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ICC-COGENT NEWSLETTER

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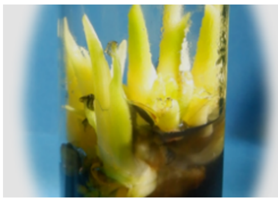


COAXIM, an Innovative Protocol for Mass Clonal Propagation of Coconuts

A clonal multiplication systems for coconuts, called somatic embryogenesis was already developed a few decades ago but never made it to a real commercial stage.

An alternative technology leading to clonal plant multiplication was thus highly desired. At the KU Leuven Laboratory for Tropical Crop Improvement, Leuven Belgium and in collaboration with the Alliance of Bioversity International and CIAT, such technology was developed

COAXIM (COconut AXIllary Meristems) is an innovative protocol which has as its main aim to accelerate coconut seedling production. Currently, coconut production is falling short of world demand, and as more of the world's coconut palm population reaches senility, are threatened by different pests, diseases and climate change, there will soon be a shortfall in coconut supply. READ MORE.

Bringing Genetic Resources and Science to Industry Advancement

An economic crop like coconut grown over 90 tropical countries globally, planted on more than 12 million hectares of land, is crucial to sustaining millions of smallholder households and raw materials supply to top most coconut oil export at 2% share in the global vegetable oil market. Recently, a positive average growth rate of the global demand for coconut products (such as coconut oil, water and desiccated coconut) is projected due to market drivers such as health benefits and its unique traits, as competitive advantage. However, the expansive supply-demand gap is flared as a persistent industry problem.This situation is due to low productivity due to ageing trees with an estimated 50% senility in the global landscape. Hence, replanting with quality planting materials and boosting productivity through strategic and scientific approaches is paramount in moving forward. READ MORE>>>

UPCOMING EVENTS

1. WORKSHOP - PROJECT PROPOSAL ON MOLECULAR CHARACTERIZATION FOR FUNDING OF ACIAR (DEC. 1-4, 2023)

2. COGENT COORDINATOR TO ICC MINISTERIAL MEETING (DEC. 5-7, 2023)

3. INTERNATIONAL COCONUT INDUSTRY FORUM, HAINAN, CHINA (DEC. 11-14, 2023)

4. WEBINAR ON COCONUT LETHAL YELLOWING (FEBRUARY, 2024)

Bringing Genetic Resources and Science to Industry Advancement

Contributor: Ms. Erlene Manohar,
COGENT Coordinator, ICC-COGENT

"Access of the industry to quality genetic materials in the form of early-bearing and higher-yielding varieties as well as with superior traits needed for specific primary and secondary processing along the coconut value chain is vital. "

An economic crop like coconut grown over 90 tropical countries globally, planted on more than 12 million hectares of land, is crucial to sustaining millions of smallholder households and raw materials supply to top most coconut oil export at 2% share in the global vegetable oil market. Recently, a positive average growth rate of the global demand for coconut products (such as coconut oil, water and desiccated coconut) is projected due to market drivers such as health benefits and its unique traits, as competitive advantage. However, the expansive supply-demand gap is flared as a persistent industry problem.This situation is due to low productivity due to ageing trees with an estimated 50% senility in the global landscape. Hence, replanting with quality planting materials and boosting productivity through strategic and scientific approaches is paramount in moving forward.

It is pondered that sustainability of coconut production and livelihoods of the farming sector is critically contingent on improving yields through planting/replanting of unproductive coconut trees with high-yielding and superior varieties.Varietal improvement, hybridization and mass propagation of quality planting materials are key elements of improving the global coconut landscape.

And these are reliant on the importance of the coconut genetic diversity conservation, distribution and use.

In the same manner that this coconut diversity can provide the genetic base to overcome climate change impact that will help the industry cope up with these agricultural risks.

Given this circumstance, the need to pole-vault research initiatives towards increasing farm yields with the utilization of improved varieties and technologies that would boost coconut farmers' incomes and eventually support the processing industries. Global R & D initiatives linked to genetic resources has to be unified for the quest of achieving the desired productivity.

The global R & D programs should be aligned to this advocacy and on focused on major thematic areas of the International Thematic Groups (ITAGs) created under the 2018 COGENT's Global Strategy Plan which includes: a) Ex-situ and In-situ conservation, b) Breeding and Genomics, c) Crop Protection, and d) Coconut Tissue Culture. Moreover, with the new perspectives of COGENT under the auspices of the International Coconut Community (ICC), the socioeconomic valuation of the use of diverse coconut genetic resources is worth a glimpse to move forward to revitalize the COGENT functions and engage key players of the industry in conserving, protecting and exploring the immense use of the coconut genetic resource for livelihoods and sustainable industry progress.

The International Scientific Conference for Coconut Conservation, Valorization and Exchange of Resources and Germplasm for Economic Development of the Coconut Industry (I-CONVERGED)

Contributors: Erlene C. Manohar and Glaisa Garcia, ICC-COGENT Secretariat

This conference is expected to provide scientific advances in support of conservation and germplasm exchange and its socioeconomic worth to the industry. The significance of scientific discoveries and knowledge exchange is the way forward to share significant contribution to the industry. The aim of addressing the lingering problem of low productivity equated to uplifting the livelihoods of coconut farming households is the prime goal of holding this conference. This activity is the platform for discussing the status of the developed research as baseline data in identifying the priority areas with socioeconomic magnitude and formulate the antidote to poverty of the coconut farming communities. To include in this activity is the biological and socioeconomic research related to conservation and use of indigenous genetic resources. Moreover, mainstreaming ethnic groups in the in-situ conservation and mass propagation is of prime aim in addition to the new thinking of COGENT with the due consideration of the farmers welfare.

Likewise, partnering with the private sector of the industry will also enhance pooled efforts to serve as the strong foundation and potential support from the industry. It is expected that these scientific efforts will set the new directions of the coconut R & D linked to the industry needs and challenges as component of the global strategy of the COGENT's road map. Specifically, this will involve better management of the ICGs and NCGs, safe exchange and judicious use of genetic resources focused on superior varieties. With the engagement of global experts, academe, policy makers, production and private sectors, pooled efforts to map out priorities and filling the gaps collaboratively are the laudable to address challenges and opportunities of industry. With COGENTs support in coordinating R & D and ensuring conservation and protection of genetic resources and related technologies, sustainability and accelerating research efforts are achievable.

The conference is designed focusing on the major thematic areas to have a comprehensive discussion and exchange of ideas that will harmonize the directions towards the ultimate goal of transforming the coconut industry into a competitive, sustainable and inclusive industry. This will be guided by scientific findings and socioeconomic opportunities anchored to coconut diversity and supported by the thematic R & D efforts. The following: priority thematic areas are:

1. In-situ and ex-situ conservation
2. Genomics and Breeding
3. Crop Protection and Safe Germplasm Exchange
4. Coconut Tissue Culture and Cryopreservation
5. Climate change adaptation to Coconut Based Farming Systems (CBFS).
6. Socioeconomic Impact of Germplasm Conservation and Use.

Addressing supply stability and product quality requirements are essential in achieving demand-driven industry prosperity. Harnessing safe movement of germplasm and using conserved quality planting material to ensure higher and more sustainable productivity are vital consideration. With the serious threat and risks brought by climate change, availability of a wide coconut genetic diversity is important for breeding climate-resilient, pest-resistant, productive varieties, which will better cater for industry needs, including marginalized groups (often women). Globally, hundreds of millions of unproductive, senile palms also need replacing with better varieties, is the strong foundation of the Global COGENT Strategy Plan.

Tissue Culture for the production of high-quality coconut seedlings in Sri Lanka

Contributors : Vijitha Vidhanaarachchi (ITAG4 Team Leader), Navodini Jayarathna, Nepuli Indrachapa Coconut Research Instiute Sri Lanka. 2023

Coconut is a perennial crop which propagate only by seed nuts mainly produced through cross pollination. Hence, formation of a heterogenous population is inevitable. Propagation through tissue culture is the only option available to avoid the heterogeneity and to produce true-to-type planting materials with promising characters. Coconut is considered as a highly recalcitrant species for tissue culture. Mass production of coconut plants through tissue culture is still being a challenge though it is researched by different laboratories in the world. The potential of different explants including immature inflorescence, tender leaf, plumule and unfertilized ovary has been examined for micropropagation.

Tissue culture division of Coconut Research Institute (CRI) of Sri Lanka has developed a successful protocol to generate clonal plants from unfertilized ovary tissue. At the stage of collection, the ovary is not pollinated and has the similar genetic make-up of the mother palm. This technology also facilitates collection of explants with a minimal damage to the selected adult coconut palm. This protocol will revolutionize the mass propagation of clean and true to type plantlets addressing the need for quality planting materials for planting and replanting programs of coconut growing countries.

Using this protocol to hybrid coconut palms with promising traits were micro propagated and clones obtained were field planted and CRI is planning to use this technology to produce true-to-type clones of disease and pest tolerant genotypes in future.

COAXIM, AN INNOVATIVE TOOL FOR MASS CLONAL PROPAGATION AND CONSERVATION OF COCONUT GENETIC RESOURCES

Contributors : **PANIS Bart**, WILMS Hannes, YU-CHUN Lia, MOREIRA Suzana

Pest and diseases such as lethal yellowing and the rhinoceros beetle, the occurrence of more intense cyclones due to climate changes as well as ageing plantations make that there is an enormous demand for good quality coconut planting materials. Additionally, coconut genetic resources, essential for breeding superior palms and that are currently all maintained in field collection are suffering from the same dangers making that the coconut biodiversity is thus threatened.

A clonal multiplication systems for coconuts, called somatic embryogenesis was already developed a few decades ago but never made it to a real commercial stage. Reasons for this are probably relatively low induction and multiplication rates and the fact that laboratories applying such technique require very specialized and skilled staff. An alternative technology leading to clonal plant multiplication was thus highly desired.

At the KU Leuven Laboratory for Tropical Crop Improvement, Leuven Belgium and in collaboration with the Alliance of Bioversity International and CIAT, such technology was developed. Bart Panis and PhD student Hannes Wilms drew their inspiration from another fruit crop: the banana. From their work on banana plants, it was suspected that a certain plant hormone, TDZ, could also be successful in multiplying coconut trees.

The scientists first extracted the coconut embryo from the nut and then applied the plant hormone to the meristem - or growing point - contained in the embryo. In this way, they succeeded in having the embryo form not only one shoot, but several side shoots. They managed, in turn, to split these shoot clusters and allow new side shoots to grow on them as well. As such, thousands of new specimens of a single coconut plant can be obtained that share the mother plant's exact same genetic profile offering enormous potential for coconut plantations worldwide.

Besides the potential to provide the world with enough high-quality planting materials this methodology (now called COAXIM) can also be applied for the safe and long term conservation of coconut germplasm; this though growing in vitro cultures or though cryopreservation in liquid nitrogen.

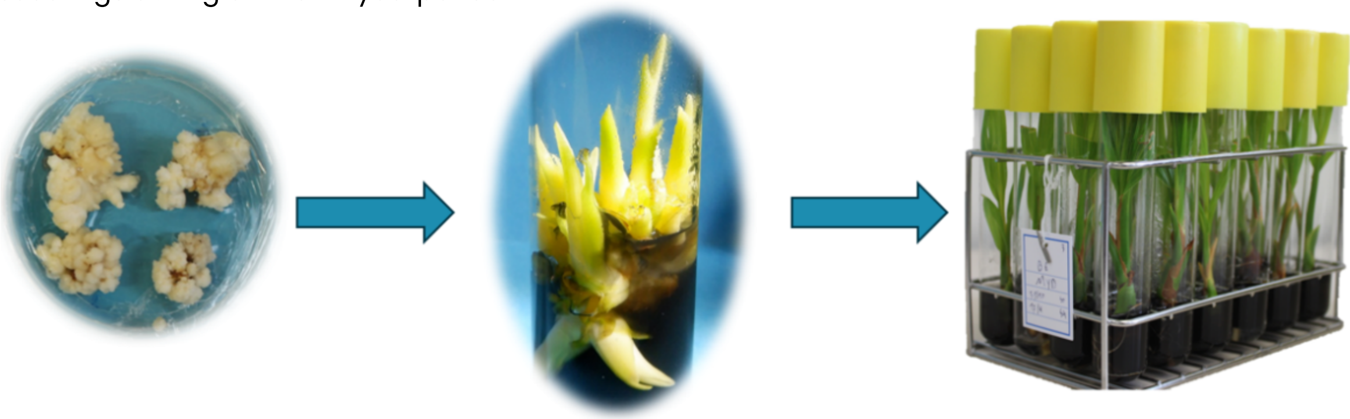
The technology was published in 2021 in the International journal “Scientific reports” (see https://www.nature.com/articles/s41598-021-97718-1) and is meanwhile successfully applied in at least four laboratories showing the that it is efficient, user-friendly and can be applied in all tissue culture laboratories. Moreover, compared to the technology using somatic embryogenesis, the present protocol does not involve a callus phase. Plants are thus believed to be genetically more stable.

IS COAXIM THE NEW AND INNOVATIVE PROTOCOL FORMASS CLONAL PROPAGATION OF COCONUTS THAT THE WORLD IS WAITING FOR ?

COAXIM (COconut AXIllary Meristems) is an innovative protocol which has as its main aim to accelerate coconut seedling production. Currently, coconut production is falling short of world demand, and as more of the world's coconut palm population reaches senility, are threatened by different pests, diseases and climate change, there will soon be a shortfall in coconut supply. The impact is two-fold, firstly it will have a profound economic impact on small holder farmers and secondly, declining coconut supply will affect the coconut product industry.

COAXIM has the potential to be the industry changer! Firstly, it provides a pathway for mass clonal propagation of coconut plants with identical characteristics to create the opportunity to propagate and plant solely elite trees, secondly, the propagation protocol is cost effective and user-friendly and can be applied in all tissue culture laboratories and finally it can be used to preserve coconut genetic resources.

To deliver these benefits to the industry, COAXIM has a three-step action plan, firstly we require an initial investment of USD 750,000 which will enable us to refine the protocol, produce and screen 500 seedlings during a 3-to-5-yearperiod.



Part 2 of the action plan is for COAXIM to concurrently provide the spring board for mass coconut seedling production to begin. This will entail an investment raising roadshow between Year 3 and 5. From year 7 onwards, COAXIM will supply an initial 3 million coconut seedlings. To deliver on this action plan and to provide sufficient coconut planting materials to meet worldwide demand, were quire a coordinated and concerted effort to identify funding and to form regional partnerships.

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AMAZING COCONUT DIVERSITY FOUND IN SOUTHERN SRI LANKA

Contributor: **Dr. Lalith Perera**1 & Dr. S A C N Perera2
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ALIKE, YET SO DIFFERENT

During the past two decades, several expeditions were made by coconut breeders of the Coconut Research Institute of Sri Lanka in search of new coconut diversity by carrying out informal surveys by collecting information from coconut climbers (pickers), coconut buyers and sellers and from formal and informal village leaders in an around southern Sri Lanka. Seven new amazing morphologically different forms of coconut, unalike to already known coconut diversity were identified in the survey named by their vernacular names, Ran pol, Bothal thembili, Juwan pol, Murusi pol, Dothalu pol, Rath gon thembili and Thatin pol. They were assessed by studying morphological characters of the stem, fronds, fruits, reproductive and bearing habits and by specific morphological characters. Interestingly all these forms were found in a few villages clustered around Unawatuna in Galle District of the Southern Province.

The morphological traits were scored over a period of 3 years to observe the temporal variation of the traits in each form. Distinct morphological characters were used to classify them into different forms within a variety. In addition, each form has unique morphological features to distinguish it from all the other forms. Fruit colour, fruit size, fruit shape, petiole colour, mesocarp or endocarp softness and thickness, and the prolificacy of nut production are examples of traits used to distinguish forms within varieties. Consequently, the new forms identified were not only different from each other, but also different from the coconut forms already identified and cataloged in 1958, 1984 and in 1997. This new diversity found will sever as novel genetic resources for future coconut breeding in the country.

SPC delivers workshops on in situ conservation and breeding for SPC farmers

Figure 1. Workshop participants at the Stewart research Station in Madang, Madang Province, Papua New Guinea.

Figure 2. Dr Roland Bourdeix explaining characterisation protocols for coconut palms to participants at the workshop in Taveuni, Fiji. The palm pictured is a hybrid between Malay Red Dwarf and Niu Leka.

Figure 3. Dr Roland Bourdeix addressing participants at the workshop at Taveuni Island, Fiji.

Contributor: **Carmel A. Pilotti,** Associate Scientist, Coconut Genetic Resources, Land Resource Division, Pacific Community, SPC, Suva, Fiji

In collaboration with the FAO-ITPGRFA Benefit-Sharing Fund under Project PR363, SPC delivered workshops in Fiji and Papua New Guinea on conservation and breeding for farmers in May 2023. The workshops were preceded by a 2-day (4 hours each) virtual workshop supported by ICC/COGENT in April 2023 which had 112 registered participants. The Benefit-sharing Fund invests directly in high impact projects supporting farmers in developing countries conserve crop diversity in their fields and assisting farmers and breeders globally adapt crops to our changing needs and demands.

The workshops in Fiji and Papua New Guinea were facilitated by Dr Roland Bourdeix as lead trainer, Mr Vincent Johnson and Dr Carmel Pilotti. Both workshops were well attended by farmers in both countries along with extension staff from PNG Kokonas Indastri Koporesen and the Ministry of Agriculture, Fiji. Participants from Samoa and Hawaii also participated in the workshop at Taveuni Island in Fiji.

Highlights of the workshop included the field activities in characterization, nursery selection of hybrids and the very interesting introduction to farmer participatory breeding through novel (as yet untested) techniques of hand pollination. Participatory trials with selected farmers or extension staff are planned if funds can be secured for these activities. The current project will end soon, and additional funds are sought to continue the extension of conservation and breeding to smallholder farmers.

SPC wishes to thank the facilitators and trainers, ICC-COGENT, FAO-ITPGRFA and participating organizations for their attendance and support

Towards the construction of a collaborative project proposal on the characterization of coconut genetic resources

Contributor: Andrea Garavito PhD, CIRAD's Coconut geneticist.

Currently, the information available on coconut genetic resources (CGR) is limited, and far behind in both quantity and detail when compared to other staple crops that have benefited from high throughput tools for their characterization over decades. In a context of rapidly evolving environmental conditions driven by climate change, understanding the potential of the existent coconut genetic pool, in both genotypic and phenotypic aspects, will accelerate the obtainment of performant and well adapted varieties, improve the rationalization of resources, and the identification of genetically valuable individuals or populations that should be prioritized for conservation.

As a first step to appraise coconut genetic diversity and to develop new tools and methods that could be used by national breeding programs and germplasm collections for an effective management and improvement of CGR, the Australian Centre for International Agricultural Research (ACIAR) mandated the French Agricultural Research Centre for International Development (CIRAD) with the construction of a commissioned collaborative project proposal on the characterization of CGR, in direct link with COGENT's ITAG 1 and 2 activities.

As a first step in the preparation of this proposal, we want to favor a **participatory building process**, that includes the point of view of actors from different backgrounds, such as researchers, private sector transformers / traders, farmers / producers' organizations, and public actors, coming from the geographical zone of the project. This will allow us to have a snapshot of current needs and future activities on research and development on coconut.

In order to formulate this participatory research plan, with the help of COGENT, we are organizing a workshop to: (i) discuss and establish an ideal collective vision of the future of the coconut sector in the region, (ii) identify the desirable outcomes, and (ii) translate the shared vision and impact pathway into different outputs addressing different research objectives. This workshop will follow the ImpresS approach (https://www.cirad.fr/en/cirad-news/news/2021/impress-the-contribution-of-research-to-societal-impact), and will be facilitated by CIRAD's ImpresS team. The results of the workshop will thus, guide the development of an impact driven project proposal and its "outcome-oriented" monitoring and evaluation system. We want this workshop to take place in the Philippines, back-to-back after the International Scientific Conference on Coconut Research and Development.

If the proposed commissioned project is accepted for funding, it will allow a better understanding of the existing coconut genetic diversity and the development of tools for its characterization applicable to breeding, replanting and conservation programs, but also the capacity building of technicians, students and researchers on the analysis and applications of such data. In term, the project will constitute a step forward to a more effective coconut breeding and conservation, for the benefit of smallholder growers in the region.

COCONUT GENETIC RESOURCES CONSERVATION IN INDIA

Contributor: Niral, V. and Hebbar, K.B
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India, is one of the pioneering countries in coconut breeding, having initiated systematic research more than a century ago, dating back to 1916. Realizing the importance of genetic resources for enhancing coconut production and productivity, collection and conservation of exotic germplasm was initiated in the year 1924, with introductions from some nations in South and South East Asia. Collection and conservation of genetic resources was intensified in the early 1950s, with exchanges between nations as well as indigenous collection within India. Presently, ICAR-Central Plantation Crops Research Institute (CPCRI), is designated as the National Active Germplasm Site for Plantation Crops (NAGS) in the country, and conserves indigenous as well as exotic coconut genetic resources sourced from 28 different countries. So far, institute has collected about 455 accessions, including 132 exotic accessions. Under the auspices of International Coconut Genetic Resources Network (COGENT), India also hosts International Coconut Genebank for South Asia and the Middle East (ICG-SAME), one of the five international genebanks, established at ICAR-CPCRI Research Centre, Kidu, Karnataka. Forty eight designated germplasm from host country (India), and germplasm collected from member countries viz., Sri Lanka, Bangladesh are conserved in ICG-SAME. In addition, germplasm collected through prospection in the Indian Ocean Islands of Mauritius, Madagascar and Seychelles, Comoros and Reunion, and the Maldives are conserved at the ICG-SAME. In situ characterization of indigenous genetic resources and also conservation, and registration of farmers' varieties is facilitated by the institute. Further, complementary conservation of coconut genetic resources as pollen, zygotic embryos and DNA is also underway in collaboration with the ICAR-National Bureau of Plant Genetic Resources.

To facilitate better utilization of the coconut accessions conserved in the ex situ field gene banks, characterization is undertaken using descriptor traits, encompassing vegetative, reproductive and fruit component traits as well as molecular markers. India took the lead in cataloguing conserved germplasm and brought the first publication entitled Coconut Descriptors (Vol. I, II), describing 74 accessions conserved in the NAGS at ICAR-CPCRI, and the subsequent COGENT World Catalogue of Conserved Coconut Germplasm. The conserved germplasm at ICAR-CPCRI, in addition to their fruit/copra/oil yield potential is in recent years being assessed for their inflorescence sap (neera) production potential. Regular surveillance of the gene banks is undertaken for monitoring pest/disease incidence and documenting variability for pest/disease incidence in the conserved germplasm. Further, the germplasm is assessed for tolerance to root (wilt) disease, low/high temperature stress and moisture deficit stress; dwarf plant habit, tender nut water quality and oil content. The germplasm resources, encompassing tall as well as dwarf accessions are utilized in crop improvement programme at ICAR-CPCRI as well State Agricultural Universities in the country for development of hybrids viz., Tall x Dwarf, Dwarf x Tall, Tall x Tall as well as Dwarf x Dwarf hybrids. So far, 55 improved varieties including 32 selections and 23 hybrid varieties have been released for cultivation in different agro-ecological zones of India. Quality planting material of these varieties and parental lines are supplied to growers from these organizations. ICAR-CPCRI also encourages licensing of varieties to entrepreneurs/farmer groups for planting material production and spread of new varieties. Further, in India, the Protection of Plant Varieties and Farmers Rights Authority, facilitates registration of new varieties, including farmers' varieties, and protects the rights of breeders/farmers over their varieties.

CLYD UPDATE

Contributor : **Dr. Waynen Myrie,**
Coconut Industry Board of Jamaica

Coconut Lethal Yellowing Disease (CLYD)

Coconut palms dying with due to LY have been reported since the nineteenth century in Jamaica, Cuba and the Cayman Islands, Caribbean Islands, USA, Mexico and Honduras based on latest reported by Wayne Myrie in 2014. According to the surveys the only common species found was a leafhopper (Haplaxius crudus as the disease vector. PCR technique was applied for phytoplasma detection using primers that amplify rDNA from universal phytoplasma sequences and specific primers for LY phytoplasma.

Many years of research efforts to find a cure for lethal yellowing were undertaken, but it is still an elusive achievement. To date, the best approach for control is an integrated program, which includes the use of resistant varieties (if available), quarantining new plants, antibiotic therapy, vector control and sanitation. Breeding of a resistant variety can provide a more direct and efficient approach to combat phytoplasma diseases. This was achieved two times in Jamaica with the production of the Maypan hybrid and the 'Special' Malayan Dwarf Yellows.

Recently, the 'Black' approach by Michael Black Farms Ltd. in Nuts River, St. Thomas, Jamaica who started this integrated approach to the lethal yellowing disease in 1998, to reduce the spread thereby minimizing the effects of the disease. The farm is 70,000 coconut trees and has loss 1.5 % of the trees to lethal yellowing. This involves felling trees at the earliest signs of the disease and replace each felled tree (at times with a over compensation for lost trees) to ensure sustainability of the crop. Close monitoring and prompt removal of diseased trees, cultural practices and prompt replanting are measures used to revive the local industry. This method requires the immediate removal, replacement of infected trees and the removal of weeds. In addition, farmers must plant other susceptible palms as indicator plants in fields and around the boundary. The integrated approach to the management of LY disease can lead to sustainable coconut production. When the approach is practiced efficiently and accurately, it has reduced the spread of the disease.

RETHINKING INTEGRATED PEST MANAGEMENT FOR COCONUT

Contributor: Dr. Celia dR. Medina, Associate Professor, IPM Expert of IWEP, CAFS-UPLB

The concept of Integrated Pest Management or IPM came about at the University of California in 1959 because of the growing concern about insecticide use. The famous book, Silent Spring (1961) further drumbeat the negative effects of pesticides on the environment which accelerated the operationalization of the concept. These conditions do not exist in coconut. Pesticides are not commonplace in coconut farming. It is even claimed that coconut is organic by default.

IPM is almost a cliché when one talks about controlling pests and diseases. What do we want to achieve in coconut IPM? What constitutes IPM in coconut? How do we develop IPM for coconut? These questions deserve a second look.

Coconut farming has many quirks that pose challenges in the development of pest management technologies and innovations. For example, the growing of a single variety on a large scale represents a monoculture that makes coconut vulnerable to incursion. Once attacked, the spread could not be easily contained because coconut landscapes are contiguous. In the landscape ecology parlance, the "habitats" (coconut farms) have many "corridors" (coconut in non-farm areas like residences) so they are interconnected.
The fact that coconut is not sprayed regularly is a blessing and a curse. When pesticides are needed, there is no legally allowed pesticide to be used. There is also a problem with the mode of delivery that is not adapted to the growth pattern of coconut.

The lens that we use in viewing pest problems shapes the way we design technologies and implement IPM. This is the subject of discussion in the upcoming book of the International Coconut Community - **"INNOVATIVE MODEL AND SCIENCE-BASED PEST MANAGEMENT FOR SUPPORTING A SUSTAINABLE AND RESILIENT COCONUT SECTOR"**.