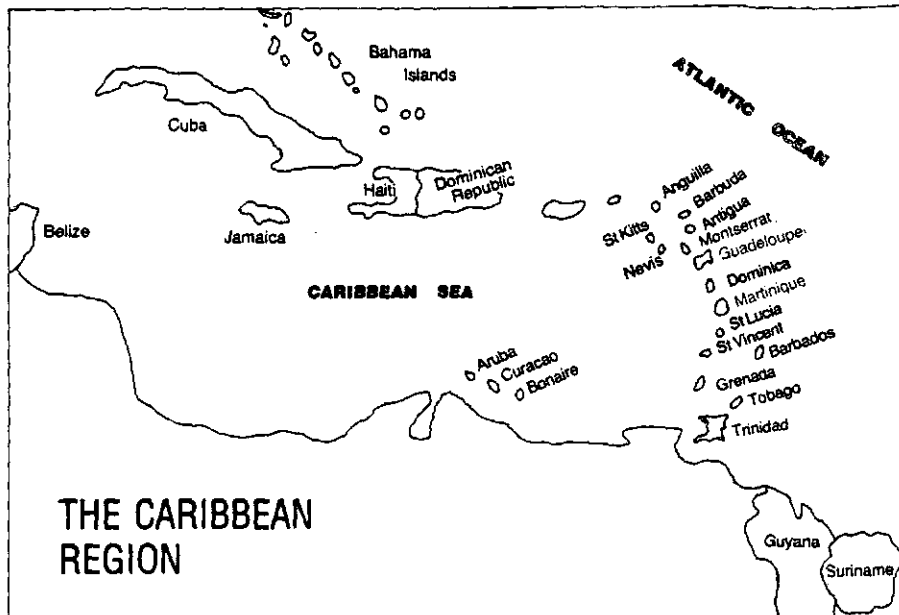


CARIBBEAN
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THE CARIBBEAN REGION

LIMITED
 CDCC/CCST/ARPM/83/16
 20 September 1983
 ORIGINAL: ENGLISH

ECONOMIC COMMISSION FOR LATIN AMERICA
 Subregional Headquarters for the Caribbean
 CARIBBEAN DEVELOPMENT AND CO-OPERATION COMMITTEE
 CARIBBEAN COUNCIL FOR SCIENCE AND TECHNOLOGY
 Workshop on Agricultural Research Policy and
 Management in the Caribbean
 Port of Spain, Trinidad
 26-30 September 1983



RESEARCH ON SUGAR-CANE AND RICE/FRUIT/
 FOOD CROPS IN TRINIDAD + TOBAGO
 Prepared by
 The Caroni Research Station, Trinidad + Tobago

Organized jointly by the United Nations Economic Commission for Latin America (UNECLA) Subregional Headquarters for the Caribbean and the Caribbean Council for Science and Technology (CCST) with support from the International Service for National Agricultural Research (ISNAR), the Swedish Agency for Research Co-operation with Developing Countries (SAREC), the International Development and Research Centre (IDRC), the Commonwealth Foundation, the University of the West Indies (UWI) and the Government of Trinidad and Tobago.



UNITED NATIONS

ECONOMIC COMMISSION FOR LATIN AMERICA Office for the Caribbean

20th September, 1983

RESEARCH ON SUGAR CANE AND RICE/FRUIT/FOOD CROPS IN TRINIDAD AND TOBAGO
CONDUCTED BY CARONI RESEARCH STATION

T.W.A. Carr
Director of Research
Caroni Research Station*

Introduction

Caroni Research Station is today the agricultural research department of Caroni (1975) Limited, and is located close to the coast of the Gulf of Paria. The research station began its existence in 1959 as the Central Agricultural Research Station formed by the amalgamation of the research departments of the major sugar companies, the then Caroni Limited and the Ste. Madeleine Sugar Co. Ltd., under the direction of Dr. A.J. Vlitos. In 1963 it became known as the Tate & Lyle Central Agricultural Research Station, reflecting the station's interest in projects which extended to broad cane production problems. In 1967 the name was changed to Caroni Research Station reflecting a change to research directed solely towards support of the local sugar industry, and Dr. F. Haworth was appointed Director. In 1973 Dr. T.W.A. Carr became Director of Research and now heads a team of ten Research Officers with supporting staff.

Structure of the Sugar Industry

The sugar industry is still the largest agro-industry in Trinidad and Tobago even though in recent years there has been a decline in sugar production from 200,430 tons of sugar in 1976 down to 81,645 tonnes in 1982. Caroni (1975) Ltd., a State Corporation, has dominated the local sugar industry producing between 90-97% of the total production over the 10 years up to 1982.

The production of sugar cane is shared between the company and a large number of independent cane farmers. In 1982 the latter group numbered

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5,555 and were represented by two organisations, The Trinidad Island-Wide Cane Farmers Association and The Island-Wide Cane Farmers Trade Union. Cane deliveries from farmers over the last few years have ranged between 38% and 40% of the total cane ground by the factories and in 1982 their deliveries amounted to 454,799 tonnes of cane. In that year 1.6% of the number of farmers delivered 500 tons of cane or more, while 55% each delivered 50 tons of cane or less; 43.4% of the farmers delivered between 50 and 500 tons each.

Company deliveries of cane to factories totalled 745,942 tonnes of cane in 1982. Like the farmers, the deliveries of cane by this side of the industry has declined appreciably from a high of 1.393 million tons in 1976 to today's level. In 1982 the canes were harvested (Company) from 31,781 acres of land with an average yield of 21.95 tonnes/acre.

In 1982 there were 4 factories in operation, but it should be noted that the two smaller factories were closed in 1983, and at present the industry will be served by the two bigger factories. In the 1981 and 1982 period all sugar produced has been marketed in the local market and in the E.E.C. market.

In addition to sugar, the company in 1982 produced about 34 million litres of molasses and 633,748 proof gallons of alcohol, 92% of which was sold as high proof alcohol in bulk. In addition the company produces around 35,000 gallons of milk annually. The company also has an elite buffalo herd developed especially for beef conformation from the crossing of several breeds of buffalo; this type is called buffalypso. Only culls and bulls from this herd are sold for meat. In terms of diversification crops, the rice pilot project sold some 47,000 pounds of paddy in 1983, but no other of this group of crops is in production for sale.

Policy and Functions

The kind of work done by the station is APPLIED RESEARCH, directed at solving problems mainly in the three broad areas of soils, agronomy and crop protection. However, recently work in agricultural engineering has begun though more of a developmental rather than a research nature.

The present policy of the station, simply stated, is:

- (a) To conduct agricultural research on sugar cane and selected food, fruit or other crops being produced commercially or developed towards commercial production by the Company, with a view to maximising yields, optimising inputs, improving efficiencies.
- (b) To communicate its findings, provide information and act in a technical advisory capacity to the Company on an on-going basis, and other organisations as may be required from time to time.

In the execution of this policy the following functions are performed:

- (a) To carry out research on sugar cane, food crops, fruit or other crops and make recommendations for improvements based on research results.
- (b) To develop a store of knowledge and expertise on these crops, through its library, station reports, publications and trained personnel.
- (c) To transfer information and technology to the cane production and diversification side of the industry by means of reports, seminars, talks, demonstrations, publications, and day-to-day personal contacts.
- (d) To provide routine technical service, such as for example, soil and leaf analyses on a limited scale for nutritional problems, tests of insecticides on froghoppers and other insects so as to monitor their tolerance, tests on crop quality and so on.

The overall research programme is now in a state of transition. From an emphasis on sugar cane almost exclusively before 1973 and up to 1981, projects on Rice, Tree Crops, Food Crops and a few other crops

are being gradually introduced from 1981 onwards. In the present circumstances of tight budgetary control of funds, a policy has been adopted of accommodating the new programmes within the present capacity of the station, though there has been small addition of staff and facilities for the new work.

Sugar Cane: It will be necessary to retain a substantial part of the research programme in sugar cane since this station does a very large proportion of all the research work on this crop that is done in the country. However, it is recognised that some judicious pruning of work on sugar cane will be necessary to accommodate the other projects.

Diversification Crops: The research projects in diversification crops will deal with problems related to the start-up of production at the specific locations selected by the company. Several organisations in the country have been doing research on the other crops for the last 20 years. The station will make use of information, expertise and experience of persons and institutions in the country related to the crops selected by the company for attention, a major objective being to avoid unnecessary duplication of past and present work and to build on what has been already established. The projects are being undertaken by personnel solely assigned to these crops, or personnel who work on sugar cane in addition to these crops. The areas selected for early attention are variety evaluation, nursery and seed propagation, surveys for potential pests and diseases, timing of planting in intensive cropping schedules, etc.

Research Programmes and Objectives

The research programme of the station is carried out in the field, greenhouse, insectaries and laboratories. Each year field trials of various kinds are located in some 70 to over 100 fields, up to now mainly concerned with sugar cane, and located all over the company's cane lands stretching from Caroni Section in the North to La Fortunee and La Gloria Sections in the South. Field trials form the bulk of the research effort, but these are backed up by studies in the laboratories, insectaries and greenhouse located at Waterloo. In general the recommendations and varieties from the research programmes are implemented on a pilot commercial basis by Production departments before being incorporated into the company's operations.

At present there are 10 major programmes of work on sugar cane and other crops with the following objectives:

1. Crop Nutrition/Soil Fertility Programme (Sugar Cane)

To determine optimum utilisation of fertilisers and soil amendments such as filter press mud and liming materials with the objective of maximising yield of sugar or other crops per acre and maintaining soil fertility.

2. Soil Physical Conditions and Water Relations Programme (Sugar Cane)

To develop soil management and irrigation practices, and monitor mechanisation, with the objective of maximising yield of sugar or other crops per acre while maintaining soil fertility.

3. Weed Control Programme

To achieve optimum control of weed competition with the objective of maximising yield of sugar and other crops per acre. Both new and current chemicals and techniques are evaluated in response to the changing weed problems.

4. Sugar Cane Pest Control Programme

To determine methods for control of froghopper, stem borer and thrips in sugar cane, and to keep check of the status of other minor pests and to develop both biological and insecticidal control programmes.

5. Sugar Cane Growth and Maturation Programme

To elucidate and manipulate the environmental and plant factors affecting the growth and maturation of sugar cane so as to maximise the yield of sugar per acre. Cultural practices and chemicals are investigated in this programme.

6. Sugar Cane Variety Improvement Programme

To maintain a continuous programme of selection to find new and better varieties compared with the standard commercial varieties. These new varieties may be developed from seed produced by the West Indies Central Sugar Cane Breeding Station (in Barbados), or may be imported from other countries.

7. Area Investigation Projects

To investigate major problem areas of sugar cane cultivation using a multidisciplinary approach concentrated on the area, and to develop recommendations to improve sugar yield per acre.

8. Rice

To study key aspects of rice cultivation (e.g. variety, pests and diseases) and to provide technical support for the development of mechanized rice production.

9. Tree Crops

To study key aspects of tree crops (emphasis on citrus and coffee) and provide technical support for the commencement of orchards, and the growth and productivity of these orchards in the development of mechanized production.

10. Food/Fruit/Vegetable Crops

To study key aspects of these crops (present emphasis on Pigeon Peas, Cassava, Yam, Maize, Pineapple) and provide technical support for the development of mechanized commercial production.

Present Staffing

| | | | |
|---|-----|-----------------------|-----------------------|
| Director of Research | ... | ... | - Dr. T.W.A. Carr |
| Senior Research Officer (Food Production) | | ... | - Mr. D.A. Buxo |
| Research Agronomist (Weed Control, Growth & Maturation) | | | - Dr. G.F. Mason |
| Research Agronomist (Variety Evaluation and Selection) | | | - Mr. A.F. Donelan |
| Agricultural Chemist (Soil Fertility, Cane Nutrition) | | | - Dr. C.R. Shand |
| Soil Physicist (Physical Conditions, Water Relations, Rice) | | | - Mr. J.E.W. Georges |
| Research Entomologist (Chemical Control) | | ... | - Mr. C.P. Kennard |
| Research Entomologist (Biological Control - Rice and Food Crops Pests) | | | - Mr. W.G. des Vignes |
| Research Entomologist (Biological Control - Tree Crops Fruit Crops Pests) | | | - Mr. C.R. Mahadeo |
| Agricultural Engineer (Rice Engineering Projects) | | | - Mr. R. Ramkhelawan |
| Experimental Officer (Variety Stage 5, Cane Diseases) | | | - Mr. E. Rampersad |
| Administrative and Library | - 7 | Maintenance Crew | - 7 |
| Field Assistants | - 8 | Scientific Assistants | - 18 |
| Daily Paid Personnel in field, insectary, laboratory | | | - 61 |

Summary of Current Projects for 1983 - 1984

| Officer | Sugar Cane | Other Crops |
|--------------------|--|--|
| Dr. G.F. Mason | Herbicide Trials on Cane Control of <u>Andropogon</u> sp. Control of <u>Imperata</u> sp. Weed Survey Treatment of Planting Material Cane Yield Estimation Stage 5 Variety Growth Studies | Weed Survey in proposed areas Control of Aquatic Weeds Herbicide Trials in Forage Crops Herbicide Trials in Food Crops |
| Mr. J.E.W. Georges | Survey of Soil Physical Properties In-field Variation on 4 series Erosion Evaluation in South | Survey of Soil Physical Properties In-field variation on 4 series Irrigated Rice Variety Evaluation Trials Upland Rice Variety Evaluation Trials Production of Seed Rice |
| Dr. C.R. Shand | Nutrient Survey N.P.K. Fertilizer Trials Liming Trials Rock Phosphate Trials Nitrogen Studies N/K Interaction Trials N/P Interaction Trials Phosphate Content of Juice Phosphate Trends in Ratoons | Soil survey of Proposed Areas and Fertilizer Recommendations |

| Officer | Sugar Cane | Other Crops |
|---|--|-------------|
| Mr. A.F. Donelan | Variety Selection, Stages 1 to 2, 2 to 3 and 3 to 4 Propagation of Cane Plants from Seeds Establishment of Stage 1, 2, 3, Variety Trials Evaluation of Stage 4 Variety Trials - Plant Cane, 1st ratoon, 2nd ratoon | Nil |
| Mr. A.F. Donelan & Mr. E. Rampersad | Cane Variety Introductions through Chaguaramas Station (post entry) Stage 5 Variety Description | Nil |
| Mr. E. Rampersad | Pre-export Quarantine at C.R.S Disease Resistance Screening Trials for Smut, Rust, Yellow Spot Stage 5 Sub-Commercial Nurseries Stage 5 Semi-Commercial Evaluation | Nil |
| Mr. C.P. Kennard | Insecticide Screening against Froghopper Insecticide Field Trials against Froghopper Granular Insecticides for Froghopper Control Froghopper Control with Growth Inhibitor Assessment of Damage by Thrips | Nil |
| Mr. C.P. Kennard & Mr. W.G. des Vignes | Biological Control of Froghopper (<u>Metarrhizium</u>) | Nil |

| Officer | Sugar Cane | Other Crops |
|---|--|---|
| Mr. C.P. Kennard & Mr. C.R. Mahadeo | Susceptibility of Small Moth Borers to Insecticides Susceptibility of Moth Borer Parasites and Predators to Insecticides | Nil |
| Mr. W.G. des Vignes & Mr. C.R. Mahadeo | Mass Rearing and Collection of Parasite Hosts for production of parasites against <u>Diatraea</u> Release and Recovery Surveys of Exotic Parasites of <u>Diatraea</u> : <u>Lixophaga</u> , <u>Metagonistylum</u> - CRM <u>Allorhogas</u> - W.G. des V. | Nil |
| Mr. W.G. des Vignes | Parasite Competition Studies against <u>Diatraea</u> | Survey of Insects associated with Rice |
| Mr. C.R. Mahadeo | <u>Diatraea</u> Succession Studies | Investigations into Pests of Citrus and Coffee |
| Mr. R. Ramkhelawan | Nil | Rice Engineering Projects |
| Mr. D.A. Buxo | Nil | Literature Review on Production of Citrus and Coffee Literature Review on on Production of Selected Food Crops - Cassava, Pigeon Peas, Pineapple Nursery Plantings of Selected Food/Fruit Crops - Cassava, Pineapple, Sweet Potato Pigeon Peas Time of Planting x Spacing Cassava Variety Trial |

Change in the Short Term Future

As the expansion of the crops other than sugar cane progresses, it is expected that work in relation to soil nutrition, soil physical conditions, disease control, pest control, agricultural engineering/mechanisation will increase and be accommodated within the programme. However, progress of work by other institutions will be kept in view so as to utilise results and avoid duplication where practical to do so, and in certain cases collaboration will be agreed upon so that results might be shared. An area of expertise not now present but needed at C.R.S. is Plant Pathology. To adequately deal with the sugar cane disease problems it is now necessary to have this expertise in-house, and since the other crops are replete with disease problems themselves it is essential to bring such a specialist on stream as soon as possible.

Effects on Production and Productivity

The research projects on crops other than sugar cane are very recent and have had no effect on productivity; indeed the commercial production of these crops is now in the initial stage so that there is yet no commercial production to be affected in production or productivity. But it must be said that in the start-up of commercial production, the information and results from work done by other organisations, especially work done under Trinidad conditions, is being utilised to inform planning and to add to the detailed site knowledge the company has of the locations where production is starting.

In the case of sugar cane production, the research programmes have played an important role in assisting operations, and some of these may be identified here as follows:

- The introduction of varieties new to local commercial cultivation is done through the evaluation system conducted by the station. In times of emergency usually brought on by a serious disease outbreak, the commercial introduction of an exceptionally good variety may proceed cautiously at the same time as the evaluation programme. Also, the new spectrum of varieties must be adaptable to the increasing extent of mechanisation especially of harvesting.

The varieties in cultivation all replaced their predecessors through this process aimed at improving yield and production of sugar cane.

- Aerial application of herbicides, though not generally applicable, is useful in specific weed control situations and have made it possible to vastly reduce man-hours, amount of time taken, and cost for those situations.
- The introduction of new herbicides in response to changes in weed flora and cultural conditions is done through the screening programme done by the station which has piloted introduction of the herbicides in use now such as 2-4D, Diuron, Velpar, Igran, Roundup, Perflan, etc.
- The insecticide programme dealing with use of insecticides against the frog hopper has been invaluable in detecting build-up of tolerance by the insect to Gammexane, Sevin, Uden for example. Also, this programme has guided the introduction of a range of chemicals for commercial use in specific situations, such as Thiodan, Supracide, Hostathion, Etrifolol, Decis, Furadan.
- Establishment of an exotic parasite, Apanteles flavipes, for control of the small moth borer, has played a part in the reduction of cane damage by this pest. But since the pest situation is a dynamic one, further introductions are being pursued with a view to maintaining low damage levels in both young tillers and mature stalks.
- Identification of nematodes as a factor depressing yields in certain locations has led to the introduction of counter measures on a semi-commercial scale. This was a new limiting factor on yields for those areas.
- From the programme on soils has come recommendations for the optimum utilisation of filter press mud, lime requirements for certain soils made acid by long use of sulphate of ammonia, cultivation practices for the reduction of erosion on undulating land, and so on.

External Linkages

In conducting its research programme on sugar cane, Caroni Research Station has had and continues to have links with other organisations which are considered beneficial to the station's work, and thus to the industry.

The station is a full member of the group of Variety Testing Stations which are linked to the West Indies Central Sugar Cane Breeding Station. Each station, including C.R.S., carries out a variety evaluation and selection programme starting each year with 30-40,000 seedlings and lasting over 7 - 9 years. In addition there are arrangements for exchange of varieties between stations. The Testing Stations are located in Belize, Jamaica, Dominican Republic, Barbados, Trinidad & Tobago and Guyana, St. Kitts-Nevis and Panama.

Collaboration with various departments of the University of the West Indies has been fostered in areas of mutual interest, and projects have been done with members of the departments of Biological Science, Crop Science, C.A.R.D.I., Soil Science. In the area of training, several students registered for higher degrees at U.W.I. have done their research projects at C.R.S.

The programme of work in the biological control of Diatraea has been done in constant collaboration with the Commonwealth Institute of Biological Control as a source of stocks of parasites and information specific to this specialisation.

The station collaborates with the Trinidad & Tobago Ministry of Agriculture, Lands and Food Production on a continuous basis in the maintenance and operation of the quarantine facility for sugar cane introduction, and from time to time on matters related to Plant Pathology, Library services, etc. In addition to the above, valuable collaboration on short-term projects has been made with other organisations, such as Commonwealth Institute of Helminthology, Tropical Products Institute, and so on.

Collaborative projects with C.A.R.D.I. have taken place from time to time, and one is now in progress.

The research programme into the crops other than sugar cane has resulted in the expansion of links with some organisations and formation of new linkages. Collaboration with Caribbean Agricultural Research and Development Institute has begun with respect to root crops, and with the Ministry of Agriculture, Lands and Food Production with respect to rice. It is expected that further collaboration will be developed as our diversification programme continues, and indeed linkages will be developed with other organisations active in research on all these food crops, as well as those concerned with such long standing export crops like coffee and citrus which we will be producing for the home market.

The Demands Beyond 1990

Caroni (1975) Limited farms a large part of the flat lands on the western side of the island of Trinidad, so its long term farming plans may substantially affect the overall farming output of the country. From the standpoint of current policies the demands to 1990 and beyond are two-fold, namely to improve the efficiency of production of sugar cane by cost effective measures, and to diversify so as to produce rice/food/fruit crops, milk and meat on an increasing scale up to about 4,000 ha. In the case of both tasks, collaboration with other organisations will be necessary, but more so with crops other than sugar cane.

The station has therefore been bringing itself up-to-date on production problems and research in Trinidad & Tobago and in the region with these crops. Thus its own research work will be selected so as to make use of what is already known and set up projects to investigate problems specifically related to the company's development programmes.

Possible Conceptual Framework for Reciprocal Co-operation

There are many organisations local and regional existing in the area working on the non-sugar cane crops. From among these existing organisations therefore it should be useful to set up expert groups with a concentrated focus, for example on Rice, Root Crops, Coffee, Citrus, and so on for provision of technical advice and to form the organisational core for regular specialised workshops which could bring

together researchers and knowledgeable producers into a forum for concentrated discussion and exchange of ideas.

These arrangements should build inter-organisation co-operation, and focus attention on the problems of single or narrow groups of crops.

Priority Programmes for Sub-Regional Execution

Sugar Cane: In sugar cane production, one project which might be approached sub-regionally is the search for and introduction of exotic parasite for the froghopper (Aeneolamia sp.).

Food Crops: In the food crops area the detailing and standardisation of a format for variety evaluation of crops should be a valuable asset in the search for improved varieties.

The institution of a specific testing station for mechanisation should help. Industry participation need not be difficult to obtain, and reports would be of interest to all. Work by this unit need not be done only at the base of operations, but they may occasionally operate on locations in different countries by means of special off-station projects. The station itself would become a focal point for the activity of agricultural engineers, and a place where a range of machinery can be seen by persons engaged in development activity.
