ACTIVITIES OF THE COCONUT RESEARCH INSTITUTE

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INTRODUCTION

The Coconut Research Institute was established as the Coconut Research Scheme in 1929 with just three technical divisions. Since then there has been a progressive enlargement of activities resulting in the creation of more technical divisions and reorganizations.

The Coconut Development Act No. 46 of 1971 defines the functions of the Coconut Research Institute as conducting and furthering scientific research in respect of the growth and cultivation of coconut palm, coconut-based cropping systems, preventing and controlling pests and diseases and establishing pilot plants for the processing of coconut products and by-products. Although the CRI is not directly responsible for extension activities, it has a vital role in this sphere - to advise the Coconut Development Authority and the Coconut Cultivation Board regarding developments in research and train their staff so that they could transfer the new technologies to the appropriate end-users.

Organization

The Coconut Research Institute is managed by the Coconut Research Board, the members of which are appointed by the Hon.Minister of Coconut Industries. The Board has three sub-committees, viz. Research Committee (to formulate the research programme in consultation with the staff and to monitor the progress of its implementation), Administrative Committee (to advise the Board on policy matters relating to the administration of the CRI) and the Estates Committee (to formulate the cultivation programme of the Board's estates and to monitor its implementations).

The research activities of the Coconut Research Institute are organized into eight divisions: Agronomy, Coconut Processing Research, Crop Protection, Genetics & Plant Breeding, Soils & Plant Nutrition, Biometry, Tissue Culture and Plant Physiology. These technical divisions are serviced by a Library, the Coconut Information Centre, Information Services Unit, the Administration Division and the Estate Management Division.

The main laboratories of the Coconut Research Institute are located at Bandirippuwa Estate, Lunuwila and are well-equipped to conduct research in the relevant disciplines. In addition to this central organization, the Institute conducts its activities at other field stations, namely, Kirimetiyana Estate at Lunuwila, Poththukulama Research Station at Pallama, Rathmalagara Estate at Madampe, Walpita Estate at Kotandeniyawa and the Adaptive Research and Demonstration Farms at Minneriya, Kalkudah and Nattandiya. The Institute also maintains three seed gardens, viz. Isolated Seed Garden at Rajakadaluwa, Makandura Seed Garden at Gonawila and Maduru Oya Seed Garden at Bogaswewa. The substations and seed gardens are about 2,200 ac in extent.

Although the Coconut Research Institute is not directly responsible for extension activities, it produces nearly all the advisory literature used by the Coconut Cultivation Board in its extension activities.

Tho Institute acts as a centre for the collation and dissemination of information on coconut to research workers in Sri Lanka and abroad.

Another important function of the CRI is to provide high-quality seednuts to the industry. These are selected from the Institute's seed garden (only one seed garden is in production yet) and from a pool of specially-selected palms and are provided to the nurseries of the Coconut Cultivation Board.

ACTIVITIES SINCE 1978

The Institute undertook several long-term research projects during the period under review. These projects were mainly on breeding, fertilizer usage, intercropping and animal husbandry and crop protection. Most projects were extensions of the earlier investigations, which were giving useful results at about that time.

The Institute's research activities on intercropping and thereby maximise land use began during this period. Of particular importance is the establishment of several long-term trials on intercropping cacao, pepper and coffee (and their mixtures) under coconut. After nearly 10 years, these investigations are providing much-needed data for the grower. Also noteworthy is the contribution towards the understanding of pasture cultivation and animal husbandry in coconut lands.

After several decades of experimentation, the Institute undertook a major review of its breeding programme and goals. This enabled a complete reorganization of the coconut breeding research work, with emphasis on producing more improved varieties, some of which are for specific conditions (eg.low inputs agriculture), a fresh look at the existing varieties and their evaluation on a broader basis. The seednut selection programme was completely reorganized, and a new pool of over 50,000 elite mother palms (known as plus palms) were selected. Goals were set to provide the country's entire requirement of seednuts from improved material from seed gardens. With this broad objective, the Institute strived to make the maximum use of the Isolated Seed Garden. Recognizing the importance of this programme, the Institute undertook to rehabilitate the Isolated Seed Garden with improved cultural practices and by installing an irrigation system and also obtained assistance for establishing another seed garden at Gonawila.

During this period, data from long-term fertilizer trials were used to introduce new fertilizer mixtures. New techniques of foliar analysis to diagnose nutrient deficiencies were introduced.

The biological control programme at the Institute was further expanded to cover several more pests. Resurgences of the introduced leaf miner pest, *Promecotheca cumingi* were effectively controlled with minimum expenditure by using biological control techniques.

At this time, the Institute also recognized the importance of tissue culture. The establishment of a purpose-built laboratory was a significant step in this direction.

THe Coconut Information Centre was established in 1979 with the assistance of the International Development and Research Centre, Canada to collate and disseminate worldwide information on coconut research and allied activities.

In the early 80's, the Institute undertook a major programme of improving its infrastruc-

ture to enable it to discharge its responsibilities in amore effective manner and to make the working environment better. These were essentially long-term development programmes, which bear fruit today.

THE CURRENT RESEARCH PROGRAMME

The Coconut Research Institute launched a five-year research programme in 1984. It was realised then that the coconut grower's income was dwindling due to a number of factors. Climatic conditions in the coconut triangle, which covers about 70% of the total coconut area in the island was deteriorating: the drought periods were longer and more frequent, which seriously affected coconut production. The cost of inputs required to maintain the holdings for a satisfactory yield was increasing, leading to a higher cost of production.

The Coconut Research Board recognized these problems and the necessity to have a programme that is dynamic and adaptable to the changing conditions. The five-year research programme was introduced with this background, considering the constraints and the socio-economic difficulties faced by the growers.

The main objectives of the programme are to increase the national coconut production, reduce cost of production and increase productivity from coconut holdings. Accordingly, the following projects were identified.

1. Improvements to soil organic matter status and water holding capacity
2. Rehabilitation of low yielding plantations
3. Establishment and management of new plantings/replantings and underplantings
4. Studies in Field Management Systems
5. Production of improved varieties
6. Production of high-quality seed and seedlings
7. Nutrient requirements of coconut, specially under stress conditions
8. Population dynamics of the pest/parasite complex of the coconut catepillar
9. Evaluation of systemic insecticides for the control of foliar pests of coconut
10. Studies on the pests of inflorescene
11. Biological control of black beetle
12. Physiology of the coconut palm
13. Premature decline of palms
14. Application of biometry in coconut research
15. Vegetative propagation of coconut
16. Intercropping
17. Biology, behaviour and control of the red palm weevil
18. Improvements to copra manufacturing process with fuel saving techniques
19. Coconut fibre technology
20. Irrigation

With the concurrence of the Ministry of Coconut Industries, research on processing is now confined to some aspects of fibre and on fuel saving techniques for copra manufacture. Any further research on processing will be carried out on contract basis by those organizations which are equipped to handle work of that nature.

The progress of the implementation of the research programme is very satisfactory. Nearly 100 experiments are in progress. Most of the field experiments have been laid in estates belonging to the Janatha Estates Development Board. Majority of the experiments are long term and the final outcome will be known after the experiments have been in progress for the full period. The highlights of the programme and the achievements are as follows:

1. Soil fertility and cover crops

Several trials have indicated the significance of cover crops in soil improvement and pro-

viding nutrients for the palm. Five cover crops, namely *Mucuna utilis* (Wanduru Me), Siratro, *Pueraria, Calopogonium* and *Centrosema,* have beenidentifiedas the most effective ones. Some of these creeping covers produce about 10 MT of leaf litter/ha/year from the second year onwards. The field experiments have amply demonstrated the soil moisture conservation by cover crops. Moisture availability in lands under these covers was about 2 to 5 times more, compared with lands without a cover crop. Further, the cover crop was found to reduce the compactness of the soil and acidity, thereby improving the soil.

Calopogonium Cover Crop

The top dry matter produced by cover crop per ha/year is sufficient to provide the annual requirement of all the nitrogen and a part of phosphate and potassium required by palms in a hectare (160).

These findings are based on field experiments and analysis in the laboratories. They have to be further tested on a larger scale before re recommendations are made to the growers.

The growers who dislike creeping covers for various reasons can use bush covers such as gliricida with advantage. Leaf loppings from three gliricidia plants will provide the entire nitrogen and about 20% of phosphate and potassium requirements of a palm. Another study in progress is a combination of gliricida, pasture and cattle under coconuts, which will provide the entire nitrogen and 50% of the phosphate requirement of the palm.

This particular research programme will lead to a substantial saving on the artificial fertilizer and the cost of production of coconut could be reduced.

2. Drought tolerant coconut varieties

In the coconut breeding programme, putative drought tolerant palms have been identified. These palms yield uniformly well in both favourable and unfavourable years. They have been crossed artificially and the progeny is being field-tested. Experiments have also clearly demonstrated the usefulness of the introduced variety, *San Ramon* as a source of improved material. The first generation palms of *San Ramon X San Ramon* have flowered in

about 4 years, giving 350 g copra/nut compared with about 250 g copra/nut obtained from the commercially grown tall variety.

3. Fertilizer use

In early 1986, a single urea-based fertilizer mixture (referred to as the Adult Palm Mixture - APM) for adult palms was introduced, which replaced the CU_1 CU_2 CU_3 CA_1, CA_2 and CA_3 mixtures. The rates of application of the APM mixture are adjusted according to the fertility of the soil and climate.

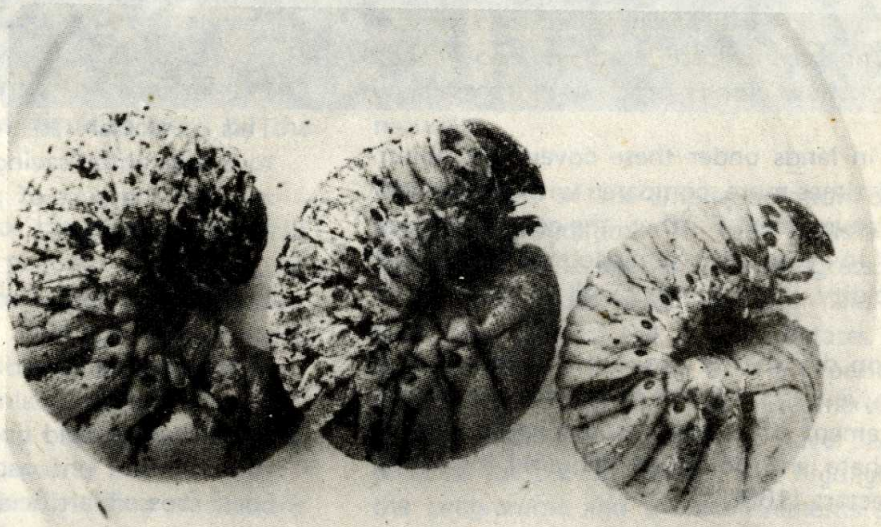
The methodology developed to determine the nutrient status of palms using leaf analysis data and thence to rationalize fertilizer usage has been widely tested in the field. At present, nearly 25 estates are included in this project. Using this method, only deficient nutrients need be applied to the palm, thereby making a considerable saving in money and also a reduction of cost of production.

4. Pest Control

Considerable progress has been made in introducing new techniques for pest monitoring and control. It has been possible to make a preliminary identification of the sex pheromones of the coconut caterpillar, which can be used in the field in traps to monitor pest position in an "early-warning system".

Novel techniques in introducing systemic insecticides into the coconut palm have been developed. These are injection of the required insecticide through roots and improved trunk injection method. These techniques replace the costly, inconvenient and environmentally-hazardous spraying of insecticides to tall palms. Further, the quantity of chemical required is much less than that compared with spraying.

A convenient method of controlling the black beetle by introducing a fungus *(Metarhizium anisopliae)* is being tested. The fungus is multiplied on maize seed, packed in polythene



Fungus infected larval stages of the black beetle pest.

bags and posted to the place where is it to be introduced to breeding sites of the beetle. The results available so far indicate that this fungus is efficient in controlling the pest under certain conditions only.

5. Tissue Culture

Culturing of tender coconut leaves has produced one plantlet, but it has not grown further. Repeated trials have failed to produce any more plantlets. This is the dilemma of Tissue Culturists. Sustained efforts over a number of years are necessary to perfect the technique.

Embryo culture techniques were perfected. These techniques are now used in the laboratory to screen varieties for their ability to withstand moisture stress and to produce seedlings of *Dikiri pol,* which has not been propagated hitherto.

6. Irrigation

Experiments to gather basic information on irrigation of coconut, intercrops and related problems were started. The irrigation system installed at the Isolated Seed Garden, Ambakele would provide some background information on the suitability of different systems under different conditions.

7. Seed Production

The Coconut Research Institute is responsible for the production of quality coconut seed for the industry. The annual requirement is about 2 million seednuts. At present, about 600,000 seednuts of the improved variety, CRIC 60, are supplied from the seed garden annually, and the balance from selected plus palms.

The Board planted 80 ac of seed garden at Makandura, Gonawila (NWP) in 1984 under the Coconut Development Project. Another seed garden was established in the System 'B' of Mahaweli at Maduru Oya. Already about 60 ac are planted using specially-selected material, from the Isolated Seed Garden. Sri Lanka's entire requirement of seednuts of improved varieties could be supplied when these seed gardens are in full production.

8. Coconut-based cropping systems

Field surveys were carried out in selected coconut holdings where intercropping is practised. It has been found that widespread intercropping is hampered due to several constraints. The more important amongst these are: inadequacy of family labour, income uncertainities arising from price fluctuations of the produce, recurring droughts, lack of adequate amount of disease-free planting material and lack of sustained extension support.

Based on these findings, arrangements have been made to establish different types of coconut-based cropping models incorporating a number of crops, in farmer's fields.

Data from intercropping trials using cacao, pepper and coffee (and their mixtures) are now available to the grower for successful intercropping in the wet zone. The economics of these systems have been demonstrated. It has been clearly established that their cultivation had no adverse effects on coconut,provided coconuts and intercrops are managed properly. In fact, cultivation of cacao and coffee under coconut substantially increased coconut yields. These trials also demonstrated the economic advantages of intercropping and the potential for maximising income from coconut lands in the wet zone.

9. Other investigations

Research work was started recently to study the contribution and advantages of an associa-

tion of a mould (mycorhiza) in coconut roots. These associations are known to assist phosphate uptake in other crops and also assist in establishment of certain crops in infertile soils.

Some recent investigations indicate that coconut seedlings could be issued to growers in narrow (say 6" diameter) polythene bags. At present the establishment rate is rather low, less than 60%. Work is in progress to improve this position. The advantages of issuing coconut seedlings to growers in small bags are easier and cheaper transport and better establishment, particularly under dry conditions.

10. Other activities

The field and financial operations of Board's estates were streamlined, and an intensive programme was launched to adopt soil and moisture conservation. Husk burying was intensified using all available husks; on occasions husks had to be purchased from outside. The crops have improved, and the cost of production has been reduced.

The extension publications and other advisory literature were issued on schedule. The journal for the grower, Pol Pawath and its English translation, the Coconut Bulletin were issued twice a year. All advisory leaflets were revised, incorporating the new recommendations to the industry. The Coconut Information Centre continued to produce literature for its research clientele world-wide.

In 1986, the Institute conducted two field days and 18 field demonstrations. The quarterly seminar series for the planting community was also conducted on schedule. Several training programmes for both local and overseas participants were conducted.