tasks were accomplished by the Information Technology Department for the year 2005:

- i. Routine maintenance of computers and peripherals.
- ii. Maintenance of NARI's website.
- iii. Assistance with the publication of the NARI in Focus newsletter.

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

1. One Dell System
2. One APC 500 UPS

The Dell System was given to the Director's Secretary to replace an older system that was damaged and unable to be repaired.

The APC 500 UPS also given to the Director's Secretary to replace an older UPS that was damaged and unable to be repaired.

Equipment damaged were:

1. Two IBM System Units – Administrative Manager's Secretary & Accounts (Motherboards)
2. One Dell Dimension – Director's Secretary (Motherboard)
3. Two Starr System Units – Horticulture & Livestock (Motherboards)
4. One APC 1000 UPS – Director's Secretary (mainboard damaged)
5. One Gateway 17" monitor – Library (flyback damaged)

6. One HP 15” monitor – Livestock (flyback damaged)

5.2 Communications

During 2005, the unit was actively involved in video recordings, newspaper article production, school tours, photography, booklet or leaflet layout production and exhibitions.

Exhibitions

Participation was done in the following national activities:

- Guyana Nights in Lethem, Georgetown, Bartica and Anna Regina
- World Food Day collaboration, Anna Regina
- GUYEXPO 2005
- Lesbeholden Nursery Field Day

School Tours

One hundred and twenty nine students accompanied by two teachers from three schools (St. Johns Secondary, Tutorial Secondary, and J. C. Chandisingh) toured NARI’s facilities at Mon Repos.

The main areas continued to be crop protection, budding and grafting and livestock production. An added feature was agroprocessing which was introduced for the first time.

Video Recording

The unit continued the production and broadcast of AGRI DIGEST on NCN Channel 11 until the end of June 2005. Short segments were produced for ‘Guyana Today’ NCN Channel 11. These included: seedbed preparation for planting, tomato pruning, tomato and cabbage cultivation, fertilizer techniques, vermi-composting, ant bait production and the importance of PGR. All programmes were recorded and produced on digital format.

Sunday Chronicle

Articles were submitted to the Guyana Sunday Chronicle for the NARI page. These articles focused primarily on recovery after flood, agronomic practices for major vegetable crops, pest management in solanaceous crops, fertilizer management and techniques for fruit and vegetable production and post harvest technology.

Posters/Brochures and Booklets Design, Layout and Publishing

Five new posters were produced using digital design and printing technologies. Two posters produced promoted the concepts of Drip Irrigation and Vermicomposting while the others dealt with NARI's locations and activities.

Brochures were designed and published promoting the agro processing techniques and drip irrigation. The following booklets were designed, laid out and prepared for publishing:

- Organic Policy
- Organic Status Report
- Intermediate Savannahs Development
- Agriculture on the Move
- Organic Training Manual (incomplete due to lack of photographs)

5.3 Soil Laboratory

A new state of the art Atomic Absorption Spectrophotometer (AAS) was acquired from funding provided by the Poor Rural Community Support Services Programme (PRCSSP). Technicians were trained to operate the instrument.

The laboratory was non-functional for most of the year until the acquisition of the AAS. Prior to that samples were only analysed for pH, organic carbon and phosphorus.

5.4 Training L. Munroe: Training in GAPs

a) Region 10

Training activities in GAPs were held in Linden, Region 10 for farmers who were identified by LEAP. Additionally, in collaboration with the Ministry of Agriculture and IICA, a “Farmers’ Diary” was developed and sessions on its use held with the farmers.

b) Region 7

Training sessions were held in Bartica for farmers along the Bartica Potaro Road and those from River view.

A disease condition of coconuts was also investigated in the Bartica and surrounding areas. The symptoms appeared to be those caused by Lethal Yellowing disease; this needs to be confirmed by sampling and having the extracts analysed for the disease.

II. BIOTECHNOLOGY, PLANT GENETIC RESOURCES AND CROP PROTECTION DEPARTMENT

(1) Plant Genetic Resources

Project:

Acclimatization of New Sweet Potato Varieties to White Sand Agro-ecologies of the Soesdyke-Linden Highway

Designated Project Team:

NARI – Mr. C. R. Paul; Mr. E. Willabus; Mrs. A. Chester

MFCL – A. Forde

1.1 Sub-Project: Transitional Trials to Evaluate the Stability of Four Putative Varieties of Sweet Potato Grown in White Sand Ecologies.

Objective: To release into commercial cultivation new varieties of sweet potato with improved production and marketing packages.

Justification: Release of new varieties into commercial production must be accompanied by certain requisite guarantees. Specific requirements are those for **Uniqueness**, **Novelty**, **Uniformity**, and **Stability**. Fulfilment of these requirements automatically secures the **identity** of the new variety and sets up a legal basis for **protection** of the Intellectual Property Rights over the released variety

The Trials: Following preliminary on-station evaluations in comparative trials four varieties (Amjad Pumpkin Potato, Professor #1, Scientist, and Little) were advanced to on-farm multi-location trials. Two hundred and thirty seven experimental plots were established at 23 sites (farms/homesteads). The target area spanned four communities: Hauraruni, Yarrowkabra, Timehri, and Kuru Kururu. Each site served as a replicate for a particular trial; some sites having more than one trial. Experimental plots were laid out in a

Strip Plot design and were grouped into four trials: Variety X Planting Density, Variety X Type of Cuttings, Variety X Time to Manure, and Variety X Row Design. Manure application was allowed as a farmer managed variable.

Early Results: Plant establishment averaged around 96%. Early in the trials a number of treatment interventions proved superior.

Planting density, for instance, could be manipulated through row designs. Single row plots were accordingly replaced with the more efficient double row plots and using different inter-row and inter-plant spacings, plant density was controlled at 45, 55, 64, and 73 thousand plants per hectare. Stem cuttings were replaced with tip cuttings, and manure application at planting was found to be superior to an application one month after planting. These were the controlled conditions under which the four entries were further evaluated.

Weevils: In an attempt to encourage a weevil population to build up in the trials the mixture of varietal maturity types were extended past their maturation periods. Consequently, days to harvest of the trials were done at 165, 170, 176, 182, 232, 253, and 260. Delayed harvesting also facilitated an evaluation of varietal persistence under field conditions.

Harvest: In addition to yield and yield components, plant establishment rate, plant density at harvest and varietal marketable tuber scores were also recorded.

1.2 Sub-Project: Comparison of Yield Performance of Four Varieties of Sweet Potato under Four Manuring Rates in a White Sand Ecology

Objective: To determine an optimum level of manure application for producing sweet potato tubers on white sands.

Justification: In view of the challenges in manuring techniques observed earlier in multi-location (on-farm) trials, it was imperative to seek a solution to compile a more comprehensive production package for farmers.

The Trial: A trial was devised to evaluate the response of four entries (Amjad Pumpkin Potato, Little, Professor #1, and Scientist), concurrently evaluated in multi-location trials, to four levels (10, 20, 30, and 40 t/ha) of manure (fresh-weight analysis) application. Plant density in this strip-plot trial design was controlled at 61,400 plants/ha, and harvest done 144 days after planting. Data recorded and generated were similar as for the multi-location trials.

1.3. RESULTS SUMMARY

1.3 MULTI-LOCATION TRIALS

Varietal Maturation Groups: The entries were confirmed to belong to 3 maturation groups: 3.5 – 4 months (Scientist), 4-4.5 months (Amjad Pumpkin Potato and Scientist), and 5 months (Professor #1).

Weevil: In expectation of weevil infestation all the varieties were harvested after five months. The shortest time to harvest was 165 days, and the longest 260 days. During these trials there was no evidence of weevils on plants (stem infestation nor tuber infestation).

Cricket Tuber Damage: Damage seemed to be more an artefact of over-maturation. Cricket damage was most severe for Scientist, followed by Amjad Pumpkin Potato and Scientist, but was ‘observedly’ lowest for Professor #1 even when its maturation period was long past more than 100 days.

Varietal Field Persistence:

1. After 3.5 months Scientist (foliage and tubers) progressively deteriorated to the extent that after 6 months yields declined to insignificance – no field persistence.
2. After 4.5 months Amjad Pumpkin Potato maintained some foliage, most tubers rotted, there was re-growth of new tubers, but most were not marketable – no field persistence.

3. Little maintained its foliage with good quality tubers with no observed rotting. There was tumorous re-growth ('tumors') on tubers themselves – putatively persistent.
4. Professor #1 was most persistent, as observed 105 days after maturation stage. With foliage retained, there were some late production of tubers; most being marketable. Old tubers showed split lesions with some healing of these regions, and rotting was rare for this variety.

Stem Cuttings: Very early in the trials the superiority in vigour of tip cuttings over stem cuttings was noted.

Time to Manuring: At-planting applications gave faster ground cover and higher yields than when applied one month after planting.

Double row vs Single rows: Double rows made for more ease in manure application. More plants could be packed into the same area with double rows, but the effect on yields, tuber size, etc., have not yet been determined.

Plant Density: The effects on yield and tuber quality still need to be evaluated. Results indicate that about 60 thousand plants/ha could be optimal.

Marketable Tuber Score: On a scale of 1 (excellent) to 5 (non-marketable), Professor #1 consistently averaged 2, Little 3, Amjad Pumpkin Potato 3.5, and Scientist 4. Scores for Scientist and Amjad Pumpkin Potato may be downward biased due to the over-maturation state of tubers.

Marketable Tuber Yields: Average yield rankings were as follows: Professor #1 > Little > Amjad Pumpkin Potato > Scientist. Highest marketable tuber yields (of plots adjusted for field) of over 25t/ha for a replicate (farmer) were consistently obtained by two farmers. High-end yield potential of the four entries for an 8.8 m² plot adjusted downwards for extension to field yields are shown in Table 3.

Table -3: High-end Field Yield (8.8 m² plots) potential of the four Sweet Potato entries, Soesdyke/ Linden Highway, 2005

Yield (t/ha)	Entry	Farmer
25.8	Little	Smith
28.9	Professor #1	Smith
30.0	Little	Morrison
30.5	Scientist	Smith
33.1	Professor #1	Smith
34.6	Little	Smith
37.7	Amjad	Smith
38.2	Amjad	Morrison

There were also corresponding yields below 10t/ha. From observations, field retention of the trials past maturation periods may account for lower than expected yields. Manuring method was a farmer controlled variable, and these were expected to be different. Generally, therefore, farmer manuring management practices can, in a significant way, be attributed to yield variations. The data would not show, but it is evident that manuring practices (timing, surface or incorporated, and especially quantity applied) were mainly responsible for both high and low yields.

1.2 VARIETAL X MANURE APPLICATION RATE

Manure Application Rate:

An optimum level of manure application, based on fresh weight analysis, seemed to be about 30 t/ha. Average yields declined slightly at 40 t/ha, and at 10t/ha yields were significantly the lowest, indicating that manuring is an essential intervention in sweet potato production on white sands.

Average Yields at Varying Manuring Rates

MANURE LEVEL (t/ha)	MEAN YIELDS (t/ha)
M30	19.5
M40	18.8
M20	15.8
M10	9.2

Varietal Yield Performance: On the average Professor # 1 consistently out-yielded the other entries.

Average Varietal Yields Across Four Manuring Rates

Entry	MEAN YIELDS (t/ha)
Professor	22.7
Little	14.9
Scientist	13.5
Amjad	12.1

1.4 PRELIMINARY CONCLUSIONS

1. There may be a low weevil pressure in the trial area.
2. Varieties have to be field managed within their maturation groups.
3. All the varieties may be acclimatized to the production ecology under consideration
4. In light of the results from the Variety X Manure Application Rate Trial, an agronomic package can now be recommended.

Follow-Up:

A detailed analysis of varietal performance stability as well as the significance of a Manuring Rate X Entry Interaction would be undertaken shortly.

RECOMMENDATION:

One or two varieties can be promoted to advanced field production demonstrations and clonal field ‘seed’ banks. Market quality evaluations can run in parallel.

Agronomic data should be generated to guide development of field production packages.

The above interventions should lead towards the release of one or two varieties during the field demonstration period.

2. PROJECT

‘Seed’ Yam and Sweet Potato Germplasm Banks/Mass Regeneration Nurseries in On-farm Plots and at the Ebini Out-station

NARI Designated Project Team: Mr. C.R. Paul; Mr. E. Willabus; Mrs.A. Chester (NARI, Mon Repos), (NARI, Ebini)

MFCL COLLABORATION: G. Critchlow; A. Forde (Extension Services)

Objective: To provide adequate quantities of seed material to supply requirements for advanced evaluations, and simultaneously maintain germplasm accessions in field genebanks.

Status: Work on this project was continued from December, 2004 with the aim of transferring all accessions of sweet potato material from the Kairuni Research Station to farmers’ plots at Kuru Kururu, and at the Ebini Out-Station; lack of adequate resources at the Kairuni Out-Station being the main motivating factors.

Sweet potato: Four sweet potato germplasm banks were replanted twice at Kuru Kururu. The Ebini Germplasm Bank was regenerated as part of a continuous cycle.

Yams: One ‘seed’ trench at Kairuni Out-Station was maintained with approximately 70 roots of one exotic yam accession. In addition three ‘seed’ trenches were extended to on-farm nurseries with about 30 roots each at Kuru-Kururu.

(2) Crop Protection

This section consists of Plant Pathology, Entomology and Weed Science as well as a Virology Unit which was added during 2004.

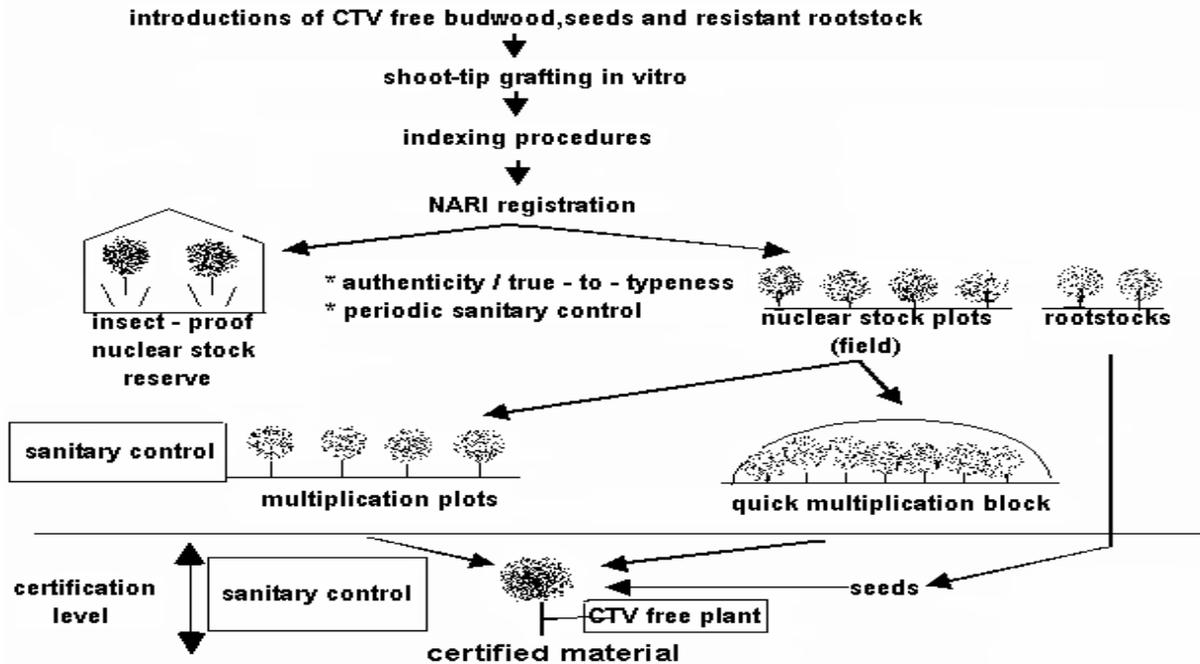
Four projects were undertaken:

(i) Project: NARI's Certification Scheme for Citrus

Aim:

To establish a certification programme for citrus seeds, seedlings, budwoods, rootstocks, scions, and plants, produced at NARI's nurseries to be free from Citrus Tristeza Virus (CTV) and its vector, the brown citrus aphid (BrCA) – *Toxoptera citricida* (Kirkaldy), through the application of various diagnostic techniques and methods. The certification guarantees, to the fruit producers, that the plant is free of the known degenerating diseases and true to type. (see Figure 1).

Figure 1. NARI's Certification Programme for Citrus Tristeza Virus (CTV).



Justification: Citrus is one of the most important group of fruit crop in Guyana, in terms of nutrition and the generation of employment and commerce.

Tristeza disease of citrus (CTV), first reported in Guyana in 1961, is caused by a closterovirus, and is the most economically important viral disease of citrus and possibly the most destructive disease of citrus.

CTV infects almost all species, cultivars and intergeneric hybrids of citrus and some citrus relatives. Many strains of the virus, from mild to severe, exist and contribute to the diversity of symptoms associated with CTV infection. The disease is vector transmitted.

The most important vector of CTV, the brown citrus aphid BrCA-*Toxoptera citricida*, was reported widely distributed in Guyana (Grant, 1961). It is by far the most efficient aphid vector of CTV, about 20 times more effective in virus transmission than *A.gossypii*. The brown citrus aphid was responsible for the rapid movement of severe strains of CTV that

killed tens of millions of citrus trees on sour orange rootstock in Brazil and Argentina in the 1930's and 1940's (Yokomi et al., 1994).

CTV is spread through the use of CTV infected budwood and by aphid vectors. CTV is vectored by several aphid species in a semi-persistent manner with the aphid retaining the ability to transmit CTV for up to 24-48 hours after acquisition (Bar-Joseph, Lee, 1989).

There are strains of tristeza that are difficult to detect in seedlings of Mexican lime but can be easily detected by ELISA. For example, a California tristeza isolate (T-159) is very difficult to identify in Mexican lime indicator plants grown under temperature regimes conducive to good symptom development, but is readily detected by ELISA. This illustrates the value of, and need for, using more than one technique in a programme. The only possible way to get viral free plants is to have a certification scheme.

A certification scheme coupled with clean stock programs can ensure that all budwood available in Guyana is certified free of CTV as well as other graft transmissible pathogens. This is universally recognized as the most important strategy to prevent and reduce further crop losses and for the improvement and continued productivity of a citrus industry.

- Activity 1:** The monitoring and periodical testing of all NARI's plant nurseries, and citrus growing areas of Guyana for strains of CTV and its vectors.
- Activity 2:** A citrus sanitary selection program of different varieties tested for the absence of diseases (CTV) using various laboratory techniques.
- Activity 3:** Developing Biological Control Methods for the brown citrus aphid (BrCA) as part of an Integrated Pest Management (IPM) system to reduce spread of CTV.
- Activity 4:** The establishment of a CTV free nuclear stock reserve in a screen house.

Activity 5: The establishment and production of CTV free budded plants in multiplication blocks at NARI's nurseries.

Activity 6: a. Gathering of data on the spread of CTV as affected by strains of CTV, vector type, hosts and location effects.
b. Maintaining a reference collection of citrus plant viruses, viroids, isolates, slides, photographs etc.

Activity 7: Education and extension programs on the CTV- complex for citrus grower nurserymen, farm advisers, technicians, extension agents, teachers, students and other concerned parties.

(2) Project:

Launching of post flood investigation and crop husbandry advisory to farmers

Visits were made from March 2nd to 15th, 2005 in the following areas: Parika and Ruby Backdam, Canal's # 1 and 2, Hague, St. Lawrence, Mahaica/ De Hoop, Cane Grove/Hope/Dutch Fort.

Status:

While visiting various farmers in the Canal's # 1 and 2, Parika and Ruby Backdam, Hague and St. Lawrence areas, we were told that the flood water was on farmlands for about seven to ten days, this was due to the high tide, ebb and flow. Flooding occurred because when the koker closes the water ascends on the farmlands for approximately three hours.

In Mahaica the flood waters were on the land for about five to ten days, and at De Hoop waters were stagnant for approximately one month.

All the farmers visited incurred losses of various cash crops, herbs, solanaceous plants, perennials, roots, tubers, vegetables, fruit trees, rice etc.

When the water receded the farmers returned to planting. They observed that during land preparation there were no earthworms but they noticed crickets, ants and sow bugs. Some farmers took the extra measure of applying limestone before planting.

Our observation revealed that the plants were in healthy condition, and there was hardly any presence of major pests, diseases and weeds, as a result most of the farmers had not used any pesticides, herbicides, fungicides etc.

In some of the areas the soil had a red / orange colour, and in some areas was very compact (hardpan) and had a dark /black surface.

Soil samples were taken for laboratory analysis.

Advisory

- Farmers were advised on what crops to plant after the flood eg. Legumes so as to return valuable nutrients to the soil.
- To make proper drains, ditches etc. so as to get rid of the remaining flood water on the farmlands, because the major end products of decomposition of organic matter in flooded soils, are carbon dioxide, methane and humic materials. In addition, a high concentration of ethanol and hydrogen sulfide which can be damaging to root systems are produced in water logged soils.
- To fork / plough the soil so that the top of the soil is turned over to the bottom, and to make their plant beds / banks a bit higher than normal. This is because soil organic matter accumulates on the surface. Micro-organisms, plants and animal material decompose slowly in anaerobic soil, the decrease in decomposition causes organic matter to build up at the surface, this causes the top soil to have a dark/black colour.
- After preparation, allow the land to weather for about ten days, as this will enable oxygen to return in the soil, thus enabling the return of microflora and microfauna to

the soil. When the soil is saturated with water it forces the air and more importantly the oxygen from the soil pores, thus killing the micro-organisms in the soil.

- To use more organic manure (pen manure, compost etc.) because soil must contain active micro-organisms, which are dependent on soil temperature. When temperatures are below the **Biological Zero** (5° C) it is assumed that the growth and function of plant and micro-organisms are negligible. Micro-organisms also rely on dead or decomposed plant or animal material to sustain their respiration. This is commonly in the form of dead leaves, pen manure and compost
- To use **Vydate L** for pre-plant soil treatment, as a disinfestations control of root knot nematode.
- To use limestone when necessary as flood waters on farmland increase the pH of acid soils and decrease the pH of alkaline soils.
- To use chemicals moderately because flood waters may carry various chemicals that have been picked up as runoff from agricultural fields (eg. sugar plantations, rice fields etc.) in other areas. The impact depends upon the type and dosage of chemicals, eg. manganese will become more soluble under flooded conditions but will return to its normal level of availability as the soil dries out.
- That a portion of some nutrients such as potassium and magnesium will leach out of the plough layer because of the excessive rainfall. If there is no **hardpan** and the subsoil is within 15-20 inches of the surface, the crop will still have access to these nutrients later in the growing seasons.
- To be careful as to the water they are using to water their crops because during the flood nitrate may be reduced to nitrogen gas which is predominantly atmospheric gas. This helps prevent nitrate from entering surface waters. Nitrate is a common water

contaminant that can lead to water quality problems, such as algae bloom and fish death.

- That their soil has a red / orange colour because soil iron may be reduced. When iron is reduced it is transformed from its immobile form to a more mobile form. Immobile soil particles cause the soil to look red or orange.

(3) Integrated Management of Crop Pests in selected growing environments.

The Characterization of the Agroecosystems of a typical coastal area - De Hoop, Western Mahaicony and a typical riverain area - Hubu/Parika Back was initiated.

Visits were made to De Hoop to analyze soil (description/type) and collect pest information. These data will be analyzed to generate information on the agroecosystem of the location.

Information gathering from Hubu /Parika Back has to be continued in the next phase of data collection. This is programmed under Project 2 of draft programme of work 2006.

(4) Identification, conservation and evaluation of plants with biopesticidal properties

Five local botanicals were added to the list of plants utilized in 2004. These are as follows:

Carrion crow bush (*Cassia alata*)

Milk weed (*Euphorbia alata*)

Corilla (*Momordica charantia*)

Sigan (*Meringa spp.*)

Sweet sage (*Lantana camara*)

Preliminary tests and anecdotal information indicate that these plants have insecticidal properties. The search is on for plants with antifungal, antibacterial and insecticidal properties against economic pests of crops.

Services:**Provision of effective, timely and affordable laboratory services in Plant Pathology, Entomology and Weed Science**

The crop protection section processed over 80 plant disease samples submitted by or on behalf of mostly non-traditional farmers. Most of the samples originated from the Coastal belt including Regions 3, 4 and 5. Post-flood assessment was made on a few farms in Region four. There was a great reduction in the number of samples received for processing and diagnosis during the year in review compared to 500 samples in 2004. This can be attributed to the floods earlier in the year.

Educational tours continued with ten schools visiting the section with main interest in Entomology and Plant pathology. Students also visited as individuals and small groups. Field testing of alternative insecticides and matrices in NARI Acoushi ant bait production continued. Mr. Christopher Warui, VSO Entomologist attached to the section conducted the testing in several locations-Kairuni, Linden /Soesdyke Highway, Orealla, Corentyne and on the Essequibo Coast.

Approximately ten thousand 200g packets of acoushi ant bait were produced and distributed in target areas of Guyana. Distribution was done in collaboration with the Ministry of Amerindian Affairs and NARI nurseries countrywide. Demand for the product was very high and the Ant bait facility has the capacity to produce above this quantity. This is the highest volume of bait produced per year in recent times at the Institute.

Team field visits:

Two visits were conducted by a team with personnel from the Ministry of Agriculture and NARI to the following areas:

- Region 7 to assess a disease problem on Coconuts. The disease has been preliminarily diagnosed as Lethal Yellowing. A report on the findings and recommendations was submitted to the Director, Dr. Homenauth by Ms.. McAllister

- Region 1- to assess and identify disease affecting plantain and banana. The disease has been preliminarily diagnosed as Black Sigatoka based on microscopic examination of fresh samples of leaves with stage three symptoms. A report on this visit was submitted to Director, Dr. Homenauth.

Staff Training:

Ms. Kaye McAllister attended a five-day workshop in Kingston, Jamaica in May 2005 sponsored by ISTA on the Electrophoretic Method for Variety identification and Use of PCR for GMO Detection. Ms. McAllister also benefited from four-day “hands on” training on the Identification of Black Sigatoka of Plantain and Banana at the plant pathology laboratory at the Banana Export Board in Jamaica.

III. AGRONOMY DEPARTMENT

STAFF

Head of Department	Ms. B. Forde
Research Scientist:	Mr. E. Ralph
Research Assistants:	Ms. A. Peters-Evans
	Mr. R. Seepaul
Research Technicians:	Ms. C. Cort
	Ms. R. Cato

1.0 INTRODUCTION

The commodities in the Agronomy Department's work programme, for 2005, were bora (*Vigna sesquipedalis*), boulangier (*Solanum melongena*), cabbage (*Brassica oleracea*), cowpea (*Vigna unguiculata*), ochro (*Abelmoschus esculentus*), poi (*Basella alba*), pumpkin (*Cucurbita moschata*), soyabean (*Glycine max*) and tomato (*Lycopersicon esculentum*)

Work was conducted in the areas of varietal improvement, crop management and seed production. Varietal evaluations were completed on cowpea and soyabean. In the area of crop management, a preliminary investigation was completed on the use of plastic mulch in cabbage production. A trial was also done to refine the agronomy of the tomato variety Heatmaster. Seed of selected vegetables and cowpea was produced.

The great flood of 2005 destroyed some of the research and seed production plots that had been established in the November – December, 2004 cropping season.

Details of the Agronomy Department's work programme for 2005 are presented in this report.

2.0 VARIETAL IMPROVEMENT

2.1 Project Title: Cowpea Varietal Trial

This trial was conducted at Kairuni, Soesdyke/Linden Highway to identify early maturing, high yielding lines for further testing.

The treatments were 20 cowpea entries. Nineteen of these entries were obtained from the International Institute of Tropical Agriculture (IITA), Nigeria. The variety Minica IV was used as the local check. The statistical design used was randomized complete block with three replicates.

The results showed that there were significant differences among some of the varieties in the number of days for 50 percent first flower. The imported line IT 97K – 461 – 4 took the least number of days (33.3) for 50 percent first flower. The line IT00K – 898 –5 took the greatest number of days (42.7) for 50 percent first flower. Days to maturity also varied significantly. The earliest maturing lines were IT 98K – 205 – 8 and IT 97K- 461 – 4, which matured in 62 days. The latest maturing lines were IT 99K – 491 – 7 and IT 99K – 1122, which matured in 85 days. The local check Minica IV matured in 79 days. Table 4 shows the mean number of days to maturity for all the entries in the trial.

Table 4: Mean number of days to maturity * of 20 cowpea lines, Kairuni, 2005

LINES	MEAN NUMBER OF DAYS TO MATURITY
IT 98K – 205 – 8	62.0
IT 97K - 461 – 4	62.0
IT 99K – 316 – 2	64.0
IT 98K – 506 – 1	64.0

IT 99K – 529 – 1	65.0
IT 96D – 610	67.0
IT 93K – 452 – 1	67.7
IT 00K – 1150	69.7
IT 00K – 901 – 5	70.0
IT 00K – 898 – 5	70.0
IT 98K – 491 – 4	70.3
IT 97K – 568 – 18	70.3
IT 99K – 1060	71.3
IT 98K – 589 – 2	71.7
IT 99K – 429 – 2	72.0
IT 00K – 1263	73.3
Local check Minica IV	79.0
IT 98K – 128 – 4	81.0
IT 99K – 491 – 7	85.3
IT 99 – 1122	85.3

* Maturity – when 95% of the pods turn brown.

Table 5 shows the seed yield obtained in the trial

Table 5: Total seed yield per hectare for 20 cowpea lines, Kairuni, 2005

LINES	MEAN YIELD Kg/ha
IT 98K – 491 – 4	4253.4
IT 00K – 1263	3776.7

IT 98K – 128 – 4	3405.0
IT 99K – 491 – 7	3350.0
IT 97K – 461 – 4	3291.7
IT 99K – 429 – 2	3275.0
IT 96D – 610	3195.0
IT 99K – 529 – 1	3175.0
IT 99K – 1122	2850.0
IT 99K – 316 – 2	2756.7
IT 99K – 1060	2653.4
IT 60K – 1150	2588.4
IT 98K – 589 – 2	2548.3
IT 98K 205 – 8	2511.7
IT 00K – 901 – 5	2503.4
IT 00K – 898 – 5	2486.7
IT 98K – 506 – 1	2463.4
IT 93K – 452 – 1	2300.0
Local check (Minica IV)	1840.0
IT 97K – 568 – 18	1215.0

The highest yielding entry was IT 98K – 491 – 4 and the lowest yielding was IT 97K – 568 – 18. The local check Minica IV also recorded one of the lowest yields. It was reported, in previous cowpea trials in Guyana that seed yields ranged from 800 kg to 2500kg per hectare. In this trial all the entries had yields higher than the lower end of the range and 15 of the 20 entries had yields higher than the higher end of the range.

On the basis of the results ten of the introduced lines were selected for further testing. These were IT 98K – 491 – 4, IT 00K – 1263, IT 98 – 128 – 4, IT 99K – 491 – 7, IT 97K – 461 – 4, IT 99K – 429 – 2, IT 96D – 610, IT 99K – 529 – 1, IT 99K – 1122 and IT 99K – 316 – 2.

2.2 Project Title: Soyabean Varietal Trial

This trial was conducted, at Kairuni, Soesdyke/Linden Highway, to identify high yielding entries.

The treatments were ten soyabean lines obtained from the International Institute of Tropical Agriculture (IITA), Nigeria. The statistical design was randomised complete block.

The germination of the entries was poor resulting in variable plant stand therefore the trial had to be used for observation and seed recovery. Table 6 shows some of the pod characteristics that were recorded.

Table -6: Quantitative characteristics of ten soyabean lines, Kairuni, 2005.

LINE	POD LENGTH Cm	POD WIDTH Cm	NO. OF PODS PER PLANT
TGX 1871 – 12E	39.2	7.3	39.9
TGX 1903 – 1F	39.8	7.1	74.6
TGX 1903 – 2F	40.9	6.9	152.3
TGX 1903 – 3F	34.9	7.1	60.0
TGX 1903 – 13F	36.2	6.9	102.3
TGX 1904 – 2F	37.5	6.8	56.3
TGX 1904 – 4F	37.1	6.8	56.7
TGX 1904 – 5F	38.5	6.9	58.7
TGX 1908 – 8F	37.2	6.7	45.3
TGX 1909 – 3F	37.4	6.4	30.3

The entry TGX 1903 – 2F yielded the largest number of pods and the entry TGX 1909 – 3F the smallest number.

The other characteristics recorded were seed length, seed width, seed thickness and 100 seed weight. Based on the recorded data the most promising entries were TGX 1903 – 2F, TGX 1903 – 13F, TGX 1903 – 3F, TGX 1903 – 1F and TGX 1904 – 5F.

This trial will be repeated using the harvested seed before any recommendation is made for future testing.

3.0 CROP MANAGEMENT

3.1 Project Title

Preliminary investigation into the utilization of black plastic mulch as a cropping technique in cabbage production.

This study was conducted at Mr. R. Francis' farm at Hauraruni, Soesdyke/Linden Highway. The aim of the study was to investigate the effects of black plastic mulch on the production of cabbage (Var. Tropicana). There were two unreplicated treatments one with mulch and the other without mulch.

The results showed that in the mulched plot, 94 percent of the plants had harvestable heads while in the unmulched plot 42 percent of the plants had harvestable heads at first harvest. The mulched plants had 10 percent more leaves, 5 percent larger heads and 7 percent heavier heads than the unmulched cabbage.

The 7 percent increase in produce may be insufficient to compensate for the cost of procurement, installation and disposal of plastic. It should be noted, however, that plastic mulches were developed as part of a technology package that included drip irrigation, fertigation and hybrid seeds. Therefore, for the full benefit to be realized these other factors need to be included. In addition, the effect of biomulches such as rice straw, leaves and grass can also be evaluated.

3.2 Project Title:

Observation of the performance of tomato variety heatmaster under various agronomic practices.

In this activity two factors were tested i.e. response to fertilizer regimes and plant population. The fertilizer regimes were:

60 t organic matter (om)/ha +180 kg Urea/ha +80 kgTSP/ha, 120 kg MOP/ha

60 t om/ha +180 Kg Urea, 80 KgTSP, 120 KG MOP/ha + liquid fertilizer

60 t om/ha + liquid fertilizer

The plant populations used were:

37,000 plants/ha corresponding to plant spacing 60 cm x 45 cm

27,777 plants/ha corresponding to plant spacing 60 cm x 60 cm

18,500 plants/ha corresponding to plant spacing 90 cm x 60 cm

The trial was transplanted June 28 and harvesting was completed September 21, 2005 Moisture was adequate during the growing period.

The statistical analysis on this trial has not been completed, however the following observations could be gleaned from the data collected. The highest yield (9615g) per plot was obtained from the application of organic matter plus inorganic fertilizer. This treatment also gave the most fruits (73) per plot but organic matter plus inorganic and liquid fertilizer yielded fruits of the heaviest weight (142.7g per fruit).

The highest population density provided the highest yield per plot as well as the most fruits per plot and heaviest fruits. It would appear that the effect of applying liquid fertilizer was to increase the fruit weight.

The combination of highest population density and organic matter plus inorganic fertilizer and liquid fertilizer gave the highest yield per plot of 11287g and the most fruits (80). This is equivalent to 104 t per ha. A proportion of fruits was lost through bird damage.

4.0 SEED PRODUCTION

Seed was produced to ensure that quality seed of adapted varieties reached farmers. During 2005, six crops were harvested for seed from Fort Wellington. These were bora, boulanger, cowpea (Minica IV), ochro, poi and pumpkin. Table 7 shows the seed yield obtained for each crop.

Table -7: Seed yield of selected crops, Fort Wellington, 2005

CROP	SEED YIELD (g)
Bora	27,618
Boulanger	2,899
Cowpea (Minica IV)	7,727
Ochro	9,305
Poi	5,354
Pumpkin	50
TOTAL	52,953

Generally production was good but pumpkin did not do well at this location. The variety of poi continued to seed early. Selection for varietal conformity continued particularly for bora, ochro and boulanger.

IV. LIVESTOCK & PASTURE PRODUCTION DEPARTMENT

HEAD OF DEPARTMENT: Mr. R. N. Cumberbatch

PROJECT OFFICERS: Dr. R. Austin
Mr. J. F. Q. Solomon

INTRODUCTION

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

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

The Livestock Department in an effort to enhance the quality of life of the rural poor continued the duck rearing project as an economic activity to three Amerindian communities, these communities were Tapakuma and Capoey in Region 2 and Toca in Region 9. In addition, the unit also assisted the community of Apoteri in Region 9 in promoting a sustainable sheep rearing programme.

The transfer of technology was another important aspect of the Livestock Programme; officers of the Department made farm visits and established duck production facilities in Regions 2 and 3, and assisted in improving the management systems of pastures. The Livestock Farm was also used as a teaching laboratory by various groups, which included both farmers and students who visited the Farm.

The Officers of the Department also presented aspects of the Department's work at various international fora. These included a presentation made at the Barbados Annual Agricultural Research Conference and at the Regional Forum for Animal Genetic Resources held in Nicaragua,

and the submission of a paper for publication to the Journal of Livestock Research and Rural Development.

DUCK UNIT

The acquisition of the parent flock of Peking ducks in 2003 and the subsequent replacement of the layer flock have resulted in the re-emergence of the duck unit, hence the problem pertaining to low egg production that was highlighted in 2003 and 2004 and resulted in a reduction in the number of ducklings sold has been solved. This unit, as a consequence, is providing the farming community with approximately 1200 ducklings weekly.

The continued development of two new strains of Muscovy ducks, **THE NARI SOLO WHITE MUSCOVY** and the **ROBIN BLUE NARI MUSCOVY** is also a part of the activities of the duck unit. During the year both birds continued to exhibit good growth characteristics, with the **NARI SOLO WHITE MUSCOVY** providing the following characteristics.

GROWTH CHARACTERISTICS

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%
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FEED CONVERSION

Drake	2.3 kg feed/ kg live weight.	Hen	2.6 kg feed/ kg live weight.
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DUCK PRODUCTION PARAMETERS FOR 2005

The production parameters of the duck programme were comparable to those of the last reporting year. Fertility of the hatching eggs was 78.3% as compared with 77.8% for the previous year, with hatchability being 66.4% as compared to 60.9% for the last reporting year.

The duck unit also investigated the use of a restricted diet to reduce the cost of production of the Peking duck. The ducks were fed between 10-30 % less than their average consumption and one group fed *ad libitum*.

SHEEP UNIT

The sheep production unit had a rather successful year. The unit sold approximately 120 quality breeding ewes to selected farmers; in addition, the unit also sold 70 breeding males to the farming community.

The sheep unit 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.

The production parameters when compared to those of the previous year were reasonable, in spite of the flooded condition experienced in January and February 2005 and the excessive rainfall in December 2005. The production parameters are shown in the table below.

Flock size of sheep at the Livestock Farm, Mon Repos, 2005

PARAMETERS	OPENING STOCK	CLOSING STOCK
Breeding males	5	5
Breeding females	156	128
Weaned males	5	6
Weaned females	71	10
Male lambs	56	22
Female lambs	82	69
TOTAL	375	240

The production parameters of the unit for the reporting year are highlighted in the table below.

Production parameters of the Sheep Unit, Mon Repos, 2004 & 2005

PARAMETERS	2004	2005
Number of lambs born	272	175
Number of ewes giving birth	84	119
Average lambs/litter	1.543	1.47
Single births	35%	37.1%
Twin births	55.9%	56%
Triplet births	8.5%	6.9%
Male lambs	49.3%	50.2%
Female lambs	50.6%	49.8%
Male birth weights	2.7 kg	2.55 kg
Female birth weights	2.4 kg	2.325 kg
Average daily gains (Male)	102.49 kg	102.125 kg
Average daily gains (Females)	91.83 kg	95.075 kg

FORAGE UNIT

The forage production unit continued to strive to provide good quality forage for the animals by maintaining improved pastures for the grazing animals. In spite of the floods during the first quarter of the year the forage unit was able to maintain its collection of improved forage species in a germplasm collection on the farm. The unit was used as a teaching laboratory for students from the University of Guyana, the Guyana School of Agriculture and the students from the secondary schools who were preparing for the Caribbean Examination Council Examination.

A number of forages was introduced into the forage nursery collection but because of the heavy rains experienced in November/December 2005 the germination was poor. These forage species have since been successfully planted in the germplasm collection at Ebini.

TECHNOLOGY TRANSFER

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

The Research Paper: *The production parameters of the Barbados Blackbelly and crossbred sheep in a controlled semi-intensive system*, by J. Solomon, N Cumberbatch, R Austin, J Gonsalves and E Seaforth, was accepted for publishing by the Journal of Livestock Research and Rural Development.

ABSTRACT

A study was conducted at the Livestock Farm of the National Agricultural Research Institute, Mon Repos, East Coast Demerara, Guyana, between January 2000 and July 2003, to evaluate the production parameters of the Barbados Blackbelly and crossbred sheep in a controlled semi-intensive production system. The data were obtained from a comprehensive record keeping system used during the study.

The animals were separated into two groups as it relates to breed, the Barbados Blackbelly and the crossbred breeds of sheep. The dams were placed into groups based on their age 1-2 years, 2-3, 3-4, 4-5 and >5 years of age, to evaluate the birth weight of lambs born to dams within their age ranges. Young lambs were evaluated on their birth weight and weaning weight to yearlings. Other parameters evaluated were average daily gains, at the pre and post weaning stages of growth for

the two breed types, birth types expressed as a percentage of total lambs born as well as pre and post weaned mortality.

There were no differences in live weight, ($P < 0.05$) between the two breed types when comparisons were made separately for sex at the different intervals. These included birth weight, weaning weight at 90 days and weights at both 180 and 270 days. There were no differences in birth weights among sexes at the different age ranges. Female lambs, however, had lower birth weights in the 3-4 years and >5 years age range when compared to the 1-2 year, 2-3 and 4-5 year ranges. Based on the LSD test, no differences ($P < 0.05$) could be detected between the two breed types for males in relation to the average daily gains of the animals at pre and post-weaning stages. The percent single births were significantly higher for the crossbred sheep when compared to the Barbados Blackbelly; this trend was however reversed when comparisons were made for twin births.

Keywords: Average daily gains, Barbados Blackbelly, birth type, crossbred sheep, Guyana

Mr. N. Cumberbatch presented a paper entitled, **a comparison of sheep production parameters in a semi-extensive management system on two ecozones in Guyana, and the implications for the future trends of the industry.** R. N. Cumberbatch, J.K.Q. Solomon and R. Austin at the Barbados Agricultural Research Conference

ABSTRACT

Three studies were undertaken in two ecological zones, the Coastal Plains and the Intermediate Savannas, to evaluate the production parameters of the Barbados Blackbelly and crossbred sheep, utilizing pasture as the main source of feed. The studies on the Coastal Plains evaluated data from two production systems, one being a farmer managed semi-extensive system and the other a controlled semi-extensive system conducted on the National Agricultural Research Institute (NARI) Farm, while the study in the Intermediate Savannas evaluated data from a controlled semi-extensive system, at the NARI Livestock Farm, in that ecozone.

At the NARI, Coastal Plains facility the animals were separated into two groups, the Barbados Blackbelly and the crossbred sheep. The dams were further grouped based on age, 1-2 years, 2-3, 3-4, 4-5 and >5 years of age, to evaluate the birth, weaning and yearling weight of lambs. Other parameters ascertained were average daily gains, at the pre and post weaning stages of growth for the two breed types, birth types expressed as a percentage of total lambs born as well as pre and post weaned mortality.

There were no differences in weight gains, ($P < 0.05$) between the two breed types when comparisons were made separately for sex at the birth, the 90-day or weaning weight, the 180 and 270 days weight.

There were no differences in the birth weights of the male and female lambs when comparisons were made among ewes at the different ages. Female lambs, however, had a lower birth weight in the 3-4 years and >5 year old ewes, when compared to the 1-2 year, 2-3 and 4-5 year old ewes.

There were no differences ($P < 0.05$) between the two breed types, for male lambs in relation to the average daily gains at both the pre and post-weaning stages.

The percent single births were significantly higher for the crossbred sheep when compared to the Barbados Blackbelly; this trend was however reversed when comparisons were made for twin births.

The farmer managed study evaluated animals on 22 farms; the animals on the farms were mainly crossbred sheep, which were allowed to run with the rams in an all-year breeding programme. The lambing interval on the farms was between 219 and 332 days, and 92% of the dams gave birth to a single lamb, the average daily gain for the pre-weaned lambs was 88g/day.

The sheep located at the farm in the Intermediate Savannahs, using an all-year breeding season had an average lambing interval of 210 days; the range was 180 to 343 days. The dams were separated into two groups the Barbados Blackbelly and the crossbred sheep; in addition, the ewes were also evaluated according to age, 1-2 years and 2-3 years.

The average weight of the Barbados Blackbelly ewes was greater than that of the crossbred ewes, the 2-3 year old Barbados Blackbelly ewes weighed on average 6kg more than the crossbred ewes of the same age. The mean lamb/ewe was 1.50 and 1.70 for the Barbados Blackbelly for the ewes within the 1-2 and 2-3 year old group respectively, while in the crossbred group the mean was 1.00 and 1.10 for the ewes in the 1-2 and 2-3 year old group.

Dr. Austin attended the Regional Forum for Animal Genetic Resources held in Nicaragua; he presented **the Guyana Report on the State of the Animal Genetic Resources.**

V. POST HARVEST AND AGROPROCESSING DEPARTMENT

STAFF

- | | | |
|--------------------------|---|----------------------|
| 1. Mr. M. Faroze | - | Head of Department |
| 2. Ms G. Parris | - | Research Scientist |
| 3. Mr. I. Khan | - | Research Assistant |
| 4. Mr Rudradat. Ori | - | Research Technician |
| 5. Ms Dhanpattie Budhram | - | Laboratory Attendant |

RESEARCH ACTIVITIES

1. FRUIT DRINK COMBINATIONS

Abstract:

This project was initiated to determine the most favorable fruit drink mixtures that can be used for the production of a fruit drink using a combination of fruit types indigenous to Guyana. The fruit types included carambola, passion fruit, pineapple, plum, West Indian cherry, mango and guava in different combinations. The brix-acid ratio was calculated and an assessment of flavor and color of the drinks determined through a taste panel.

The mixture of pineapple and mango in a 3 to 2 ratio with a brix/acid ratio of 593.9 and cherry and mango in a 1 to 1 ratio with a brix/acid ratio of 390.9 recorded the best scores in both flavour and colour. Other good scores were obtained from passion fruit and guava

in a 1 to 1 ratio and a brix/acid ratio of 93.6, plum and mango in a 2 to 3 ratio with a brix/acid ratio of 322 and guava and mango in a 1 to 1 ratio with a brix/acid ratio of 280. Carambola and guava in a 3 to 1 ratio with a brix:acid ratio of 274.5 scored the highest for flavour but ranked comparatively lower than other combinations in the color attribute.

2. PECTIN PRODUCTION

Preliminary studies were initiated on the production of pectin from fruit waste material including skins, pulp etc. The fruit types included grapefruit, orange, lime, lemon and golden apple. Fruit types such as watermelon, gooseberry and passion fruit will be added to the list. The process involves the extraction of pectin using an alcohol to precipitate it, prior to drying. Pectin is a substance used extensively in industries such as in pharmaceuticals, cosmetics and agro-processing e.g jams, jellies, ice cream, beverages, baked products etc. as food stabilizers, enhancing viscosity etc. Guyana imports most of the pectin substances that are used in local food manufacturing.

3. PRODUCTION OF SELECTED PRODUCTS

Preliminary studies were attempted on the production of selected products. This included ochro in brine, avocado in brine, grapefruit in syrup, cashew jelly, dried pineapple, dried cashew apple, fruit icicles (cherry, cashew and pineapple). In the year 2006 efforts will be made to finalize these into clearly defined research projects.

WORKSHOP/TRAINING

1. The mushroom unit at NARI in close collaboration with the University of Guyana conducted a training programme on mushroom cultivation at the Berbice Campus. Lectures and presentations were made by speakers attached to the mushroom unit of NARI.

2. The mobile agro-processing demonstration unit made several trips to the fruit production and processing areas of Guyana. Among the areas included were NARI (Mon Repos, East Coast Demerara), Canal #1 Polder and The Everest Ground, Georgetown (Guyana Nite activities). During these visits demonstrations were made on the use of some of the equipment in the Unit. It is hoped that through these training activities the Guyanese people can be sensitized to the importance of utilizing local fruit and vegetable produce for conversion to processed forms and value added products. Later in the year additional trips were made to other locations including Region # 5, Linden and Georgetown.
3. The Postharvest and Agro-processing department in collaboration with NGMC conducted a series of training programmes on the marketing and proper postharvest handling practices of fruits and vegetables. The areas included Anna Regina, Essequibo and MMA (Region # 5).
4. The postharvest and agro-processing department conducted three training programmes on agro-processing to interested participants. One was done at NARI, Mon Repos to an audience that included both public and private stakeholders. The second was conducted at Charity, Essequibo to the Charity Women's Group and the third to a Region # 5 Group. Several presentations were made on certain important aspects of food processing such as quality control, food spoilage effects, packaging, labeling, pectin production, solar drying technology, marketing issues and food standards. Several products including dehydrated fruits and vegetables were on display. The Women's Group at Charity were involved in a practical session of baking a cake using raw materials such as banana flour and banana raisin supplied by the department.
5. The postharvest and agro-processing department participated in the Guyexpo exhibition held at the Sophia Complex, Georgetown and in Bartica Night. Several exhibits from the department including dehydrated products, locally produced pectin, jams, jellies etc. were on display.

OTHER ACTIVITIES

1. The commercial production of edible mushrooms (Oyster) commenced during this year. Once successful growth and production are established it is intended to invite potential investors and producers to a training programme on the commercial aspects of edible mushroom cultivation as an activity to propagate the technology.
2. The postharvest and agro-processing department worked in close collaboration with the Region# 3 farmers' Association and PRCSSP on the project to establish a packhouse and processing facility at the Parika Marketing Complex. This project is considered very important in preparing farmers' produce in Region # 3 with the necessary quality required for the export market.

VI. SOIL & WATER MANAGEMENT DEPARTMENT

STAFF:

Mr. M A Livan:	Head of Department
Mr. David B. Fredericks:	Research Scientist
Mr. S Hollingsworth:	Research Technician II
Mr. S. Paul:	Research Technician II
Ms M. Joseph:	Research Technician I

General: The work of the Soil and water management department was severely affected by the flood of January – February 2005. Many of the maps, reports and monoliths in the Soil and Land Use Division were destroyed while the transformer and rotary shaker in the Soil Microbiology Laboratory were completely destroyed making this laboratory inoperable for the rest of the year. Work was therefore centred on recovering/restoring of reports, maps, Rhizobium strains, etc.

1. SOIL AND LAND USE DIVISION

Project: Computerising of Soil and Land Use Surveys Reports

Title: Establishment of a Database for Soil and Land Use Maps

Objective: To have easy access to Soil and Land Use information on Guyana.

Justification / Beneficiaries

This is necessary for informed decision making by farmers, researchers and entrepreneurs. Too often complaints are made at national and other fora of untimely access to existing data owing to shortage/absence of institutional memory. This project, like its predecessor 'Establishment of a CD of Soil and Land Use Survey Reports (2004)', is intended to reduce response time for existing datasets to less than 5 minutes.

Methodology

1. All soil and land use maps within the Division will be categorised into 15 themes.
2. These maps will be stored in three steel cabinets labelled 1, 2 and 3 respectively.
3. The drawer / slot of each cabinet will be occupied by large water-resistant cardboard folders.
4. All folders will contain maps based on their theme and the type of map material e.g. Stable Base, Tracings and Prints.
5. Maps will be accessed through a 5-digit reference code denoting theme, cabinet number, slot/drawer, folder number and map number.

Preliminary Results

1. In excess of 1000 map sheets for Guyana exist within the Division.
2. Approximately 100 sheets have minor to extensive damage owing to the January 2005 Guyana Floods.
3. All maps are recorded under 15 map themes, these include:
 - a. Topographic Maps produced by Directorate of Overseas Surveys (DOS).
 - b. Seacoasts Maps of Guyana.
 - c. Map of Geological Surveys.
 - d. Drainage and Irrigation Maps.
 - e. Soil Maps not produced by Simonson.
 - f. Soil Maps produced by Simonson.

- g. Location Maps for projects.
 - h. Topographic Maps of Guyana produced by Terra Surveys.
 - i. Vegetation Maps
 - j. Maps of Project Plans
 - k. Land Use and Land Cover Maps
 - l. Land Capability Maps
 - m. Climatic Maps
 - n. Administrative Maps
 - o. Other themes e.g. Communication Linkages.
4. 40% of all map sheets have been placed in cabinets and assigned a five digit code for easy access.
5. Map Catalogue on Soil and Land Use is 50% complete.

Other activities of the division

1. A field visit was made to a community in the Rupununi Savannahs. The report on this visit follows.

Title: Report on Field Visit to Tiger Pond Community Farm, Rupununi Savannahs

- Objectives:**
- (i) To understand the farming system presently conducted in this community.
 - (ii) To produce a report that will recommend appropriate land use practices for this ecosystem.

Justification / Beneficiaries:

The general area of the Pakaraima Mountains, West Central Guyana is hinterland in nature. As is expected, many communities practice crop farming both for subsistence and commercial purposes. These farmers do not readily benefit from agricultural extension services compared to their counterparts on the Coastal Plains of Guyana. Thus, any opportunity that can aid in improving their farming and production systems should be capitalised on. This Safari presented such an opportunity, and was welcomed by both the community and the technical team.

Methodology

1. On farm interviews were conducted with representatives of the community farm to determine the crops cultivated and their land use problems.
2. Soil samples (0 - 20 and 20 - 50 cm) were collected at two locations through the use of augering (according to "FAO Guidelines for Soil Profile Description"). The first sample was collected in the vale where cassava plants showed stunted growth. The second sample was collected at the foot slope where cassava plants were dying presumably from infections on their stems. These samples were analysed to identify the soil nutrient status.
3. Infected cassava stems were collected for laboratory pathological diagnosis and recommendations at NARI.

Results:

Soil and Tissue Characteristics of the Farm

1.1 Physio-chemical Characteristics of the Soil

The soils of this area fall within the association of shallow excessively drained greyish brown and brown sandy loam and sandy clay loam soils. These soils are classified as Lithosols, deep saprolite and acidic rock phases at the Great Group level.

The soil in the west of the farm is deep, coarse sand. It is grayish in colour with white substratum. It is droughty and very friable. It has a relatively low pH (3.6), low electrical

conductivity (0.14) and low phosphorus (4.0 ppm.) (Tests conducted by NARI's Soil Chemistry Laboratory). This section of the farm is unsuited for crop production as droughty soil conditions and high soil temperatures persist for long periods during the cropping cycle. Soil auger samples at depth of 10 - 40 cm were hot to the touch.

The soil in the east is shallow, and has a sandy loam texture, which may be gravelly or stony, consisting of topsoil directly overlying the weathering rock. It is brown in colour with gray substratum. It has medium pH (5.7), low electrical conductivity (0.21) and low phosphorus (8.0 p.p.m.). This area has moderate potential for agricultural development. However, the fact that some crop production is being conducted indicates that the area lends itself to the possibilities of improved practices.

Pathological diagnosis was done on the soils but no nematode was found.

1.2 Pathological Diagnosis of Cassava Tissue

The results of diagnosis conducted by NARI's Plant Pathology Laboratory on cassava stem samples indicate:

1. The presence of Bacterial colonies.
2. The presence of *Aspergillus* (spp.) and *Botryodiplodia theobromae* fungus.
3. Severe infestation of 'scale insects'.

'Scale insects' are known to attack cassava plants especially during the dry season. They act by robbing plants of essential nutrients, thereby weakening the plants and making them susceptible to attacks by bacteria and fungi.

Recommendations

The recommendations that follow are based on the findings above.

1. Farmers should concentrate their efforts of crop production on the eastern section of the farm. The western section of the farm is presently unsuited for crop production.

2. Regular monitoring of the cassava crop (especially in the dry season) for early detection of 'scale insects' should be done.
3. Where early 'scale insect infestation' is noticed (before fungus appears and plants start to dry), plants should be drenched with soapy water to which a few drops of bleach are added. The soapy water removes the 'scale insects' and the bleach acts to prevent bacterial and fungal infection.
4. If neem is available, soak some leaves overnight in water and apply the liquid to infected plants.
5. Plant material severely infected with 'scale insects' has no chance of recovery as bacteria and fungi have destroyed their vital tissues. Severely infected plants should be collected and burnt off farm.
6. Sticks may be treated before planting by washing with soapy water.
7. Avoid the use of pesticides for treatment of these diseases.
8. To pursue the optimizing of agricultural land use in this area, it is recommended that the relevant personnel conduct an assessment of the available resources in the area.

Other Considerations

Members of the community farm should be encouraged to:

1. Have an effective liaison with the Ministry of Agriculture/NARI. This linkage could also address the problems of acoushi ants and rats in the field.
2. Acquire and store seed, fertilizers and other farming requirements sufficient for at least two cropping seasons.
3. Establish appropriate storage facilities for harvested produce.
4. Secure adequate transportation facilities and markets for their produce.

Other activities of the division

Two environmental seminars were attended in 2005. These were as follows:

1. National Awareness Seminar on Desertification
2. Launch/Workshop of National Capacity Self-Assessment (NCSA) Project

Project Proposals

Two Project Proposals were prepared for NARI's collaboration with other agencies. Both proposals are awaiting funding from the relevant collaborators. The proposals were as follows.

1. An assessment of the Agricultural Land Use Potential in Monkey Mountain Village, North Pakaraimas, Region 8
2. The Use of Fat Pork to Establish Green Areas At Selected Sites in Linden Region 10.

II. SOIL MICROBIOLOGY

Three strains from the available strains of Rhizobium were cultured and their efficiency of nodulation on cowpea was investigated in a greenhouse study. The treatments were as follows:

1. Tha 401
2. Tal 420
3. 086
4. No inoculum +fertilizer N
5. No inoculum no fertilizer

Plants were harvested at weeks four and six and the following parameters were measured:

- Plant height
- Number of nodules/plant
- Number of effective nodules/plant
- Plant dry matter weight

The results indicated that for plant height treatment #1 (Tha 401) had the tallest plants and was significantly taller than treatments 3 (086) and 4 (fertilizer) with treatment 3 having the shortest plants.

There were no significant differences between treatments for number of effective nodules though treatment 2 (Tal 420) seemed to have the most effective nodules and treatment 4 the least.

Plant dry matter weight was highest in treatment 4 (fertilizer) and this was significantly higher than treatment 3 (086).

The results show that strain 086 is not an effective strain for cowpea as its nodulation potential and its effect on plant growth is poor. Whether the high dry matter weight of the fertilized treatment versus the other treatments, can be transferred into grain yield needs to be tested in field trials.

Other activities

The Head of Department acted as the external supervisor for the following University of Guyana Final year students' projects:

- Effect of high levels of aluminium on the growth of tomatoes
- Comparison of Organic and Conventional sugar cane production and the effect on soil physical properties
- Comparison of the rate of decomposition of different mixtures of Bagasse and filter press mud
- Evaluation of TM-21 (A chemical Biostimulant) in sugarcane production.

RE-VEGETATION OF THE NORTH EAST KARA KARA MINED OUT AREA

Introduction

Bauxite mining activities in the Linden area have resulted in extensive landscapes characterized by large, stark, unconsolidated piles of mine spoils, virtually devoid of vegetation, dumped on gently sloping sandy ground with sparse vegetation. The sloping topography of these mined-out areas, their sandy texture and lack of soil cover on the spoil piles and subjacent sandy slopes increase the potential for erosion during periods of intense rainfall, with the most active erosion occurring in the spoil piles. The low pH and lack of or poor development of soil militate against the establishment of vegetation, since conditions are acid and there is not a good medium for plant/vegetation growth. Vegetation, where present, is sparse and consists mainly of iron grass (*Sporobolus jacquemintii* Kunth.), razor grass (*Paspalum virgatum* Linn.) and fat pork (*Chrysobalanus icao*), which colonize the ground in patches. These species do not provide

adequate ground cover, which would: 1) Increase infiltration and soil moisture retention and 2) Decrease runoff and so reduce erosion. Therefore, relatively large areas remain unconsolidated and readily available for ongoing erosion. The plants present have little effect on the movement of water and sediment that flow down slope from the erosion of the spoil piles. The existing vegetation does not provide adequate organic matter content to promote soil formation and improve the poor structure of the incipient soil.

The overall effect is that there is unabated erosion of the spoil piles with the potential to cause siltation of waterways and damage to the communication network (roads and bridges) during periods of intense rainfall. Moreover, there is no alternative or beneficial use of these extensive areas after mining. Re-vegetation of the slopes subjacent to the spoil piles would put this land to beneficial use and provide possible economic agricultural ventures such as crop and livestock rearing for residents in the area. This action would also lead to a reduction in erosion and an increase in the vegetative cover.

Through the initiative of the Guyana Geology and Mines Commission (GGMC) and the National Agricultural Research Institute (NARI), a team from NARI and GGMC made an exploratory visit to the abandoned East Montgomery, Dorabece and Kara Kara bauxite mines to assess their potential for re-vegetation. North East Kara Kara mined out area proved to be the most suitable because of its accessibility, relatively gentle topography and relatively few spoil piles, and the area west of and subjacent to the base of the southern spoil pile was selected for the re-vegetation trials. East Montgomery and Dorabece mined out areas will need some amount of earth movement to make them suitable for re-vegetation.

General Objective

The general objective of the re-vegetation trials is to re-vegetate four hectares of ground subjacent to the spoil piles in North east Kara Kara mined out area with appropriate tree or crop species of economic importance and pasture grass to support small ruminants, while simultaneously reducing runoff and erosion by promoting vegetative growth at the base of the spoil pile.

Specific Objectives

1. To improve the soil quality (pH, structure and nutrient content) by the addition of ameliorants and manipulation of the soil characteristics to produce an improved medium for plant growth. This will include addition of organic matter to improve soil structure through establishment of *Glyricidia spp* and *Brachiara humidicola grass* as ground cover. The *Glyricidia spp*, which will be used as mulch, will also enhance the soil nitrogen content.
2. To control runoff and erosion from the spoil piles and encourage infiltration on the slopes by: establishing lines of *Vetiver* grass along the contours, contour harrowing, and establishing ground cover over the entire project area by planting *Brachiara humidicola grass*.
3. Out of the *Brachiara humidicola grass* ground cover, to initially establish 1.3 ha of pasture for grazing by small ruminants. As the limes and *Paulownia* grow to a certain height, it will be possible to graze small ruminants over the entire project area.
4. To establish 1.3 ha of *Paulownia spp.* which is a rapid growing forest specie that can be used for plywood manufacture.
5. To establish 1.3 ha of limes as an economic crop.

Two additional specific objectives were added in October 2004. These were:

6. To establish fat pork (*Chrysobalanus icao*) over part of the project area, and
7. To establish cashew (*Anacardium occidentale*) over part of the project area.

Description of Project Area

The project area is east of the Linden Highway and south of Kara Kara Creek, at the beginning of the road leading to the Kara Kara mines. It is bounded to the north by the mine road, to the east by the western spoil pile of the North East Kara Kara mine, and to the west by an embankment that extends along the eastern edge of the Linden Highway. The land slopes from south to north towards the Kara Kara Creek. E-W contours were established across the slope. The area is divided

into three 1.3 hectare plots oriented N-S running down the slope: the easternmost plot is for the establishment of *B. humidicola* grass for pasture for small ruminant livestock; the middle plot is for the establishment of *Paulownia* plants, and the westernmost plot is for the establishment of lime plants.

There are two major erosion gullies in the spoil pile, one to the southeast and one to the southwest of the project area.

Figure 2 shows the project area.

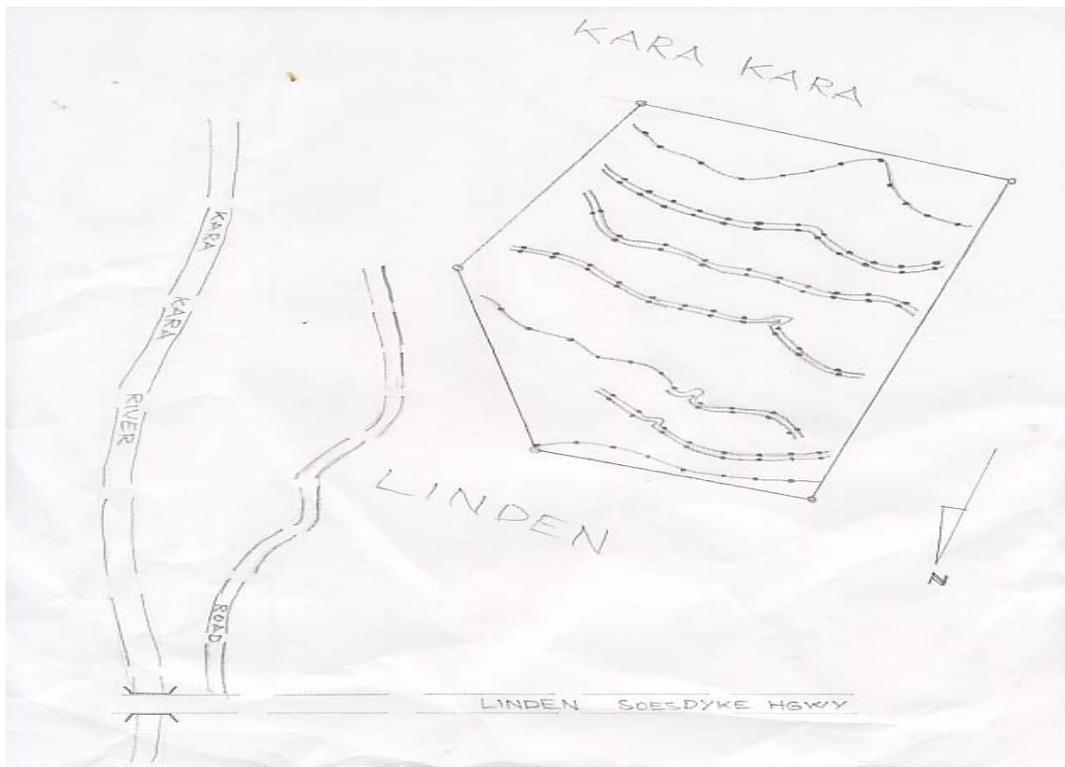


Fig. 2: Sketch Plan of the Revegetation Project Area (Not Drawn To Scale), Kara Kara

Strategy

The strategy used was to improve soil pH, nutrient and organic matter status by the periodic addition of lime, organic and inorganic fertilizers, and to improve soil structure by addition of organic matter through establishment of ground cover grass (*B. humidicola*) and *Glyricidia* shrubs that would be used as mulch. Lime and fertilizers were applied directly to planting areas for grass and planting holes for plants. By fixing nitrogen, *Glyricidia* would enhance the soil nitrogen

content. Improved soil nutrient, organic matter content and structure will promote growth of the *B. humidicola* and *Vetiver* grasses and lateral spread of the *B. humidicola* grass to enhance ground cover.

Erosion of the spoil pile has the dual effect of moving large quantities of sand and progressively spreading it over, and creating disruptive erosion channels in the subjacent ground resulting in the progressive covering and disruption of the area that is being vegetated, close to and away from the base of the spoil pile. Erosion control was effected by planting of rows of ‘fences’ of *Vetiver* grass along the contours established over the project area and across the lower to middle reaches of the two major erosion gullies in the spoil pile, in the north eastern and south eastern borders of the project area. As the establishment of the *Vetiver* grass fences were affected by spoil pile erosion, it became necessary to install rows of silt fences, made of fabric, across the two major erosion gullies. The establishment of the *B. humidicola* grass as ground cover over the entire project area was used as a measure of erosion control by reducing runoff and increasing infiltration.

Water management was effected by the erosion control measures to promote infiltration and reduce runoff, and by increasing the organic matter content of the soil and establishing ground cover.

In the northern third of the area, the *B. humidicola* grass was established as pasture for small ruminants in a part of the project area. When the lime and *Paulownia* trees grow to a certain height, the ground cover *B. humidicola* grass throughout the project area will be used as pasture.

Subsequently, in October 6, 2004, it was agreed that fat pork (*Chrysobalanus icao*) and cashew (*Anacardium occidentale*) would also be planted. Seedlings will be planted as opposed to seeds to enhance the success of establishment.

Work Done

Work done during the period was as follows:

- Under Objective 2): Maintain Silt Fence; Plant *Vetiver* grass in gullies
- Under Objective 3): Maintain *B. humidicola* ground cover and pasture grass

- Under Objective 4): Replant and maintain *Paulownia*
- Under Objective 5): Replant and maintain limes
- Under Objective 6): Collect and set fat pork seeds
- Under Objective 7): Maintain cashew plants

At a meeting between NARI and the GGMC held on June 6, 2005, the Commissioner insisted that vehicles from the GGMC should be used for transporting the project officers to the project site.

Work for the period was seriously hampered by the non-availability of the vehicle to get to the project site during the latter part of the period. During the entire period, July – December 6 the GGMC vehicle was available six times.

The non provision of funds for the October - December period and the unavailability of vehicles to visit the site destroyed the continuity of the work and rendered some of it ineffective. Requests for a vehicle to GGMC were met with the response that either the vehicle or a driver was unavailable.

Erosion Control

The silt fence material ordered from Forestry Supplies Inc. had arrived in the country but was not cleared until sometime later. Meanwhile those received from the GGMC were erected in January. The heavy rainfall experienced in the latter part of May resulted in the sand on the upper slopes of the spoil pile sliding down the slopes and ripping out the silt fences. The *Vetiver* grass planted in April suffered the same fate as the silt fences. These fences were later repaired and new fences were erected in the southeast gully but the unavailability of stakes for the fence and the unavailability of transportation to visit the site brought this activity to a halt.

The *Vetiver* grass lower down the slope was fertilized in January, March, July September and October.

The *B. humidicola* established in the other areas was fertilized in January, March, July, September and October. Grazing by cattle is rampant.

Pasture: - The heavy erosion in the south-east is still restricting the development of the pasture in the upper reaches of the slope; however, with the removal of the fat pork lower down the slope the grass (*B. humidicola*) is gradually colonizing the area.

The flood on the East Coast of Demerara during January and February, 2005 resulted in the death of the *Glyricida* plants that were in the Nursery at Mon Repos awaiting transplanting. Five hundred cuttings were later obtained from Ebini and placed to root. In September, 120 of these cuttings were transplanted at the project site. The unavailability of transportation facilities and the onset of the dry season prevented the further planting of the remainder of the *Glyricida*. At present three of the *Glyricida* plants were damaged by cattle. The others seemed to be well established and are doing well as is evidenced by the active nodules on some of the roots that were examined.

Paulownia: The flood on the East Coast of Demerara during January and February, 2005 resulted in the death of 400 *Paulownia* plants that were in the Nursery at Mon Repos awaiting transplanting. Root cuttings were obtained from Ebini and placed for rooting in the nursery at Mon Repos. Three hundred *Paulownia* plants were planted during the period. However, due to the heavy rainfall, erosion and lack of care – due to the infrequent visits caused by the unavailability of transportation facilities – about 90% of these plants have died. One of the major causes of death of these plants was the waterlogged condition in the planting holes due to the settling out of the clay sized particles which sealed the surface and sides of the planting holes thereby starving the plant roots of oxygen. Another cause of death of the plants is what appears to be a calcium deficiency as evidenced by the yellowing and eventual death of the younger leaves and apical meristem of the plant.

The older plants were circle weeded, pruned and fertilized with pen manure obtained from Silver Hill.

Limes: - The existing lime trees were sprayed for citrus leaf miner, circle weeded and fertilized. Chicken litter was spread around the plants. Pruning was also done. Accelerated erosion in the south west gully has resulted in 20 of the lime plants either being covered with eroded material or washed away down the slope.

Praedial larceny is a problem as is evidenced by the removal of five lime plants that were dug out and taken away.

Cashew: - Cashew plants (*Anacardium spp.*) that were planted in January 2004 are growing robustly but have been affected by anthracnose/rust that appeared on the leaves.

Fat Pork: - At a meeting held on June 6, 2005 the Commissioner advised that 1000 – 3000 Fat pork trees be planted in other mined out areas in Linden, that schools should be involved as a weekend exercise with an environmental focus. To this end a project proposal was prepared for the propagation and planting of fat pork in bauxite mined out areas of Linden. This project will involve the schools in the Linden area. NARI will propagate the plants and sensitize the community through a Participatory Rural Appraisal approach, with pupils from the senior schools involved in the planting of the trees. NARI will undertake to determine the correct planting density of the trees.

Others: - A paper entitled “**Re-vegetation of the North East Kara Kara Mined out Area: 18 months Later**” was presented by Mr. M. Livan to the National Mining and Quarrying Conference held in August, 2005.

RECOMMENDATIONS

There is urgent need for the erection of fences around the plot as the area is used daily by grazing cattle which not only eat the grass but also trample the young plants. About 30 to 40 heads of cattle seem to graze the area daily.

The infrequent visits caused by the unavailability of a vehicle to visit the site and lack of funds have severely hampered the development of the project. Owing to the unavailability of transport the following occurred.

- a) We were unable to plant the total number of *Glyricida* plants

- b) Had we been able to visit the plot more regularly we would have observed the problems with the *Paulownia* and taken corrective actions
- c) We would have been able to repair the breached silt fence in the south west of the plot and save the lime plants that were destroyed.
- d) We would have been able to complete the planting of the *Vetiver* in the gullies.
- e) We were unable to fence the project area

VII. HORTICULTURE DEPARTMENT

STAFF

Director of NARI and Head: Dr. O. Homenauth¹

Research Assistant: Ms. M. Sookdeo

Research Technicians: Ms. D. Singh
A. Dhanraj²

Clerical Support: Ms. L. Persaud³

Plant Nursery Supervisors: Ms. V. Lindore Bartica
Mr. B. Sahadeo Benab
Ms. J. Sutton Charity
Mr. L. Mendonca Hosororo
Mr. A. Techchand Mon Repos
Mr. I. Singh Pouderoyen
Ms. R. Farias St. Ignatius
Ms. G. Todd⁴ Timehri

Other: Ms. J. Klass Kairuni Horticultural Station

INTRODUCTION

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

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

In 2005 there was a severe shortage of Research Assistants. This affected the quantity and quality of work done.

¹ Assumed duties December 2004

² Appointed September 2005

³ Transferred to Accounts Dept. NARI, April 2005

⁴ Transferred from Head Office to Plant Nursery, June 2005

SECTION A. RESEARCH AND DEVELOPMENT

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

Objectives

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

Status

This is an ongoing project and maintenance of local and foreign varieties continued in plots located at Benab, Fort Wellington, Kairuni, Mon Repos and Timehri. New selections such as, Sweet tamarind and the Rata fruit were added.

Throughout this year several exotic plants were planted at various Plant Nurseries.

Mon Repos Plant Nursery - 1 Rambutan red variety (marcottage- 4 months old)
2 Sweet Tamarind (*Tamarindus indica* L.), and
2 Rata fruit (*Garcinia dulcis*)

Timehri Plant Nursery - 1 Rambutan red variety (seedling- 1 year old)

Preparations are being made to accommodate the yellow variety of Rambutan, a variety of Peach, and the Bahara fruit (*Artocarpus lakoocha*).

2. Project Title: Exploring various vegetative propagation techniques (budding, grafting, cuttings, marcottage) on different tropical fruit trees.

Objective

To identify the specific vegetative propagation technique (budding, grafting, cuttings, marcottage) that will be effective for different fruit crops.

Justification

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

Status

This project has been completed, where fruits such as Rambutan, Genip, Guava, Cocoa, Golden apple, and Passion fruit were propagated by vegetative means. A specific type of vegetative propagation was allocated for each fruit crop except the Golden apple. Results were as follows:

Fruit crop		Type of vegetative propagation
Rambutan	-	marcottage
Genip	-	marcottage
Guava	-	marcottage
Cocoa	-	wedge grafting
Passion fruit	-	cuttings

3. Project Title:

Influences of Organic and Inorganic fertilizers on growth and yield responses of two varieties of grafted mango (*Mangifera indica*)

Objective

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

Status

This project was established in 2002 at Field 30, Mon Repos but suffered a setback owing to the flood of January 2005 and ruminants which continuously damaged the plants.

4. Project Title:

The yield potential of three varieties of passion fruit.

Objective

To identify the yield of three passion fruit (*Passiflora edulis* Sims) varieties, namely Local Yellow, Local Pink and Brazilian Yellow growing on a clay soil at Mon Repos.

Status

This project was established in 2003 at Field 18, Mon Repos but owing to excessive floods in early January 2005, the plots were destroyed. The trial was replanted in March 2005 and terminated in November 2005. The reasons cited for termination was the rise of inferior hybrids, which occurred among the three varieties of passion fruit.

Passion fruit is an open pollinated crop, thus it is recommended that appropriate isolation distances be implemented and maintained to alleviate the problem of cross pollination which can affect the quality and quantity of yield as was observed.

SECTION B. PRODUCTION

5. Project Title: Plant Nursery Operations

OBJECTIVE

To propagate quality plants at the various Plant Nurseries.

STATUS

General

Routine work continued at all Plant Nurseries. There was a lack of accurate record keeping and timely input of data due to incompetence of the staff assigned to execute the tasks. Efforts to rehabilitate the Mon Repos Fruit Orchard proved futile owing to the lack of proper execution of tasks by staff of the Mon Repos Nursery.

The Department continues to suffer from the lack of qualified technical staff to assist in the achievement of goals.

VIII. HUMAN RESOURCES REPORT

1. RECRUITMENT OF STAFF

A Other Technical and Craft Skilled

- 1) Mr. Rudradat Ori -Research Technician 1 - 2005-09-26
- 2) Mr. Leslie Wilson - Research Technician 1 - 2005-09-27
- 3) Mr. Anthony Dhanraj - Research Technician 1 - 2005-09-27

B Clerical and Office Support

- 1) Ms. Malini Singh - Assistant Accountant 2005-10-05
- 2) Mr. Avinash Deonarine - Accounts Clerk 11 2005-12-01

C Semi-skilled Operatives and Unskilled

- 1) Mr. Bhageerat Itwar - Security Guard 2005-07-08
- 2) Mr. Deochand Narine - Security Guard 2005-11-12
- 3) Mr. Welton Griffith - Security Guard 2005-11-18
- 4) Mr. Rajcoomar Persaud - Security Guard 2005-06-10
- 5) Mr. Premnauth Doodnauth - General Worker 2005-11-16
- 6) Mr. Dennis Benjamin - General Worker 2005-08-11
- 7) Mr. Anthony Eastman - General Worker 2005-06-20
- 8) Mr. Nigel Pollard - General Worker 2005-06-20
- 9) Mr. Mohanlall Jagdeo - General Worker 2005-09-05
- 10) Mr. Ameer Baksh - General Worker 2005-10-20

2. PROMOTION

A Other Technical and Craft Skilled

- 1) Ms. Goldwyn Todd - Plant Nursery Supervisor 2005-06-16

B. Clerical and Office Support

1) Ms. Liloutie Persaud - Accounts Clerk 11 2005-01-06

C. Semi-skilled Operatives and Unskilled

1. Mr. Deonarine Sanchara - Equipment Operator 2005-02-04

2. Mr. Nehru Persaud - Senior Guard 2005-08-01

3. Mr. Hary Ram - Senior Guard 2005-08-01

3. RESIGNATION

A Senior Technical

1. Dr. Patrick Chesney - Research Scientist 2005-03-21

2. Ms. Juneann Garnett - Research Assistant 2005-05-10

3. Ms. Charissa Wilson - Research Assistant 2005-12-01

B Other Technical and Craft-skilled

1. Ms. Shelley Heath-London - Snr. Research Technician 2005-12-25

2. Ms. Loyce Ifill - Snr. Research Technician 2005-12-22

3. Ms. Natalie Miller-Bressette - Research Technician 1 2005-11-01

4. Mr. Brahim Evans-Saffee - Research Technician 1 2005-08-23

5. Mr. John Jordan - Electrician 2005-08-08

6. Ms. Maple Marshall - Storekeeper 2005-11-1

C Clerical and Office Support

1. Mr. Wayne Melville - Accounts Clerk 11 2005-03-24

2. Mr. Kellissa Fanfair - Accounts Clerk 11 2005-04-06

D. Semi-Skilled Operatives and Unskilled

1. Mr. Richard Pearce - Nursery Foreman 2005-02-28

TERMINATION OF SERVICE

4. DISMISSAL

A. Other Technical and Craft Skilled

1. Mr. Lawrence Saheed - Research Technician 1 2005-10-01

B Semi-skilled Operative and Unskilled

- 1) Mr. Leslie Peters - Mechanic 2005-04-13
- 2) Mr. Andre Watts - Security Guard 2005-05-27

C Death

- 1) Ms. Olive Porter - Security Guard 2005-08-22
- 2) Mr. Farouk Muntaz - Security Guard 2005-03-15

TRAINING

A. OVERSEAS

Short Courses/Workshops/Study Tours

Short Courses

1. Mr. Lionel Jagbir, Farm Manager, participated in a Training Course on “**Vermicomposting**”, held in Trinidad and Tobago, from February 27, 2005 to March 06, 2005,
2. Ms. Somwattie Pooran, Research Assistant participated in a Training Course on “**Vermicomposting**”, held in Trinidad and Tobago, from February 27, 2005 to March 06, 2005,
3. Dr. O. Homenauth, Director, participated in a “**FAO/CARICOM/CARIFORUM Steering Committee Meeting**”, held in Barbados, from April 08, 2005 to April 09, 2005.

4. Mr. Ramdeo Seepaul, Research Assistant, participated in a Training Course on **“Building Capacity in Vegetable Production and Water Management”** held in Antigua, from June 07, 2005 to July 02, 2005.
5. Dr. O. Homenauth, Director, participated in Meeting on **“Analysing Agriculture Service Techniques and Innovation Systems for ACP Professionals”**, held in Jamaica, from July 18, 2005 to July 22, 2005.
6. Mr. M.S.A. Faroze, Research Scientist, participated in a Training Course on **“ Global Environment Change and Food Systems Programme”**, held in Jamaica, from August 30, 2005 to August 31, 2005.
7. Dr. O. Homenauth, Director, participated in a Meeting on **“5th Caribbean Week of Agriculture”** held in St. Kitts/Nevis, from October 05th, 2005 to October 08th, 2005
8. Mr. Rickford Adrian, Research Assistant, participated in a Training Programme on **“Fertiliser Quality Control”** held in Faridadbad, Haryana, India, from October 06, 2005 to November 06, 2005.
9. Dr. Robin Austin, Research Scientist, participated in a Training Course on **“Animal Genetic Resources”** held in Nicaragua, from December 05, 2005 to December 09, 2005.

Conferences:

1. Mr. Nigel Cumberbatch, Senior Research Scientist, participated in **“National Agricultural Research Conference”**, held in Barbados from July 18, 2005 to July 19, 2005.

Workshops

1. Ms. Kaye McAllister, Research Scientist, participated in a Regional Workshop on **“Electrophoretic Methods and PCR-Techniques for Variety**

Verification and GMO Detection”, held in Kingston, Jamaica from May 09, 2005 to May 15, 2005

B. LOCAL

Short Courses

1. Ms. June Eastman, Confidential Secretary, participated in a Training Seminar on **“NIS in Perspective”**, held at the National Insurance Scheme Headquarters, Guyana, from April 27, 2005 to April 28, 2005.
2. Ms. Anthonette Benjamin, Typist Clerk participated in a Training Seminar on **“NIS in Perspective”**, held at the National Insurance Scheme Headquarters, Guyana, from April 27, 2005 to April 28, 2005.
3. Ms. Anthonette Benjamin, Typist Clerk, , participated in a Workshop on **“Typist Skills”**held at the Public Service Management Training Division, Guyana on July 19, 2005.
4. Ms. Monica Sookdeo, Research Assistant, participated in a Training Programme on **“Certificate in Supervisory Management – Module 1”**, held at the Public Service Management Training Division, Guyana, from June 27, 2005 to July 01, 2005.
5. Ms. Roseann Jaundoo, Assistant Accountant, participated in a Training Programme on **“Certificate in Supervisory Management – Module 1”**, held at the Public Service Management Training Division, Guyana, from June 27, 2005 to July 01, 2005.
6. Ms. Joan Caesar, Registry Supervisor, participated in a Training Programme on **“Registry Management – Module 11”**, held at the Public Service Management Training Division, Guyana, from August 03, 2005 to August 05, 2005.

TABLE 8: STAFFING AT NARI – 2005

Categories	No. of Positions	Positions filled	Positions vacant
Administration	16	10	6
Senior Technical	50	22	28
Other Technical and Craft skilled	70	30	40
Clerical and Office Support	36	14	22
Semi-skilled Operatives and unskilled	304	164	140
TOTAL	476	240	236

TABLE 9: STAFFING IN THE ADMINISTRATION – CATEGORY, NARI 2005

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

Administrative Assistant	1	1	0
Chief Security Officer	1	1	0
Supervisor, General Services	1	0	1
Deputy Chief Security Officer	1	1	0
TOTAL	16	10	6

TABLE 10: STAFFING IN THE SENIOR TECHNICAL CATEGORY, NARI 2005

	Authorized Positions	Positions Filled	Vacant Posts
Senior Research Scientists	8	1	7
Research Scientists	20	12	8
Senior Research Assistants	4	0	4
Research Assistants	18	9	9
TOTAL	50	22	28

TABLE 11: STAFFING IN THE CLERICAL AND OFFICE SUPPORT CATEGORY, NARI 2005

	Authorized Positions	Positions Filled	Vacant Posts
Confidential Secretary	1	1	0
Registry Supervisor	1	1	0
Personnel Assistant	1	0	1
Secretary	4	0	4
Typist/Clerk 1/11	5	3	2
General Clerk	3	2	1
Assistant Accountant	1	1	0
Assistant Accountant (Audit)	1	0	1
Accounts Clerk 111	1	0	1

Accounts Clerk 11	4	3	1
Records Clerk	2	1	1
Audit Clerk	1	1	0
Cartographic Trainee	1	0	1
Expediter 1/11	1	1	0
Telephonist 1/11	1	0	1
Office Attendant	5	2	3
Stores Clerk	1	0	1
Inventory Clerk	2	0	2
TOTAL	36	16	20

TABLE 12: STAFFING IN THE OTHER TECHNICAL AND CRAFT SKILLED CATEGORY, NARI 2005

	Authorized Positions	Positions Filled	Vacant Posts
Senior Research Technician	5	3	2
Research Technician 11	9	7	2
Research Technician 1	22	10	12
Senior Field Assistant	1	0	1
Farm Manager	1	1	0
Plant Nursery Supervisor	1	0	1
Livestock Farm Supervisor	1	1	0
Senior Electrician	1	0	1
Mechanical Supervisor	1	0	1
Senior Mechanic	1	1	0
Senior Mechanic/Operator	1	0	1
Senior Storekeeper	2	0	2
Auto Electrician	1	0	1
Carpenter	4	2	2
Electrician	2	1	1
Mechanic	4	0	4
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	0	3
TOTAL	70	30	40

Positions Created

Other Technical and Craft Skilled

Position Filled

Communication Officer	1
Communication Information Specialist	1
Information Technology Technician	1

TABLE 13: STAFFING IN THE SEMI SKILLED OPERATIVES AND UNSKILLED CATEGORY, NARI 2005

	Authorized Positions	Positions Filled	Vacant Posts
Nurseryman 1	15	5	10
Nurseryman 11	10	4	6
Crop Attendant	4	1	3
Plant Operator	2	0	2
Equipment Operator	7	4	3
Mobile Equipment Operator	9	2	5

Toolroom Attendant	1	0	1
Stores Attendant	2	0	2
Heavy Duty Driver	4	3	1
Heavy Duty Mobile Equipment Operator	1	0	1
Driver/Mechanic	3	0	3
Drivers	6	2	4
Sanitation Workers	8	5	3
Personal Assistant	1	0	1
Senior Field Foreman	4	0	4
Senior Nursery Foreman	1	0	1
Senior Stock Foreman	1	0	1
Field Foreman	5	0	5
Nursery Foreman	5	3	2
Foreman	2	1	1
Stock Foreman	1	0	1
Assistant Foreman	3	3	0
Assistant Nursery Foreman	3	2	1
Laboratory Assistant	4	1	3
Laboratory Attendant	9	7	2
Senior Livestock Attendant	1	0	1
Caretaker	2	2	0
Livestock Attendant	4	2	2
Handyman	2	0	2
Porter	2	1	1
Library Attendant	1	0	1
Security Supervisor	3	0	3
Senior Guard	5	4	1
Security Guard	49	34	15
General Worker	120	76	44
Watchman	4	0	4
TOTAL	304	164	140

IX. FINANCIAL REPORT

NATIONAL AGRICULTURAL RESEARCH INSTITUTE BALANCE SHEET

AS AT DECEMBER 31, 2005

\$ 2004		NOTES	\$	\$
178,251,380	FIXED ASSETS	6		176,150,300
	CURRENT ASSETS			
11,866,950	Stocks		11,866,950	
9,041,373	Debtors		13,930,057	
8,108,340	Short Term Investment	7	8,288,200	
1,027,512	Cash at Bank and on Hand		-	
30,044,175			<u>34,085,207</u>	
	CREDITOR AND ACCRUALS			
	Amount due within one (1) year			
(2,817,018)	Creditors		(2,495,984)	
-	Bank Overdraft		<u>(174,751)</u>	
<u>27,227,157</u>	NET CURRENT ASSETS			<u>31,414,472</u>
205,478,537	PROVISION FOR LIABILITIES & CHARGES			<u>207,564,772</u>

(5,606,815)	Ministry of Works	(5,606,815)	
	Ministry of Finance	-	
<u>(5,606,815)</u>			<u>(5,606,815)</u>

<u>199,871,722</u>	NET TOTAL ASSETS		<u>201,957,957</u>
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FINANCED BY:

51,897,479	Grant Foreign Sources		51,897,479
218,658,647	Government Contribution	8	235,858,647
935,796	Revaluation of Stock		935,796
<u>(71,620,200)</u>	Accumulated Surplus (Deficit)		<u>(86,733,965)</u>
<u>199,871,722</u>			<u>201,957,957</u>

CHAIRMAN (A. R. C.) DATE DIRECTOR DATE

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

STATEMENT OF INCOME AND EXPENDITURE

FOR THE YEAR ENDED DECEMBER, 31, 2005

\$	OPERATING INCOME	NOTES	\$	\$
2004				
10,696,071	Income from Agricultural Produce	2		14,829,592
9,311,680	Grant	3		8,859,002
196,792,597	Government Subvention			208,741,537
<u>6,374,247</u>	Miscellaneous Income	4		<u>9,291,115</u>
<u>223,174,595</u>				<u>241,721,246</u>

OPERATING EXPENDITURE

166,954,701	Employment		166,123,752
6,647,764	Fuel and Lubricants		8,270,952
8,468,195	Repairs and Maintenance		

		11,059,536
9,573,872	Field Supplies and Services	12,864,127
27,530,040	Depreciation	24,172,958
<u>36,032,729</u>	Administrative Costs	<u>34,343,686</u>
<u>255,207,301</u>		<u>256,835,011</u>
<u>(32,032,706)</u>	Net Surplus/(Deficit)	<u>(15,113,765)</u>

STATEMENT OF ACCUMULATED SURPLUS/(DEFICIT)

(39,587,494)	Accumulated Surplus/(Deficit) as at Jan. 1, 2005	5	(71,620,200)
(32,032,706)	Add Current Year Surplus / (Deficit)		(15,113,765)
<u>(71,620,200)</u>	Accumulated Surplus/(Deficit) as at Dec. 31, 2005		<u>(86,733,965)</u>

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

STATEMENT OF SOURCE AND APPLICATION OF FUNDS

FOR THE YEAR ENDED DECEMBER, 31, 2005

\$		\$	\$
2004			
	SOURCE OF FUNDS		
(32,032,706)	Deficit for the year		(15,113,765)
	Add : Adjustments for just items not involving the use of funds :-		
182,902	Loss on Disposal of Fixed Assets	-	
27,530,040	Depreciation	<u>24,172,958</u>	
<u>27,712,942</u>			<u>24,172,958</u>
<u>(4,319,764)</u>			<u>9,059,193</u>

FUNDS FROM OTHER SOURCES

8,500,000	Government Contribution	17,200,000
-	Revaluation of Stock	-
-	Grant Foreign Sources	-
<u>8,500,000</u>		<u>17,200,000</u>

4,180,236	Total Funds From All Sources		26,259,193
APPLICATION OF FUNDS			
	- Ministry of Finance		-
8,295,539	Purchase of Fixed Assets	22,071,878	
8,295,539			22,071,878
(4,115,303)			4,187,315
INCREASE/DECREASE IN WORKING CAPITAL			
254,014	Increase/(Decrease) in Stock		-
1,071,406	Increase/(Decrease) in Debtors	4,888,684	
2,429,223	(Increase)/Decrease in Creditors	321,034	
3,754,643			5,209,718
MOVEMENT IN NET LIQUID FUNDS			
192,234	Increase/(Decrease) in Short Term Investment	179,860	
(8,062,180)	Increase/(Decrease) in cash at Bank & on Hand	(1,202,263)	
(7,869,946)			(1,022,403)
(4,115,303)			4,187,315

NATIONAL AGRICULTURAL RESEARCH INSTITUTE

NOTES TO THE ACCOUNTS

1. ACCOUNTING POLICIES

(a) Accounting Conventions:-

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

(b) Fixed Assets:-

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

Buildings	5%
Motor Vehicles	20%
Machinery and Equipment	20%
Laboratory Equipment	20%
Household Furniture and Fittings	20%

Library Books

15%

Depreciation is provided following the year of acquisition.

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

(c) Stock:-

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

(d) Loans:-

Loans are stated net of unearned and uncollected interest.

(e) Pension Plan:-

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

(f) Transferred to NARI:-

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

2. INCOME FROM AGRICULTURAL PRODUCE

This figure is made up as follows:

	\$
Sale of Plants	7,359,891
Sale of Organic Produce	34,964
Sale of Livestock Produce	7,013,635
Sale of Grain Legumes	237,840
Sale of Vegetables & Seeds	111,300
Sale of Papaw	8,790
Sale of Processed Items	-
Sale of Orchard Produce	63,172
	<u>14,829,592</u>

3. GRANTS

This figure is made up as follows:

	\$
Ministry of Agriculture (I N S A P)	1,850,000
Geology & Mines Commission	1,193,129
FAO/Animals Genetics Resources Report	514,300
Amazon Caribbean Chemicals	12,000

Poor Rural Communities Support Services Project	4,631,943
Inter American Institute for Co-operation on Agriculture	657,630
	<u>8,859,002</u>

4. MISCELLANEOUS INCOME

This figure is made up as follows:

	\$
Sale of Acoushi Ant Bait	1,160,020
Electricity Receivable	1,618,226
Interest Receivable	223,466
Other Income	251,440
Rental of House	675,000
Fees and Fines	28,419
Sale of Unserviceable Items	3,915,000
Income from Land Preparation	152,200
Rental of Equipment	290,700
Sale of Printed Materials	17,992
Accommodation Guest House	958,652
	<u>9,291,115</u>

5. ACCUMULATED DEFICIT AS AT JANUARY 1, 2005

	\$
Balance brought forward as at January 01, 2004	(71,621,565)
Add adjustment on Bank Statement for previous period	<u>1,365</u>
	<u>(71,620,200)</u>

6. SCHEDULE OF FIXED ASSETS AS AT DECEMBER 31, 2005

COST	BUILDINGS ETC.	MACH. & EQUIP. & MOTOR VEHICLES	FURNITURE & FITTINGS & OFFICE EQUIPMENT	LABORATORY EQUIPMENT	LIBRARY BOOKS	ANIMALS	CONSTRUCTION WORK IN PROGRESS	GRAND TOTAL
AT 2005 - 01 - 01	212,478,929	119,945,701	46,700,172	45,160,009	2,161,217	1,656,131	71,410	428,173,569
ADDITIONS / ACQUISITION	8,451,801	7,496,985	1,701,297	4,395,343	26,452		7,464,209	29,536,087
DISPOSAL / TRANSFERS		5,663,629					(7,464,209)	(13,127,838)
AT 2005 - 12 - 31	220,930,730	121,779,057	48,401,469	49,555,352	2,187,669	1,656,131	71,410	444,581,818
<u>DEPRECIATION</u>								
AT 2005 - 01 - 01	74,205,835	88,827,850	41,962,566	43,174,226	1,751,712	-	-	249,922,189
DISPOSAL / TRANSFERS		5,663,629						-5,663,629
CHARGED FOR THE YEAR	10,626,366	10,177,122	2,163,501	1,044,761	161,208	-	-	24,172,958
AT 2005 - 12 - 31	84,832,201	93,341,343	44,126,067	44,218,987	1,912,920	-	-	268,431,518
NET BOOK VALUE	136,098,529	28,437,714	4,275,402	5,336,365	274,749	1,656,131	71,410	176,150,300

7.	SHORT TERM INVESTMENT	\$
	4-Jul-91 Certificate No. 99221	8,288,200
		<hr/>
		<u>8,288,200</u>

8.	GOVERNMENT CONTRIBUTION	
	This figures represents Inflows from Government for Capital Works	\$
	Incorporated Reserves	12,454,472
	Govt. Contribution Balance as at Jan. 1, 2004	206,204,175
	Add Govt. Contribution during the Year	17,200,000
		<hr/>
		<u>\$235,858,647</u>