COCOINFO INTERNATIONAL

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From the Editor-in-Chief

MODERNIZATION OF THE COCONUT INDUSTRY TO ENSURE SUSTAINABILITY

It is a prestigious moment for coconut farmers and stakeholders around the globe as we join to celebrate with India the 100 years of Coconut Research. The Asian and Pacific Coconut Community congratulate the Government of India and the Central Plantation Crops Research Institute with the Coconut Farmers of India on the eventful commemorations this December.

It is wise for coconut stakeholders to focus on our strengths, the positive trends and sustainable outcomes as we collectively share our visions, mission and goals for the development of the coconut sector going forward. When we unite in our efforts, the burden of our challenges becomes manageable and our objectives and outputs are achievable in real time. The global market demand has increased so dramatically for coconut and its products in the recent years that it is time for the sector to accelerate production to meet the demands.

The coconut sector is maturing in many ways nationally, in respective countries and internationally, both within and outside the Asian and Pacific Coconut Community network of members. The sector recognises the imminent challenges and is therefore making genuine efforts in addressing them along with the key issues that include:

- Emerging pests and diseases that seriously affect coconut production and productivity such as the recent incidences of Coconut Scale Insect in the Philippines, Lethal Yellowing in Africa and Caribbean, the Bogia Disease in Papua New Guinea;
- Damaging effects of climate change on coconut population and productivity hence the negative effects on socio-economic wellbeing of farmers;
- Declining production due to senility of palms that is worsened as a result of inaction by respective countries to pursue aggressive replanting programs; and
- Inadequate supply of and access to planting material in the form of seed nuts or seedlings.

Many countries look towards examples set by leading producers like India and Philippines to learn and improve their position on managing the negative environmental and biological impacts on coconuts caused by pests, diseases and adverse climate change effect to name some. Farmers however continue their best efforts of planting coconuts utilising local material available as reesearchers continue to seek more elite planting material to give farmers.

The market outlook continues to be positive for the main products:

- Crude coconut oil (CNO) prices are at USD 1446/MT, 26% higher than in same period last year;
- Dessicated Coconut selling prices for Philippines, Sri Lanka and Indonesia is USD 2000-2400/MT;
- Virgin Coconut Oil market price range is USD 4000-6000/MT depending on market destination;
- Coconut water, the fastest growing beverage at over 20% annual increase in exports;
- Coconut sap based products are developing the niche markets; and
- Shell charcoal, activated carbon, coir and oleo chemical products are maintaining markets.

The challenge facing suppliers of both the traditional and non-traditional products of coconut is not being able to meet the volumes required now by the global market. This is caused by inadequate and inconsistent supply of raw material from coconut growers of which smallholders are attributed with 80%-90% of coconut production.

Only in the last 10 years the private sector and industry has seen growth in six digits numbers in monetary value by the coconut and coconut

products as new scientific knowledge and improved technology is applied in both the process and type of machinery and equipment developed for greater efficiency and effectiveness in meeting quality standards of the various products for the global market.

In recent months coconut water craze has entered large populous markets such as in China and recently in Japan apart from the larger Western markets in USA, Brazil, Canada, Europe and through to New zaeland and Australia. Virgin Coconut Oil consumption has risen sharply in the last 5 years globally due to increasing awareness of its health benefits as indicated by collective export volumes increasing by at least 20% each year. It is the high value products of coconut that would increasingly impact the coconut world. APCC looks forward to the producers and exporters involved in value added products of coconut to be able to share their success by passing on viable prices to the growers to sustain desired supply of raw material in fresh coconuts.

It is evident the coconut sector in India has developed rapidly over the last decade with the growth of institutional capacity in Coconut Development Board, Central Plantation Crops Research Institute, Central Coir Research Institute and the Coir Board of India. The mobilisation of growers at farm level was a very important strategic move through the three-tier design of Farmer Producer Organizations. This is a key ingredient for sustainable development as new knowledge and technology is channeled well thus empowering stakeholders to maximize returns on the opportunities presented. Innovation that promotes inclusive growth engages particularly women and youth that in the process institutionalizes the development of coconut making it sustainable.

APCC successfully concluded, in Indonesia last September, the 47th APCC COCOTECH Conference which is the Community's technical panel that is convened every two years. It is encouraging to receive reports of increasing innovation at farm level, research institutions, equipment manufacturers as well as the proactive initiatives in marketing and product development by the private sector. The establishment of important forums of exchange and collaboration within coconut growing countries relating to Integrated Pest Management, Tissue Culture, Climate Change Preparedness, Product Quality Standards and Clinical Studies on Nutrition and Health Benefits is a major step towards amassing the immense wealth intellectual and technical capacity of the Community to be channeled toward the growing and sustaining the sector. It would be advisable to take some moments to review the highlights of the Conference presented in this publication.

The important message to our coconut farmers is to vigorously plant coconuts to replace the senile palms, develop new coconut lands and work towards improving productivity of existing trees. The selective modernizing of farm inputs and management, intercropping with economically viable cash crops, rearing of small livestock, inland fisheries and integration of such economic activity would no doubt sustain the coconut industry. Timely development of micro-propagation techniques to meet the demand for quality planting materials is now a matter of critical importance and should be addressed with a sense of urgency.

Life under the coconut tree needs to become increasingly wealthy, healthy and a happy lifestyle. This new-look coconut life needs to attract our young generation who should easily chose to go back to the farm as a business and a way of life.

When we plant a coconut it is one step towards sustaining the livelihood of the next generation, as a Minister for Agriculture from the small Pacific nation of Kiribati once quiped in reference to the Chinese proverb that *"if you give a man a coconut, you feed him for a day but if you teach a man to plant coconut, you feed him for a lifetime."*

URON N. SALUM
Executive Director and Editor in Chief

CARIBBEAN RUNNING OUT OF COCONUTS

The Caribbean is not able to meet the growing global demand for coconut products, especially water - a situation not likely to be resolved any time soon. Stakeholders in the regional industry, who met in Jamaica in June noted that the urgency of the situation requires a strong, collaborative and sustainable development programme that is built on high-quality planting material. "The region is running out of coconuts," Dr. Compton Paul, Regional Coordinator of the four-year Coconut Industry Development for the Caribbean project, told the audience during Thursday's opening ceremony.

"We don't have enough coconuts to do the kind of processing we are talking about, even for coconut water, because you are finding that the people are not allowing the nuts to mature properly before they harvest them for coconut water because the demand in that market is so great," he later explained to The Gleaner. Small farmers, processors, researchers and technicians were among the regional stakeholders gathered at The Jamaica Pegasus hotel in New Kingston to discuss nursery and seedling management, varietal selection, hybridisation and tissue-culture production. The region is still grappling with the effects of the lethal yellowing disease, which has devastated entire plantations in Jamaica and most of the other coconut-growing countries, resulting in a severe shortage of seed nuts - a situation from which it is yet to recover.

Financed by the European Union (EU) at a cost of €3.5 million and implemented jointly by the Caribbean Agricultural Research and Development Institute and International Trade Centre, the project, now in its second year, seeks to revive and put on a path to sustainability the coconut industries in nine CARIFORUM countries.

Improving Quality

"As part of the project, we are to deal with the production of high quality material - not only seed nuts. It has also to deal with, first of all, the types of varieties that are in our countries and what we need to do to improve the varieties that we have - either by seed nuts or by tissue culture," Paul disclosed. To this end, more than 20 persons from different stakeholder groups in the affected countries have already been trained in the production of high-quality planting material.

However, the search to find coconut varieties that are resistant to lethal yellowing and the other diseases, as well as pests, is ongoing, the regional coordinator disclosed. "We are looking at moving germ palms from Mexico, South East Asia, Brazil, Africa - wherever we can find improved germ palms. We already sent some people to Mexico. We are also sending some people to Brazil to look at the varieties that are available there and how we can get those varieties into the Caribbean region."

Meanwhile, Dr. Wayne Myrie, plant pathologist at the Coconut Industry Board and chairman of the national stakeholders' platform for the regional coconut industry development project, gave some insight into just what Jamaica is missing out on. "The coconut water industry in the United States is valued at about US$550 million per annum.

It is projected to grow to US$4 billion by 2019. We have just managed to get a very tiny percentage of that market. I can't give you the exact figure, but a very tiny percentage. He continued: "The European Union, at the moment, is importing €550 million worth of palm and coconut each year. CARIFORUM countries just managed to export €28,000 to the EU, so the potential for the growth of this industry is tremendous." ***(http://jamaica-gleaner.com)***

NEW VIRGIN COCONUT OIL FACTORY IN SAVUSAVU, FIJI

A new Virgin Coconut Oil factory-will soon be established in Savusavu. The Copra Millers Association of Fiji will be diversifying its product to virgin coconut oil through a half a million dollars investment in the Northern Division, where construction will begin next month.

Association Acting General Manager John Deo says copra farmers will move away from the traditional coconut farming to whole nut processing. “The farmer has to collect the husks from his farm and bring it to the mill. We will have a set of machines which will de-husk, de-shell and milking and up to the virgin coconut oil production.” Deo says due to the health benefits, the virgin coconut oil has three to four times more value than coconut oil. The Association has already received order for three thousand liters of Virgin Coconut oil from Malaysia and USA. *(http://www.fbc.com.fj)*

FIJI DELEGATES VISITING THAILAND

Fiji delegates led by Mr. Jitendra Singh, Permanent Secretary for Agriculture Ministry of Agriculture, visited Thailand on 11-13 July 2016. On the first day, the delegates had a meeting with Thai officers of Ministry of Agriculture and Cooperatives (MOAC) chaired by Inspector General, Dr. Wimolpron Thtisak at Trang Hotel Bangkok.

The following day, the delegation visited Tropicana oil Co. Ltd. During this visit Mr. Suradet, Tropicana CEO, welcomed them and accompanied them to see the VCO (Virgin Coconut Oil) cosmetic R&D laboratory, VCO product showroom and organic nursery farm. Tropicana company processes organic coconuts into VCO and converting the by-products into planting media for organic vegetable production. They implement a zero waste production system and encourage farmers to join and convert their ordinary farms into organic coconut farms. Besides Tropicana, the delegation also visited K-fresh factory that produces young tender coconuts and its new product lines such as coco pudding and coco snowflake with or with-

out carbon and they were happy to taste the new products.

The company told the delegates that it encourages the coconut farmers to implement food safety and organic farming with bio control for coconut pest management. On third day, 13 July 2016, the delegates visited the showroom for equipment and processing machineries at Thai Kitchenmart in Nonthaburi. Then they went to Saraburi to visit Livestock feed Mill named CPF under Charoenpokphan at Nongkhae district, Saraburi. The delegates had exchanged ideas and discussed with CPF team led by Mr. Sarongrit Mekanurat, Vice President of CPF Program. These study visits were assisted by former APCC Assistant Director and supported by Horticulture Research Institute (HRI) Department of Agriculture, Thailand.

FARMERS URGED TO ENGAGE IN BEEKEEPING TO INCREASE YIELD

The Agriculture Department in Tamil Nadu state has urged coconut and mango farmers to take to rearing of bees so as to increase pollination and thus productivity, a news report from *The Hindu* has said. "Honey bees play a major role in pollination which directly increases yield in any crop. Hence, we have been promoting rearing of bees in coconut or mango groves," said J. Sekar, Joint Director of Agriculture. He cited the success of pollination rate in gingelly crop at the Agriculture Department's State Seed Farm at Tirukadaiyur where "TVM 6" is being cultivated. Bees are attracted towards white-coloured flowers. Further, the ball-shaped gingelly flowers facilitate easy and smooth entry for the flies for suckling nectar. The bees, in that process, promote pollination in the crop. As pollination process was more important for mangoes and coconuts for registering higher yields, the farmers will be exposed to the advantages of this phenomenon at the State Seed Farm. *(UCAP Bulletin)*

THE BLESSINGS OF COCONUT OIL IN INDONESIA'S PAPUA

A long stretch of black sandy beach on the fringe of Dabe village in Papua, Indonesia lies empty. It is a weekday, but nobody is out fishing in the nearby waters. Instead, villagers were busy chopping coconuts by the hundreds and extracting the meaty, inner lining rich in oil known as copra. Others were using presses to shred cut coconut, later extracting the oil.

Wainin Namantar, a local fisherman, is among them. In past years, the men in Dabe fished from March to October while the women gathered and hunted for food in the surrounding forest. The men sold the fish, shrimp, and crabs they caught for IDR 30,000 (US$2.50) a kilogram. About 3,300 hectares of Sarmi district is covered with coconut trees. Coconut is the most readily available commodity across Sarmi, but because it is so plentiful, it is often treated like garbage. "We never did anything with the coconuts except eat them," said Wainin.

In 2014, dozens of Dabe residents were taught how to produce crude coconut oil in a project funded by New Zealand Aid (NZAID) and jointly implemented by UNDP and the Ministry of Development Planning. The project is part of UNDP's People-Centered Development Programme, which aims to harness existing local capacity and economic opportunities to improve livelihoods.Villagers, ranging in age from their 20s to the late 50s, learned how to chop coconuts quickly and effectively, shred coconut using expeller presses, and separate the clear crude oil from the thicker part they themselves use for cooking.Within a few short months of the training, Dabe villagers produced 400 liters per month, providing a monthly income of IDR 4.8 million (US$360).Before the project began, many villagers did not earn stable monthly income and they did not have any economic activity. The poverty level in Papua province stands at 27.8 percent, almost tripled than the national average.

"This is a huge change from what was happening in previous years," said villager Zacharias Namantar. Wainan and Zacharias are among the 481 people in Sarmi who have benefited from this project. The program's focus is on the extraction of oil from coconuts, post-harvest training in the production of cooking oil and assistance with operating production factories. Health certification has been acquired from the Food and Drug Agency, and the finished, refined cooking oil, called PHICO, is sold in shops in Sarmi and Jayapura, Papua's capital city. "We want to get serious about selling PHICO refined coconut oil and virgin coconut oil for cooking purposes, and because of this, the regency of Sarmi collaborated with us to set up two factories," said Ferdinand Leohansen Simatupang, part of UNDP's People-Centered Development Programme. The two local factories employ eighteen villagers.

Sarmi Regent Mesak Manibor agreed that the best way forward for local economic development was the establishment of factories for coconut oil production. Eventually, they hope to have a marketing plan to sell the oil across Papua. "We have so many coconut trees here. The coconuts fall on the ground and nobody does anything with them. It is a waste," Mesak said. "It is best that they can be turned into refined cooking oil that can eventually be sold widely."

Before the training, ten coconuts produced one liter of oil priced at IDR 10,000 (US$.75). Today, once sold to the local refinery, it is priced at IDR 12,000 per liter (US$1). After the initial group was trained, more villagers requested that the project and government include them as beneficiaries so that they could earn income. Training was given by factory's workers, so skills and knowledge have been successfully transferred to local people. Dabe resident Sarlotta is thankful for this work. "Our parents focused on educating the boys.

The girls in the family stopped going to school at age 15. We have worked ever since," she said. "My family needs money...I can make about IDR 200,000 (US$15) a month. I can get detergent, salt, fuel, sugar, food and rice."

The same goes for Dorce, who is able to send her two sons to school as a result of this work. "One son is now in junior high school, and another in senior high school. This is because of the IDR 400,000 (US$30) a month I make doing this work with coconuts. They can get an education and do not have to help the family out to make money." *(http://www.undp.org)*

INDONESIA SHARES BEST PRACTICES FOR COCONUT PROCESSING WITH ASIA PACIFIC COUNTRIES

The RI Foreign Ministry's Directorate of Technical Cooperation, in cooperation with the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM CSSTC) and the Ministry of Agriculture has held the International Training on Coconut Product Development. The program was officially opened at the Swiss-Belhotel Maleosan, Manado (27/5). This training was attended by 37 participants from 13 countries in the Asia and Pacific region, namely Fiji, Cambodia, the Marshall Islands, Myanmar, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Sri Lanka, Timor Leste, Tonga, and 10 participants from the eastern provinces of Indonesia: North Sulawesi, east Nusa Tenggara, Maluku, North Maluku, Papua and West Papua.

The Director General of Information and Public Diplomacy (IDP) Ministry of Foreign Affairs, Ambassador Esti Andayani, who also serves as Director of NAM CSSTC attended the opening alongside the Head North Sulawesi Plantation Office, the Vice Regent Head of Minahasa Utara, and other officials from both central and local levels.

In her speech, the Director General said that the training was designed as part of the commitment of the Government of Indonesia in the framework of South-South Cooperation, particularly for countries in the Pacific region. Since 1999, Indonesia has conducted 467 capacity building programs and technical assistance involving 5,581 participants around the world. Particularly for the South Pacific, Indonesia is committed to providing capacity building programs worth 20 million US dollars, which was set by the President in 2014. Since then, Indonesia has held 44 programs for the Pacific countries in the fisheries, good governance, tourism, agriculture, and other sectors.

The Director General expects that this training can be used as a means to share best practices Indonesia in the coconut processing industry. The high demand for coconut products while the industry's low capacity to meet demand can be seen as an opportunity for the countries of Asia Pacific.

Meanwhile, in the report of Mr. Ir. Dedi Nursyamsi, Head of Research and Development of Agricultural Land Resources, RI Ministry of Agriculture, the coconut tree can be considered the "tree of life" because all parts of the coconut can be processed in creative ways and utilized as commodities.

The hope is that the training will allow the participants to produce creative ideas from refined coconut and nd create home-based coconut processing industries in their respective countries. The Manado Palm Plants Research Hall as the executing / implementing agency has developed an 8 day training program for in Manado, and participants will perform various activities related to the development of coconut commodity into high-value products. The training includes classroom theory sessions, practice in the laboratory and the field, as well as a visit to the oil industry. The training agenda will also include excursions to introduce the potential of tourism as well as the SME industry in North Sulawesi. *(http://www.kemlu.go.id)*

JAPANESE FIRM TO INVEST $1M IN BALI COCONUT WOOD FACTORY IN INDONESIA

A Japanese firm has expressed interest in investing Rp 15 billion ($1.1 million) in a factory in Bali, to make furniture from coconut wood, a senior official at the Investment Coordinating Board, or BKPM, said. Coconut wood has become the main alternative source of hardwood, especially in the Asia-Pacific region, where coconut trees grow in abundance. Manufacturers consider coconut wood cheaper than hardwood, which could potentially reduce any harm to the natural forests.

"One of the contributing factors is the abundant supply of good quality coconut trees in Bali as a producer. The company will process the coconut trees to create furniture and products for home decoration," BKPM Chairman Franky Sibarani said. Additionally, the main target market consists of Japanese tourists, who also spend longer periods in Bali. "In the future, the firm is looking at Surabaya East Java as another potential site for building a factory since they also produce good quality coconut trees," Franky added.

Saribua Siahaan, BKPM's promotional representative in Tokyo, said the investment agency is ready to facilitate Japanese companies who want to invest and expand their business in Indonesia. "All permits and projects will be facilitated and monitored," Saribua said. According to the BKPM, Japanese investment in Indonesia amounted to $1.58 billion in the first five months of this year, consisting of 427 projects, which provided employment to 28,377 people. Last year, Japanese investment in Indonesia stood at $2.87 billion, with a total of 2,030 projects which provided employment to 115,400 people. Japanese investment in Indonesia

is spread out across sectors such as electronic, machinery, chemical and pharmaceutical. However, the bulk of it is still in manufacturing, particularly the automotive sector. *(http://jakartaglobe.beritasatu.com)*

30TH NATIONAL COCONUT-WEEK AND THE 3RD INTERNATIONAL COCONUT FESTIVAL AND TRADE FAIR IN PHILIPPINES

The Philippine Coconut Authority (PCA) will hold the 30th National Coconut Week and the 3rd International Coconut Festival and Trade Fair on August 18 - 21, 2016 at the Mega Trade Hall, Hall 1 Summit, 5th Floor, Mega B SM Megamall, EDSA corner Julia Vargas Street, Mandaluyong City. The event aims to promote new coconut products, technologies and investments in coconut based industries in the region.

PCA STOPS COCO SEEDLINGS SMUGGLING FROM LEYTE TO CHINA

The Philippine Coconut Authority (PCA) regional office said the government has already curbed the alleged smuggling of coconut seedlings from Leyte Island to China, a report from the Philippine News Agency Tacloban Bureau said.

PCA Eastern Visayas Manager Jose Pilapil said with the coordination efforts with various government agencies, the rampant buying of partially de-husked coconuts has stopped in Leyte and Southern Leyte provinces.

PCA has sought the assistance of Philippine Ports Authority, Philippine Coast Guard, Bureau of Customs, Philippine National Police and other enforcement agencies both in the region and in Central Visayas to intercept shipment of partially de-husked coconuts.

Exporting unhusked and partially husked mature coconuts is strictly prohibited under Executive Order 1016 issued by then President Ferdinand Marcos in 1985. *(UCAP Bulletin)*

INTERNATIONAL CONFERENCE ON COCONUT IN DAVAO CITY

With the theme "Bridging Industries", Cocolink 2016 was a conference and an exhibition that intends to bring the country's coconut industry playe rs together under one roof on July 27-29, 2016. Venue was at the SMX Convention Center, SM Lanang Premier, Davao City, Philippines. The event was spearheaded by the Davao Region Coconut Industry Cluster, Inc. (DRCICI) in collaboration with the Philippine Coconut Authority, Department of Trade and Industry, Department of Agriculture, and ACDI/VOCA. Cocolink 2016 was a convergence of all stakeholders in the industry envisioned to address the challenges and optimize opportunities through cooperation among Philippine coconut industry players and enablers which include local and global partners in the coconut value chain, the organizers said. The event was also a venue where local and international industry players link together to promote common interests and share best practices from production to marketing, it added.

Session topics included Coconut Production Technologies; Coconut-based Farming Systems and Income Diversification; Catapulting Philippine Coconut Products for the Global Market; Coconut Industry Development Initiatives and Sustainability Programs. The 3rd National Coconut Coir Summit was held during the event. Likewise, there was Business-to-Business Meetings with Buyers of Coconut Food Products and Non-Food Products to be managed by the Export Marketing Bureau of the Department of Trade and Industry. *(UCAP Bulletin)*

SICCI SUPPORTS COCONUT PRODUCTS DEVELOPMENT

The Solomon Islands Chamber of Commerce and Industry (SICCI) participated in the International Training on Coconut Products Development held early in June 2016 at the Palmae Research In stitute (BALIT PALMA) in Indonesia. The training was conducted as a development cooperation program on the field of coconut development for farmers, small farmer groups and other small organisations in the Asia-Pacific region, particularly those with similar characteristics of coconut farmland in Indonesia. The training aimed to empower coconut farmers to build their business and livelihood. Solomon Islands was one of the thirteen participating countries from across the Asia Pacific region.

Representing Solomon Islands through SICCI, was the Chairman of the Solomon Islands Coconut Industry Working Group (CIWG) Bevan Vollrath, and the Export Industry Development Officer, Ms. Samantha Maeke. The coconut tree, often called the 'tree of life', plays a significant role in societies and economies across many countries across Asia and the Pacific. Its importance spans across many spectrum from economic and cultural values to aesthetic and health benefits. However, higher value could be obtained from the coconut tree as a commodity in comparison to what is currently being utilized. The coconut industry faces huge challenges specifically rural coconut farmers and processors, who are the current dominant players in the arena. Some of the issues experienced by coconut industries across the region include lack of mechanical coconut processing technologies, inadequate pest management techniques, inefficient and ineffective coconut value-adding methods and limited government policies that are coconut specific and prioritized.

In response to the identified challenges, the training explored alternatives to manage these challenges using a wide range of knowledge and skills brought by each participant. It provided informative and 'look and learn' sessions on topics including the zero waste concept, improved coconut processing machineries and value-adding methods, better coconut varieties for higher quality and yields, good management practices, proper pest

management and promoting information-sharing and networking. The coconut industry in Solomon Islands can benefit from the training outcomes by utilising the knowledge and skills shared. On the local scale, coconut farmers can benefit by applying good management practices, the zero waste management concept coupled with value-adding products production and early stages of pest management. As part of private-public partnership, the Solomon Islands Government and the private sector is encouraged to continue to further its support for farmers and farmer groups with acquiring relevant coconut processing machineries as well as using effective and efficient pest management methods. More so, there should be easily accessible information on coconut products development as well as strong farmer and coconut industry linkages between Asia-Pacific countries coconut sectors.

SICCI sees trainings like this as invaluable not only to the coconut industry but to the entire economy. SICCI expresses appreciation to the Indonesian Government for the opportunity to be part of the training. Plans are in place for the lessons learnt from the training to be shared through the Solomon Islands Coconut Industry Working Group (CIWG) to ensure sustainability of the coconut industry, as well as improving the socio-economic wellbeing of farmers and Solomon Islanders into the future. *(http://www.solomonstarnews.com)*

BEETLES THREATEN SOLOMONS' COCONUTS

An Australian company which works with coconut farmers in Solomon Islands says climate change is affecting crops, but right now they are faced with bigger problems. Experts say the Pacific region's coconuts are under threat from rising sea levels, and unpredictable weather patterns as a result of climate change. But Kokonut Pacific's Managing Director Richard Etherington said a renewed infestation of rhinoceros beetle was killing large palms and was an immediate serious threat to farmers. "I'm conscious that there is coastal erosion, there are coconuts planted very close to the sea on the back of beaches. There's probably more immediate challenges, there is an outbreak of the rhinoceros beetle". Richard Etherington said the beetle burrows into the trees and was able to take out large crops quickly. He said to deal with the effects of climate change farmers could always plant palms further inland. *(http://www.radionz.co.nz)*

VANUATU LAUNCHES COCONUT PALM STRATEGY

About a million coconut trees will be planted in Vanuatu in the next decade, as the country tries to get the most out of the important crop. The Agriculture Minister, Matai Seremiah, this week launched the National Coconut Strategy, which looks to replanting after Cyclone Pam. Mr. Seremiah said the strategy would help ensure the greatest varieties are planted to ensure food security, resilience, and improve their economic viability. "Instead of just looking a copra, we're looking at virgin oil, looking at how to use the coconut tree to get timber out of the coconut trees, and all that."

"Most of the coconut trees were planted before independence and now they are not producing as much as a couple of years ago and if we don't start replanting now, production will continue to decrease." Matai Seremiah said while the strategy was mainly focussed on replanting after Cyclone Pam, the country has needed a strategy for a long time. *(http://www.radionz.co.nz)*

VANUATU TO PLANT 50,000 COCONUTS

Fifty thousand coconuts are to be planted in Vanuatu as part of a National Coconut Strategy launched by the government. The nine year plan from the Ministry of Agriculture aims to revive the country's coconut industry after the devastation wrought by Cyclone Pam last year. Agriculture Minister Matai Seremiah speaking at the launch said an initial distribution of 50,000 coconuts would go to cyclone affected communities in Shefa and Tafea provinces. As part of the strategy awareness programs would be carried out throughout the country to get communities involved in replanting coconuts. *(http://www.radionz.co.nz)*

APCC PARTICIPATES IN COCOLINK 2016, AN INTERNATIONAL COCONUT CONFERENCE IN DAVAO, PHILIPPINES

APCC participated in the COCOLINK 2016, a first time International Coconut Conference conducted under the theme of Bridging Industries, held from 27-29 July 2016 at the SMX Convention Centre, Lanang, Davao City, Philippines. The Conference was organised under the auspices of the Davao Region Coconut Industry Cluster, Inc (DRCICI) in Philippines. Mr. Uron N. Salum, Executive Director, APCC presented on "The State of the World Coconut Industry". The other presenters included officials from Philippine Coconut Authority (PCA), scientists and researchers from Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), private sector companies and other stakeholders. The Conference included sessions on coconut industry development, expanding opportunities for coco coir and catapulting the Philippine coconut products for the global market,

PHILIPPINE COCONUT AUTHORITY'S ZAMBOANGA RESEARCH CENTRE (ZRC) SERVE COCONUT FARMERS

ED APCC visited the Zamboaga Research Centre in the company of Dr. Ramon L. Rivera, OIC Deputy Administrator R&D of PCA. Visit of ZRC included field visit of programs and interactions with the professional team. ZRC undertakes an annual production of 1 million MATAG hybrid seednuts for distribution to coconut farmers. The Centre is equipped with tissue cul-

ture laboratories as well as facilities for food processing and development of processing equipment. ZRC is accommodated on 450 hectares of land of which about 260 hectare comprise the coconut seed garden.

ANDRA PRADESH LIFTS INCENTIVES FOR EDIBLE OIL REFINERS AT PORTS

Andhra Pradesh State in India, home to one-fourth of the country's port-based edible refining capacity, has decided to do away with tax incentives for new units as excess capacity stifled the existing units, said a news report by a local daily Business Standard.

In Andhra Pradesh, new edible oil refining units were eligible for a reimbursement of VAT at 2.5 percent for big units, 3.75 percent for medium size units and 5 percent for smaller units under the Industrial Policy 2015-2020. Encouraged by the government tax incentives, units with a total refining capacity of 4 million tons have come up in Andhra Pradesh at the two private deep water ports of Krishnapatnam and Kakinada on the east coast in a short span of time. Large port-based edible oil refining capacity also exists in states like Gujarat and Maharashta, though no tax incentives are given to the new units by the respective state governments anore.

"For an industry that operates on a thin 1-2 percent margin, the state government's tax incentives make a huge difference. That is why several people had set up their refining units here only to face a problem of excess capacity later on," Pradip Chowdary, founder and Managing Director of Gemini Edibles and Fats India Private Limited (GEF India) told Business Standard, while welcoming the government's decision. His company runs a 800 tons per day capacity refining plant at Krishnapatman Port. Citing the over capacity issues, the Krishnapatman Edible Oil Refiners Association had itself appealed to the state government to stop incentives to the units some time ago. Based on these concerns the state government has now put the industry in the negative list. *(UCAP Bulletin)*

NO TAKERS FOR COCONUT PROCUREMENT CENTRES IN KARNATAKA

In another development, over a month since the Karnataka State government set up coconut procurement centres to help growers, who have been facing severe downfall in the price of coconut, none has procured even one quintal of coconut so far, according a report in The Hindu. Hundreds of farmers had inquired with the officials about the procedures to sell their produce, but none bothered to bring coconuts to the centres.

The procedure to sell coconuts to theKarnataka State Cooperative Market Federation (KSCMF), which set up the procurement centres, was lengthy. The farmers had to obtain identity cards from the respective village accountants and certify the crop from Horticulture Department and approach the centre. Quality experts from the Horticulture Department would grade coconuts before purchasing. The KSCMF will purchase the products only if the quality matches their standards. *(UCAP Bulletin)*

NEW APCC NLO OF MALAYSIA, MR. BADRUL HISHAM BIN MOHD MEETS ED APCC

ED APCC held discussions with Mr. Badrul Hisham Bin Mohd, Deputy Secretary General (Development) and APCC NLO, Ministry of Agriculture and Agrobased Industry, Government of Malaysia on the collaborative efforts that could be undertaken for the sustained development of the coconut sector in Malaysia. Mr. Badrul acknowledged that Malaysia is the host for the 54th APCC Session/Ministerial Meeting in 2018.

APCC COLLABORATION WITH CENTRE FOR AGRICULTURE AND BIOSCIENCE INTERNATIONAL (CABI)

A follow up discussion to a visit by CABI to APCC Jakarta during 2015 was recently held in at the CABI office in Kuala Lumpur. CABI expressed willingness to collaborate with APCC on coconut related research work and publication. CABI is a not-for-profit inter- governmental development and information organisation based in United Kingdom. The CABI regional centre in Malaysia established in 1988 works across the whole of South East Asia which is still largely agriculture dependent, very bioversity rich and environmentally fragile.

SUPPORT PRICE: STATE TO WAIT FOR CENTRE'S DECISION

The state government will wait for the decision of the Union Cabinet on providing aid to growers of coconut and arecanut, before deciding on its next step of action. Coconut and arecanut growers are in distress following a crash in prices. Chief Minister Siddaramaiah had convened a meeting of the floor leaders, union ministers from the state on Tuesday to discuss the issue.

Briefing reporters, Law Minister T B Jayachandra said Union Chemicals and Fertilisers Minister Ananth Kumar told the meeting that the Union Cabinet, which is scheduled to meet in New Delhi on Wednesday, would take a decision on launching a Market Intervention Scheme to purchase the commodities. "We will wait for the decision of the Union Cabinet and decide on our next move," Jayachandra said. The Karnataka Rajya Raitha Sangha and the Green Brigade have sought a minimum support price of Rs 45,000 per quintal for arecanut and Rs 15,000 per quintal for copra. *(http://www.deccanherald.com)*

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FELDA WELLNESS CORPORATION (FWC) RELEASES NUTRACEUTICAL PRODUCTS

FWC recently in 2015 released three key lines of products produced from Cultured Coconut Extract. The process applied is intended to retain the highest quality of coconut oil. The product brand is Neutrax that can be taken in liquid form (Neutrax Original), as food supplement (Neutrax Soft Gel) and the other products for external use (Neutrax Therapy Oil). ED APCC had the privilege of visiting FWC in Kuala Lumpur to find out a bit of the work done by the organisation. FWC is a health and wellness innovator and incubator of next generation technologies, products and strategies in bio-pharmaceuticals.

AMBASSADOR OF PHILIPPINES IN INDIA VISITS COCONUT DEVELOPMENT BOARD, INDIA

Her Excellency Ma. Teresita C. Daza, Ambassador of Philippines to India visited Coconut Development Board under Ministry of Agriculture and Farmers Welfare, Government of India on 29th August 2016. She was welcomed by Dr. Anand Kumar Singh, Chairman, Coconut Development Board. She had discussions with Chairman, CDB and senior officials of the Board on the developments in the coconut sector. Philippines stands second in area under coconut behind Indonesia and third in production of coconut as per APCC Statistics 2014. India stands third in area under coconut and first in production.*(www. coconutboard.gov.in)*

USM RESEARCH WITH COCONUT WATER PROCESSING

A visit by the ED APCC to the Universiti Sains Malaysia (USM) was initiated through Prof. Azhar Mat Easa, Dean, School of Industrial Technology of the University. USM is a research intensive University and also the second University in Malaysia established in 1969. The USM research team presented scientific work currently undertaken on how fresh coconut water could be processed to maintain freshness, taste and quality including maximising of shelf life. USM work was one of the presentations at the upcoming COCOTECH Conference in Bali.

VIETNAM COCONUT WATER 'CRACKING' THE US MARKET

Sales of coconut water products have exploded within the US market over the past several years, says Chau Kim Yen, General Director of Ben Tre Import and Export Joint-stock Company (Betrimex). The growing interest in health and wellness has been the main driver for the US sales of coconut water, said Ms. Yen, adding that people are becoming more proactive when it comes to issues concerning their health. They are seeking healthier food and beverage options with simpler ingredients and less sugary options. There is a definite movement to 'back to basics' eating and drinking, Ms. Yen noted, seeking out foods and beverages with simpler ingredients. Coconut water is very firmly within this group and has benefited as a result. She said official figures show the US coconut water market growth rate in2015 was 27% with US$778 million in gross revenue, adding that many market researchers are now predicting that by 2019 Coconut water sales will hit US$1.9 billion.

The US coconut water market is dominated by only a handful of companies with the largest three being – Vita Coco, O.N.E. and Zico. She said Betrimex has now entered the market with its new product, Cocoxim, a canned coconut water, and has received a favourable initial response. The company is also in the preliminary stages of market entry into other markets such as Canada, the EU, Australia and Japan. Now that various medical reports have come out confirming that coconut water does not pose any threat to health and is in fact just the opposite—very nutritious, all that has changed. Betrimex forges ahead to crack open the US coconut market. *(http://english.vov.vn)*

JACOBI CARBONS LANKA RECEIVES PRESIDENTIAL AWARD

Jacobi Carbons Lanka (Pvt) Ltd (JCL) won the Presidential Award for Highest Foreign Exchange Earner Award for Non-Kernel Product Category for both 2014 and 2015 at the 20th EDB Presidential Award Ceremony held at BMICH last Tuesday (9th August) with the patronage of His Excellency the President, Maithreepala Sirisena and many other Key Ministers and Governor of the Central Bank of Sri Lanka.

This Prestigious award program is conducted by Export Development Board of Sri Lanka (EDB). Jacobi Carbons Lanka (Pvt) Ltd is a Board of Investment (BOI) approved company to manufacture coconut shell base value added activated carbon products for the export market. JCL exported more than 19,000 metric tons of value added activated carbon, worth more than 35 Mn USD (5.0 Bn Rupees) per year in 2014 and 2015. JCL manufacturers value added activated carbons mainly from coconut shell charcoal for a wide range of purification and adsorption applications *(Excerpted from The Sunday Times, Sri Lanka, 28 August 2016)*

HIGHLIGHT OF THE 47TH APCC COCOTECH CONFERENCE AND EXHIBITION 2016

Muhartoyo[1]

Cocotech Conference and Exhition is an international coconut conference and technical panel organized once in two years with different themes reflecting the development of coconut sector. Initially Cocotech Conference was organized every year, as per decision made in the 40th APCC Session in Kuala Lumpur, Malaysia, on 1st – 5th December 2003, the conduct of COCOTECH Conference and Exhibition was then decided to be organized once in two years.

COCOTECH Conference and Exhibition is a gathering of various stakeholders in the coconut value chain from around the world comprising of policy makers, senior government officials, researchers, extensionists, traders, product processors, machinery manufacturers, exporters and the friends of coconut who share the latest developments in knowledge, technologies and best practices in the coconut sector.

This conference is organized by the Asian and Pacific Coconut Community (APCC) together with an APCC member country who offers hosting facilities. Many APCC member countries that have experienced in hosting this event are India, Indonesia, Malaysia, Philippines, Samoa, Sri Lanka, Vanuatu, and Vietnam. During the conference, coconut product exhibition was also organized to showcase the state of the arts on the product development and packaging. Likewise manufacturers of coconut processing machineries take parts in the exhibition.

To organize the 47th COCOTECH Conference and Exhibition, the Asian and Pacific Coconut Community (APCC) was in collaboration with Ministry of Trade, Government of Indonesia.The Conference was held on

Director General of International Trade Negotiation, Ministry of Trade, Government of Indonesia, Mr. Iman Pambagio accompanied by APCC Executive Director, Mr. Uron N. Salum Officially opened the Conference by sounding the Gong

September 26-30, 2016 at the Ramada Bintang Bali Resort, Kuta, Bali, Indonesia. Themed "Innovations that Promote Inclusive Growth and Sustainability of the Coconut Sector", the conference's host facilities were provided jointly by the Ministry of Trade and the APCC.

The 5-day conference covered ten technical sessions and a field tour for the conference delegates. The sessions were on:

1. Policies and Programs Promoting Growth and Sustainability of the Coconut Sector
2. Progress on Clinical Studies on Nutrition and Health Benefits of Coconut Products
3. Product Development for Growing and Emerging Markets
4. Technological Advancements for Rapid Multiplication, Varietal Improvement and Commercial Production of Planting Materials
5. Importance of Effective Integrated Pest Management and Climate Change preparedness for the coconut industry
6. Potential Growth and Sustainability of Virgin Coconut Oil and Related Products

A view of the panelists of the 1st Session chaired by Mr. Iman Pambagyo, Director General of International Trade Negotiation

Dignitaries including Ambassadors are among Participants

1. Importance of Quality Standards, Products Certification and Consumer requirements for coconut products
2. Innovative Technologies for Downstream Processing
3. Interaction with manufacturers of equipment and machine for downstream processing
4. Indonesian stakeholder interaction.

The 47th COCOTECH Conference was well attended. A total of over 380 participants from 30 countries joined the Conference. The Exhibition had 28 booths displaying products from India, Indonesia, Malaysia, Philippines and Thailand. Many value added coconut products displayed in the exhibition booths among others are: Virgin Coconut Oil (VCO), packed coconut water, coconut water powder, VCO based-body care products/ spa products, desiccated coconuts, coconut milk, coconut sugar, coconut sap syrup, liquid coconut sugar, coconut shell charcoal, coir based products and handicrafts.

Some producers of coconut processing machineries such as TI Global, Essar Engineers, TI PVT Ltd., Marshall-Fowler Engineers India Pvt. Ltd., Goma Engineering, and Gem Forging also participated in the exhibition.

APCC Executive Director, Mr. Uron Salum Handing Over the Plaque of Appreciation to Mr. Raymond Kahindi, Interim Head, Nuts and Oil Crops Directorate , Kenya

A view of the Exhibition Area

Group Photo of the Conference Participants

The recommendations emanating from COCOTECH were endorsed by the plenipotentiary delegates from the member countries in the delegate Session for implementation by the member countries and the APCC Secretariat side meetings on Clinical Studies Establishment of a Tissue Culture forum, Establishment of an Integrated Pest Management Network and meeting of the International Coconut Genetic Resources Network (COGENT) were convened during the COCOTECH with active participation of the researchers and scientists.

Amongst the emergence of new knowledge and the development of appropriate technologies shared at the Conference were about:

- Information shared by CICY in Mexico and complimented by University of Queensland in Australia in relation to technologies on somatic embryogenesis that could provide solution to rapid multiplication thus enabling mass production of high quality coconut seed nuts for planting;
- Maximising potential of VCO processing via a hybrid method that could combine both the wet and dry process with use of the centrifuge system in the later, an improvement shared by the Philippines that does not compromise the high quality of VCO processed;
- The low-cost method of processing Desiccated Coconut using appropriate technology with cost-effective use of second hand refrigeration containers modified for use in drying and processing of good quality DC products created from the Solomon Island for use in remote island locations;
- Equipment tested in Fiji is able to produce coco veneer by virtually peeling a coconut log and the product from which are high quality wood material for building wall panels, floors and many uses; and
- Advancement in technologies in the equipment manufactured for processing of any kind of products from coconut.

[1]Muhartoyo is Documentalist of Asian and Pacific Coconut Community, Jakarta, Indonesia

THE RIGHT TECHNOLOGY TO PROCESS QUALITY VIRGIN COCONUT OIL FOR THE GLOBAL MARKET

Divina Bawalan[1]

1. Background Information

Coconut oil is one of the most well known coconut product in the world next to copra. It is the most utilized product with various edible and non-edible applications. The traditionally processed coconut oil which is derived from copra has been in the commercial market for more than a century now. It is first produced in the Philippines in 1908. In the year 2000 or almost a century later, the highest quality version of coconut oil which is processed differently was first introduced in the United States and later on in other foreign markets. Generally referred to as "virgin coconut oil" or VCO, it is the purest form of coconut oil, water clear in color and contains natural Vitamin E.

VCO is derived from fresh coconut meat either via the dried, granulated coconut meat or coconut milk route which is processed under very strict sanitary conditions. Hence, it is fit for human consumption after oil extraction and filtration. Likewise, it has a mild to intense coconut aroma, the intensity of the scent depends on the type of process used for producing it. Unlike the copra derived coconut oil which has to undergo refining, bleaching and deodorization to make it edible, VCO has not undergone any further processing with chemicals or any other substance

From the time it entered the commercial market up to the present, VCO has been one of the highest valued products derived from the coconut kernel. VCO is now enjoying tremendous publicity due to its nutraceutical and functional food properties which have been extolled in numerous publications and acknowledged by international experts on nutrition and health professionals. Hence, VCO is qualified to enter the health and wellness global market which was reported to have already reached US $ 3.4 trillion in value (www.globalwellnessinstitute.org).

Virgin coconut oil (VCO) & VCO based-Products from the Philippines

The study entitled 2014 Global Wellness Economy Monitor reported that the wellness sectors seeing the most significant growth since 2010 (www.global wellnessinstitute.org) are the following:

- Healthy eating, nutrition and weight loss (108 percent increase to $276.5 billion)
- Preventative and personalized health (78 percent increase to $243 billion)
- Complementary and alternative medicine (65 percent increase to $113 billion)
- Beauty and anti-aging (51 percent increase to $679 billion)

2. VCO Processing Technologies

VCO processing technologies can be generally classified into the fresh-dry and the fresh-wet processes. Under each of these categories are different processing methods which are applicable at different scales of operation as shown in Figures 1 and 2. Fresh–dry process is the general term given to all technologies in which virgin coconut oil is obtained directly from fresh coconut kernel. All processes require drying of fresh kernels in comminuted form (grated, shredded, ground, milled) before extracting the VCO. On the other hand, fresh–wet process is the general term given to all technologies in which virgin coconut oil is recovered from coconut milk by various means after it has been extracted from comminuted (grated, shredded, ground or milled) fresh coconut kernels.

It should be noted that this paper will just focus on the two (2) processing methods which are generally adopted for commercial production of VCO and applicable for medium to large scale operation. These are:

- Fresh-Dry High Pressure Expeller Method (desiccated coconut route)
- Fresh-Wet Centrifuge method (coconut milk route)

2.1 Processing Steps Common to both Methods

Both methods undergo the same processing steps until the fresh coconut meat is ground or converted into small particle sizes. These are:

2.1a De-watering

This process step removes coconut water from fresh de-husked coconuts by poking the good "eye" into a rotating drill, then placing the nut facing down in a rotary conveyor with slots to drain and collect the coconut water. The collected coconut water which is intended for further processing is filtered and immediately stored in tanks at 4 ^{0}C to prevent spoilage. It should be noted that if processing of coconut water will not be integrated into the operation, the de-watering step comes after the paring step where water is removed simultaneously with cutting of the whole pared coconut meat into pieces. If coconut water will not be further processed, it has to be directed to a waste water treatment plant in compliance with existing environmental laws.

2.1b De-Shelling

De-shelling involves the removal of brown shell from the nut in order to free the meat. Removal of the shell is now generally done using a de-shelling machine where the nut is manually pushed in between the tip of a vertical knife and rotating wheel. An experienced de-sheller can process 200 – 250 nuts per hour or 1,600 - 2,000 nuts per 8 hour day.

2.1c Paring

Paring involves the removal of the brown testa covering the white meat. In the Philippines, it is done manually using a double-bladed knife. The process is like peeling off the skin of potatoes. The paring knife is curved in such a way that it can follow the contour of the coconuts. It is regularly calibrated such that very little white meat can be shaved with the brown skin. . It should be noted that several years ago, a Philippine-designed and fabricated paring machine was introduced. However, it was not generally adopted and processing plants reverted back to manual paring because the efficiency and quality of the pared meat is still below that of manual paring. The thickness of the paring could not be controlled and a lot of testa was still adhering on the surface of the white meat after passing through it. This makes the work more tedious because the parer has to redo the job after passing through the paring machine.

2.1d Inspection and Cutting

After paring, the white meat is placed in a conveyor to bring it to a segregated area for inspection, cutting, washing and grinding. Inspectors are stationed along the conveyor line to do the following quality control measures on the white meat:

- removing specks of testa or brown skin that is still left on the surface of the meat
- segregating rotten and germinated nuts which went unnoticed through the production line

The white meat then goes to a rotary splitter to cut the white meat into smaller pieces.

2.1e Washing

White meat pieces are subjected to two (2) - stage washing using potable, chlorinated water. The first stage is done in a washing tank and the second stage is done in a screw washing conveyor fitted with spray nozzles.

2.1f Grinding/Wet Milling

Sliced and washed white coconut meat/kernel is fed to the grinder where it is ground between a stationary and rotating disk that have distinct teeth profile with provisions for adjustment to get the desired particle size. These are fitted with feeding screws to ensure a fairly even particle size. For the fresh-dry high pressure expeller method, the coarse particle size setting is used while for the fresh-wet centrifuge method, the fine particle size setting is used.

2.2 Process Steps Specific/ Distinct to Fresh-Dry High Pressure Expeller Method

The following steps follow the grinding/wet milling steps if the fresh-dry high pressure expeller method will be pursued.

2.2a Pasteurization / Sterilization / Blanching

As the ground/milled or comminuted wet meat leaves the grinding machine, they are conveyed directly into the blanching machine where they are subjected to live steam injection at specified temperature and time duration. The purpose of pasteurization is to neutralize enzymatic action on the fresh meat and kill *Salmonella* and *E. coli* microorganisms which are food poisoning agents. The most likely sources of this contamination are through contact with human carriers or contaminated water during processing.

2.2b Drying

As the wet meat leaves the pasteurization/blanching equipment, they are subjected to a drying process. In the Philippines, the most commonly used dryer for DC and for commercial VCO production is a conveyor type tunnel dryer popularly known as Proctor Schwartz (named after its manufacturer) which is composed of three stages with decreasing temperatures. For full VCO operation, a conveyor type dryer can be designed to only have two stages. To dry, hot air is continuously blown on the wet meat as it moves along the stages in a conveyor belt or apron. At the last stage, the wet meat has turned into desiccated coconut and the moisture is reduced to 2.5 to 3.0 %. For drying of wet meat earmarked for VCO production, the speed of the conveyor is adjusted to get the required moisture content at 4 %.

2.2c Oil Extraction

The dried kernel is fed to the high pressure expeller with built-in

cooling system immediately after drying with the right condition of the feed material and setting for the expeller.

The two (2) products that come out of the expeller are the VCO with entrained fine particles of dried meat and coconut flakes which undergo post processing steps.

2.2d Filtration

The oil coming out of the high pressure expeller appears turbid because of entrained very fine particles of dried meat (called "foots" in coconut oil industry) which is clarified through mechanical filtration or some other means to have VCO.

2.3 Process Steps Specific/ Distinct to Fresh-Wet Centrifuge Method

The following steps follow the grinding/wet milling steps if the fresh- wet centrifuge method will be used.

2.3a Heating

The ground fresh coconut meat/ kernel from the grinder is passed through a tubular conveyor where it is heated by steam to a temperature ranging from 35 - 50 ^{0}C. Heating increases the milk recovery from the ground meat.

It should be noted that this is part of the practice in coconut milk processing plant but not in most VCO processing plant. However, it should be borne in mind that the VCO recovery from the fresh-wet process is dependent on the amount of coconut milk extracted per kilo of ground fresh coconut meat. Hence, it makes sense to pre-heat the coconut meat prior to milk extraction.

2.3b Pressing/Milk Extraction and Screening

The heated ground meat is then fed to an extractor or press to separate the coconut milk from the solid residue (called "sapal" in the Philippines). There are two types of equipment used in extracting coconut milk from the ground meat. The first is a horizontal screw press which works on the same principle as the expeller being used in extracting coconut oil from dried granulated coconut meat but with certain modifications and setting. Most coconut milk screw press/expeller has fixed choke clearance i.e. it cannot be changed unlike the oil expeller for dried granulated coconut meat. The other one is the vertical hydraulic press. In terms of milk extraction efficiency and ease of operation, the screw press is better since it allows continuous feeding from the tubular conveyor where the ground meat is heated. In hydraulic pressing, the

Small Coconut Milk Extractor

ground coconut meat is placed in special cloth bags and subjected to high pressure.

The milk coming out of the screw press is subjected to a two-stage screening process to remove fine residue particles that come out with the coconut milk to prevent clogging of the centrifuge. This is done using a vibrating screen with two different mesh sizes.

The screened coconut milk is transferred to a holding tank for centrifugation. On the other hand, the coconut milk residue recovered after coconut milk extraction should be further processed into another type of VCO and coconut flour to increase profitability of the operation.

2.3c Centrifugation

There are three versions of the centrifuge process.

In the first version which is being used by some VCO producers in Thailand and Indonesia, the screened coconut milk is pumped sequentially to a series of three (3) disc type centrifuges which are designed for three (3) phases separation, namely a) liquid heavy phase, b) liquid light phase and c) solids. The second version which is being practiced in the Philippines only uses one (1) disc type centrifuge suited for three (3) phase separation. The screened coconut milk is allowed to pass the same centrifuge 2 or 3 times until a clear VCO is obtained.

Small Centrifuge

The third version which is reported as being done by a manufacturer in Thailand uses a combination of tubular centrifuge and vacuum evaporation system to recover the VCO. The screened coconut milk is first separated into coconut cream and skim milk in a tubular centrifuge. Then the coconut cream is further processed into vacuum evaporators to obtain VCO.

2.3d Vacuum Drying – the VCO coming out of the 3 phase disc type centrifuge after 3 passes still contains moisture ranging from 0.3 to 0.5 %. Hence, there is a need to vacuum dry the oil to satisfy the 0.1 % moisture content stipulated in the current VCO standard.

2.4 Comparative Notes on the Fresh-Dry High Pressure Expeller Method and the Fresh-Wet Centrifuge Method

It should be noted that there is no perfect technology. Each of the said VCO production technologies has its own advantages and disadvantages. Shown in Table 1 is the comparative matrix for the fresh-dry high pressure expeller and the fresh-wet centrifuge methods using relevant parameters such as sensory characteristics of VCO produced, oil extraction rate, energy and water requirement, etc.

3.0 Misconceptions in VCO Processing

It is quite uncanny that despite of its many disadvantages, people still think that the fresh –wet centrifuge method is the best technology to process VCO. It may be attributed to some misconceptions in VCO processing.

3.1 Process Temperature

One of the biggest misconceptions in VCO processing is that the use of heat will make coconut oil lose the attributes of being "virgin" oil. A lot of people think and a lot of VCO producers claim that coconut oil should be processed without any heat to be entitled to the label "virgin". However, it should be noted that process temperature is not listed as a qualifying criteria for an oil to be considered "virgin". These criteria are the following:

- The oil is not refined or no other processing is done on the oil other than filtration;
- The oil is fit for human consumption after extraction;
- The oil retains the aroma or scent of the seed or nuts where the oil is extracted i.e. it should smell like coconut if it is VCO.

In addition, process temperature is not listed as a requirement in the current APCC and Philippine standards for VCO. The water clear color of VCO as stipulated in the standard is a self-checking mechanism in itself on the level of process temperature that should be allowed because high temperature will discolor the oil. Likewise, it should be emphasized that the main reason why virgin coconut oil is being bought at a much higher price than any other edible oils is because of the presence of high percentage of medium chain fatty acids (MCFA) particularly lauric fatty acid which has been shown to have anti-microbial properties, promote weight loss, boost immune system and other health benefits. Information on the stability of different nutrients to temperature, light and other factors showed that fatty acids are not affected by temperature as long as the smoke point of the oil is not reached. It is the vitamins which are very susceptible to increases in temperature.

3.2. "Extra Virgin" and "Cold Pressed" Label for VCO

A lot of VCO producers in different coconut producing countries who are selling on the retail market are placing "extra virgin" and "cold pressed" in their label without actually understanding what said label means or entails. Likewise, there is a misconception that VCO produced from the centrifuge process is considered as "extra virgin" and "cold pressed".

To gain a full understanding of the terminologies involved, a literature and internet research was conducted which revealed the following:

- a. The term "extra virgin" is exclusive to olive oil. However, the term "virgin " can be applied to olive oil as well as other types of oil provided the criteria discussed in Item 3.1 are satisfied. The main reason for the "extra virgin" label being exclusive to olive oil is because when the fresh olives are pressed at ambient temperature, what is coming out can be called "olive oil juice" which is essentially a mixture of olive oil and water. Upon centrifugal separation, the olive oil can already be recovered. On the other hand, when fresh coconut kernel/meat is pressed, what comes out is coconut milk which is an emulsion of oil and water stabilized by protein. To recover the coconut oil, the water has to be separated by breaking the protein bond either by heating, or by high speed centrifugation or natural/biological fermentation or by enzymatic action or some other means.

b. Information from internet websites gave conflicting information on what really is "cold pressed oil". Several websites mentioned that the term "cold pressed oil" do not have legal definition in several countries like United Kingdom and the United States. . Instead, it is just a marketing strategy because for an oil to be efficiently extracted from its plant based source (seeds, nuts, etc.), it has to be heated to a certain extent to allow the oil to flow freely. In most websites, the term "cold pressed" is associated with olives for reasons stated in item a. above. On the other hand, some websites mentioned that the term "cold pressed" is associated with an oil that has been extracted/ processed at a temperature below 122 ^{0}F or 50 ^{0}C. Under this condition, VCO produced from centrifuge process cannot also be considered "cold pressed" because the oil is being pre-heated to 60 ^{0}C before vacuum drying. On the other hand, VCO produced from the natural fermentation process can be considered "cold pressed" because it is getting separated from coconut milk at temperatures of 37 ^{0}C and below.

It should be noted that the APCC and Philippine VCO standards do not define the labels "extra virgin coconut oil" and "cold pressed"

Table 1.

COMPARATIVE NOTES ON FRESH-DRY HIGH PRESSURE EXPELLER METHOD AND FRESH-WET CENTRIFUGE METHOD

Parameters	Fresh-Dry High Pressure Expeller Method	Fresh-Wet Centrifuge Method
Material where VCO is extracted/recovered	Comminuted or granulated coconut meat at 3 - 4 % moisture content obtained from fresh coconut meat which is immediately processed and dried after opening the nut	Newly extracted coconut milk from comminuted fresh coconut meat
Sensory characteristics of VCO produced	More viscous and feels greasy to the skin; with oily after taste when ingested ; moderately intense coconut aroma More suited as base oil for specialty soap and hypoallergenic cosmetics and skin care products.	Has the best sensory characteristics; light texture or non-greasy feel and easily absorbed by the skin; without oily after taste when ingested; smells like newly opened coconut Generally preferred for functional food application.
Oil Extraction Rate	Highest among VCO technologies; about 9 % of the total weight of the input de-husked Philippine coconuts; about 58 % of the desiccated coconut input	Lowest among VCO technologies; about 5 % of the weight of the input de-husked Philippine coconuts; about 27 % of the coconut milk input
Physical Characteristics of VCO produced	Solidifies at temperatures of 22 ^{0}C and below and **liquefies faster** at temperatures of 27 ^{0}C and above	Solidifies at temperatures of 22 ^{0}C and below and **liquefies slower** at temperatures of 27 ^{0}C and above
Characteristics of the oil after extraction	Oil coming out of the expeller already has a moisture content of 0.1 % and below which already passes the current VCO standard ; Oil is turbid because of entrained very fine particles of dried meat which should be clarified through mechanical filtration or some other means.	Oil coming out of the centrifuge after 3 passes still has a moisture content of about 0.5 %. This requires further processing through vacuum drying or other means to meet the 0.1 % MC stipulated in VCO standard
By-Products Generated other than coconut water, coconut shell and testa	Coconut flakes (about 33 % of DC input) which when ground to at least 100 mesh can already be sold as coconut flour, a high value functional food product with high dietary fiber. This is another product that can qualify for the global health and wellness market	Wet coconut milk residue (about 40 – 48 % of the comminuted fresh coconut meat input) which has to be further processed into either low fat DC or coconut flour to improve profitability in operation Skim milk (about 55 % of the coconut milk input) which at present does not have any developed market yet; Entails add'l operating cost for treatment as part of the waste water
Energy Requirement	High because drying of fresh comminuted coconut kernel from 50 % to 4 % M.C. requires a lot of energy. However, energy cost is lower because coconut shell is used as fuel to generate process steam.	Energy cost is high because high speed centrifugation and vacuum drying requires more electrical power
Potable Water Requirement	Lower because main usage of potable water is only during the preparation of fresh coconut meat prior to drying and end of shift cleaning of process equipment	About 2 times more than fresh-dry because cleaning of equipment is more frequent during operation to prevent spoilage of in-process coconut milk and microbial build-up
Volume of Waste Water Generated	Lower because waste water only comprise of coconut water (if it will not be processed) and wash waters from the preparation of fresh coconut meat and end of shift cleaning of process equipment	More because aside from waste water mentioned for the expeller process, additional wash water is generated from frequent cleaning of coconut milk related process equipment plus the skim milk obtained in the centrifugation process.
Special Requirement for equipment	High pressure expeller with built-in cooling system; otherwise the resulting oil will be pale yellow in color which will not pass VCO standard	Coconut milk extractor with high extraction rate; 3 phase (liquid-liquid-solid) Centrifuge with high centrifugal force

4.0 Right Technology to Process Virgin Coconut Oil

Given the fact that both the fresh-dry high pressure expeller and the fresh-wet centrifuge methods have their own advantages and disadvantages, what is then the right technology to adopt in the production of VCO for the health and wellness global market?

It should be noted that the choice of technology to adopt depends on the scale of operation, amount of investment that an entrepreneur is willing to spend and most of all on the demand of the buyer. Likewise, it should be emphasized that the best process technology will NOT produce high quality VCO if good manufacturing practices on the selection of nuts and handling of fresh coconut meat starting from the opening of the nut will NOT be strictly followed.

The author proposes that the hybrid VCO processing technology is the right technology to adopt to enter the health and wellness global market. The hybrid technology (Figure 3) is a combination of the fresh-wet centrifuge and the fresh-dry high pressure expeller methods wherein VCO1 is produced from coconut milk using the centrifuge method. The coconut milk residue generated from the fresh-wet centrifuge method is combined with comminuted fresh coconut meat and processed under the fresh-dry high pressure expeller method to produce VCO2 and coconut flour.

The hybrid VCO process technology has the following advantages:

- It will produce 2 types of VCO which can cater to all health and wellness sectors with increasing growth
- It will produce coconut flour as a co-product which is also qualified to enter the health and wellness global market. It is also considered as a functional food because of its high dietary

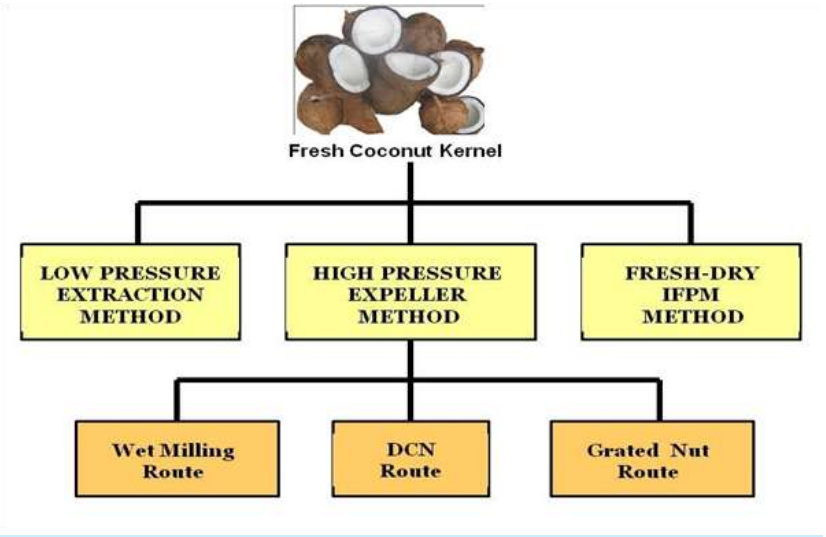

Figure 1: VCO Technologies under the Fresh- Dry Process

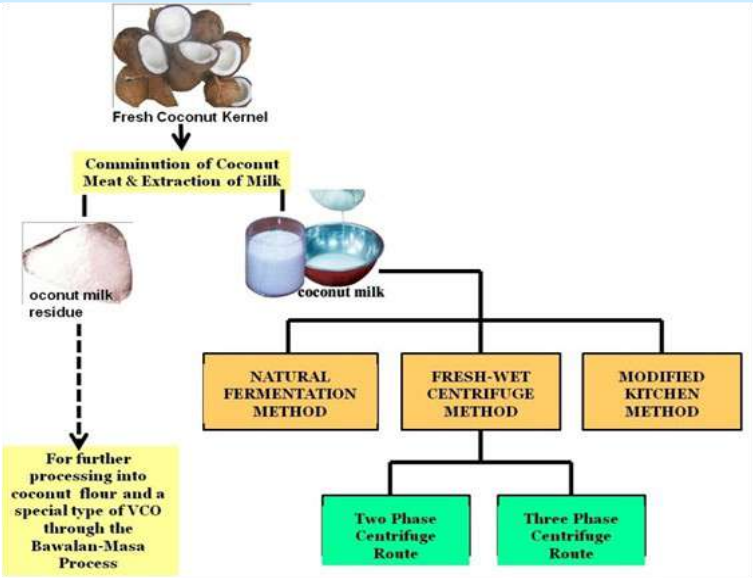

Figure 2: VCO Technologies under the Fresh-Wet Process

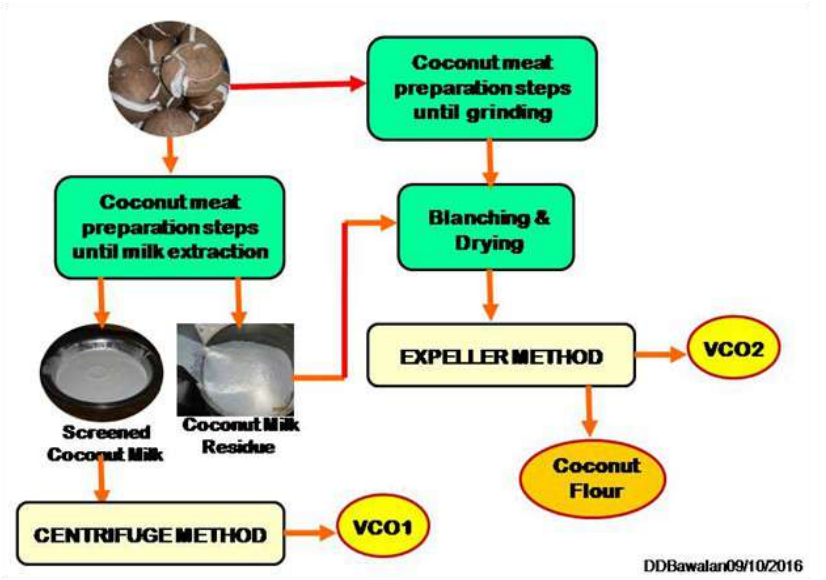

Figure 3: Hybrid VCO Process Technology

fiber content.

- It will correct the low oil extraction rate and improve the profitability of the fresh-wet centrifuge method since the residual oil in coconut milk residue can be recovered and at the same time produce coconut flour which is also a high value product.
- VCO produced from a combination of dried coconut milk residue and comminuted coconut meat will be less viscous than the VCO produced from the standard fresh-dry process, thereby enhancing its sensory characteristics.
- Extraction of the residual oil from coconut milk residue will be much easier if it is combined with freshly-dried comminuted coconut meat

5.0 Processing Options for Generated By-Products in VCO Commercial Operation

To be able to sell the VCO at a competitive price and enhance profitability in plant operation, it is advisable to utilize as much as possible the by-products generated during the production of VCO. Listed below are the options for utilizing the by-products.

5.1 By-Products Common to Both Fresh-Dry High Pressure Expeller and Fresh-Wet Centrifuge Methods

- Coconut shell - generally used as fuel in boiler to produce process steam; it is also used as fuel for drying the testa or brown skin of coconut meat which is generated in the meat preparation stages of both methods.
- Coconut water – either process into coconut water beverage through the use of UHT system or into coconut water concentrate by vacuum evaporation. Otherwise, spend money to treat it as waste water to comply with environmental laws.
- Testa – generally dried for further oil extraction. It is ideal to dry it within four (4) hours after the paring step to recover good quality coconut oil.

VCO Produced by Some APCC Member Countries

5.2 By-Products Distinct to Fresh-Dry High Pressure Expeller Method

- Coconut Flakes - grind into at least 100 mesh to produce full protein, medium fat coconut flour which is another high value product with functional food properties.

5.3 By-Products Distinct to the Fresh-Wet Centrifuge Method

- Coconut Milk Residue – a food grade material which can be further processed either as a low fat desiccated coconut or into another type of VCO and coconut flour via the fresh-dry process.
- Coconut Skim Milk - a highly perishable substance that can be processed into low-fat beverage(either plain or flavored) which is ideal for people with lactose intolerance. No developed market yet. Research and development are required to determine various utilization and applications. Currently being disposed and treated as waste water

6.0 Final Remarks

- VCO is a unique and multi-functional product that can serve the various sectors in the increasing health and wellness global market. Hence, VCO producers has to ensure that only high quality VCO will be produced through strict adherence to GMP and sanitary operating conditions and the use of right process technology
- Processing of by-products generated is a must to reduce production costs so that VCO can be sold at a competitive price.

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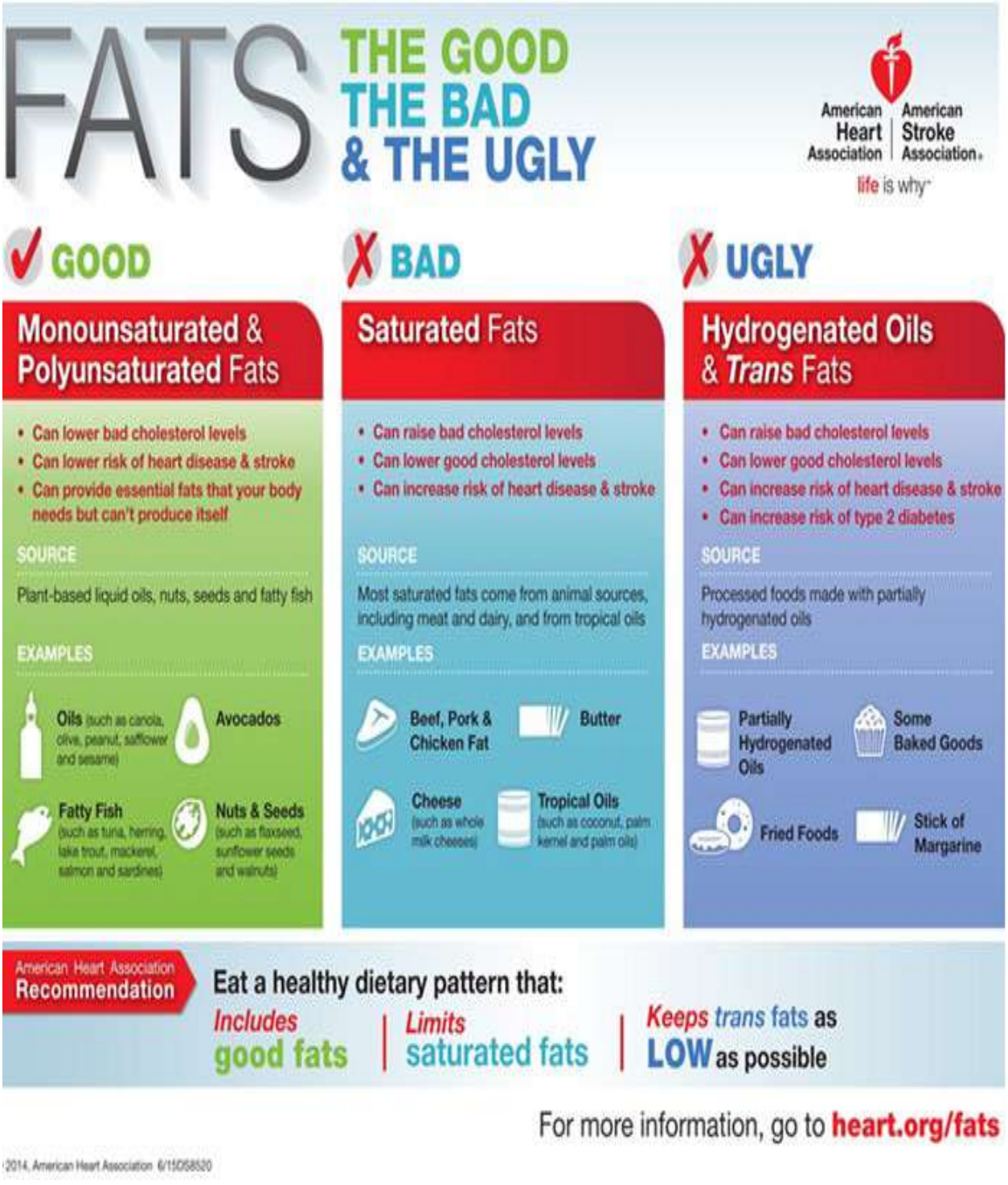
THE TRUTH ABOUT GOOD, THE BAD AND THE UGLY FATS

Dr. Narong Chomchalow[1]

It is most distressing to have read the American Heart Association/ American Stroke Association's billboard entitled "Fats—The Good the Bad & the Ugly" which provides a completely wrong information about fats. For example, on the left-hand side of the board, it states that "Good: Monounsaturated & Polyunsatu- rated Fats can lower cholesterol levels, can lower risk of heart disease and stroke, and can provide essential fats that your body needs but can't produce itself". It is now well known that unsaturated fats, with at least one double bond, are hazardous to health, as they are subjected to oxidation and hydrogenation, which create free radicals and trans fats, respectively. Even



is the one in the middle, which states: “Bad: Saturated fats can raise bad cholesterol levels, can lower good cholesterol levels, can increase risk of heart diseases and stroke”. Among the sample provides is coconut oil! The information displayed is not subjected to scientific verification.

It is unbelievable that such information is released from such a prestigious organiza-tion. No wonder a lot of American people are suffering from heart disease at a high rate even up to the present when numerous heart doctors, drugs and hospitals are available.

Coconut Oil is a Good Source of Fat

Facts about Fats

Fats are organic compounds containing fatty acids whose molecules contain variable number of carbon atoms having a methyl group (CH_3) at one end and a carboxyl group (COOH) at the other end. There are two main kinds of fats, saturated and unsaturated fats.

- Saturated fats are those in which the molecules have only single bonds, thus does not subject to oxidation (which creates free radicals) or hydrogenation (which creates trans fats). Thus, all saturated fats are good fats as no free radicals nor trans fats are formed.

- Unsaturated fats are those in which the molecules have at least one double bond, thus are subjected to oxidation or hydrogenation. Thus, all unsaturated fats are bad fats.

Good Fats

Good fats are those that contain high amount of saturated fats which do not create free radicals nor trans fats. Examples of good fats are animal fats, coconut oil, palm oil.

Bad Fats

Bad fats are those that contain high amount of unsaturated fats that create: (1) *free radicals* as the result of oxidation, and (2) *trans fats* as the result of hydrogenation. Examples of bad fats are vegetable oils, such as soybean oil, corn oil, safflower oil, sunflower oil, etc.

Ugly Fats

Ugly fats are trans fats derived from partial hydrogenation of unsaturated oils, in which one atom of hydrogen is switched from the *cis* position (i.e. two H atoms are on the same side) to the *trans* position (i.e. one H atom is on one side while the other H atom is on other side).

Fats and Cholesterol Levels

Fats and cholesterol are different compounds. Their levels in the artery are independent of each other. Although there is only one type of cholesterol, most people separate it into LDL cholesterol (one that carries LDL) and HDL cholesterol (one that carries HDL). LDL cholesterol is affected by diet. Knowing which which ones don't is the first step in lowering your risk of heart disease and stroke. Your body naturally produces LDL cholesterol. Eating trans fat raises your blood cholesterol level even further.

Foretts, et al. (1989) reported that those old-aged females in the nursery who have high level of cholesterol are the ones who live the longest; and death rate of the persons with low cholesterol is five times higher than those with high cholesterol. It is now accepted that high level of cholesterol is not the cause of atherosclerosis that leads to the deposition of plague in the artery, which ends up in having heart disease. The real cause of heart disease is the injury in blood vessel leading to the heart, which is caused by various factors, such as toxin, disease, high blood pressure and stress. If the blood vessel is injured, platelets will be circulated to cure the injury and deposited there to stop bleeding. Other substances such as protein, fats (particularly unsaturated fat) and calcium also move there, but not cholesterol, in which only a small amount is circulated and deposited there to be used to constitute the membranes of the newly formed cells.

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HOPE FROM COCONUT SECTOR: EMERGING YOUNG COCONUT ENTREPRENEURS IN INDONESIA

Mawardin M. Simpala[1]

Indonesia has managed to change its economy from agriculture based-economy to an industrial and service economy. Gross domestic product grew more than 100 times within four decades from USD7.5 billion in 1968 to USD888.5 billion in 2014, nevertheless agriculture share to the GDP decreases significantly from 49% for the same period in 1968 to only 10.26% in 2014. Meanwhile the structure of economy has changed, so has the labor force. According to Indonesian Central Bureau of Statistic proportion of agricultural workers has consistency dropped from nearly 60 percent in 1988 to 38.91 percent in 2010. Labor force is shifting from primary agriculture to secondary sector such as industry, construction, trading, transportation, finance and service.

The decreasing number of agricultural workers is unfortunately coupled with aging farmers. The number of young farmers or those who are under 35 is getting less. Indeed it is a global concern, for example, in UK it has been reported that the percentage of farmers under 35 has fallen from 16% in 1990 to 2.8% in 2011. Indonesia is slightly better with 12% young farmers but it has far larger population to feed meaning that the country needs to boost its food production.

The younger generations are reluctant to take agricultural sector for their career. For the young, the image of farmers is the poor who often hardly sustain themselves and work with dirt. Most of the young prefer to work in industrial or service sectors. Even the educated youngsters who originally come from rural areas prefer to stay in the city for an office job. Concerned with this issue, Indonesian Minister of Agriculture Amran Sulaiman who has agricultural education and business background states that his office will develop and promote programs to encourage the young to return to agriculture. The programs aim to create awareness among the young generations that farmer is a noble job and has same opportunity for success. Farmers are important and noble profession as they work to feed people in big modern cities which will collapse without food supplies from farmers. Brenda Schoepp, a Canadian prominent writer, agriculture and environmental activist, said that 'once in our life we need a doctor, a lawyer, a policeman and perhaps a preacher, but every day, three times a day we need farmer.

In coconut sector, fortunately, it is not the case especially in the past few years. As a matter of fact, many already understand that coconut business has been established in Indonesia for a long period of time dated back in the colonial era. Coconut industry has contributed to the country's development in early independence. It also benefits some of the prominent businessmen such as Ciputra, Peter Sondakh of Rajawali Group, Eka Tjipta Wijaya of Sinar Mas and Mochtar Riady of Lippo. These tycoons have links to coconut in many ways from being raised in coconut producing areas, inherited copra business from their father or pioneering their venture with copra before moving to and prosper in another industry such as manufacture, property, mining, media etc.

The increased interest and number of the young who work on coconut sector for example can be seen from coconut shell charcoal business. Such increase is confirmed by Bambang Warih Kusuma, the owner of internationally recognized COCOCHA brand barbecue briquette. According to Bambang, the pioneer of the briquette business in the country, the number of charcoal related entrepreneurs increases significantly estimated by more than 64 percent in the last 3

Indonesian Coconut Plantations

years and half of them are young entrepreneurs.

Prominent young entrepreneurs emerge all over the country and some are reported by media. They worked for different coconut products. Some of them toil on coconut shell charcoal related business such as running a shell burning kilns, trading and producing briquette for barbecue. Some others are also interested in venturing on a controlled, clean and air-conditioned environment of food industry such as desiccated coconut and virgin coconut oil. Others prefer to work with farmers producing coconut sugar. Their motivations are varied from the basic reason of striving for better economy, expressing and extending their business capacity, and continuing what they already learned at the university or college. Some have social motivation to help farmers or continue an inherited business from their parents.


Helmy Affandi

One of them is Helmy Affandi (28) who runs a Surabaya based-briquette business. He started his venture through PT. Empat Sekawan, a company he set up with Christopher Imantaka and Johan Hermawan, his university colleagues. He was still a student at Ciputra University when they started the business. Helmy who was elected president director of the company initially worked on coconut fiber. They were inspired by Mr. Ciputra, a well respected businessman in the country and founder of the university. Ciputra always reiterates that businessmen are those who can turn waste to gold. Coconut fiber will exactly fit into the phrase. The coir or coconut fiber is often treated like waste as most of the husk, source of coir, is burnt. Processing the husk into coir and exporting it is the process of creating gold. Helmy and his friends studied at Ciputra University which has mission to educate and create young entrepreneurs. Now they expand their business to coconut charcoal. They started this new venture as a trader who raw materials for an activated carbon factory in China. After running this venture for a while they met buyers for coconut shell charcoal briquette which made them work on coconut shell charcoal briquette briquette production. After running for 3 years with a simple start they managed to produce 72 to 90 tons of briquette a month and exported it to Russia, United States and Middle East. He said that two of his coconut based-businesses make annual turnover of USD1,650,000.


Haqqul Bashar

Helmy and his friend started as student but the story of Haqqul Bashar is a slightly different. He was working in a state owned-bank when he started to be aware of business opportunity in coconut. On a weekend he went to Polewali, a small coastal town 6 hours away from Makassar for a survey. He met some suppliers there and successfully related them with potential buyers he knows in Makassar, the capital city of South Sulawesi. From there he started the coconut trading. Being able to make a good first profit Haqqul then went back and forth from Makassar to Polewali. He departed to Polewali after office hours on Friday and returned to Makassar on Sunday evening to catch up Monday for his office work.

Having done this for four months Haqqul decided to focus on his business full time and resigned from his job. After running the coconut trading for a while decided to apply a loan from the bank he used to work with. Now he is producing white copra as he can see double profit by buying fresh coconuts and processing it into white copra as got the coconut shell for charcoal production as by-products. Haqqul produces 24 tons white copra a month and for this he employs 14 workers at his factory. This friendly bachelor recorded an annual turnover USD310,000. After four years he plans to expand his business by opening another factory in different province. “I feel happy with what I am doing now,” he concluded, “apart from doing business I am helping the local people by providing them with a job.”


Sandilla Tristiany

Social entrepreneurship was in her mind when Sandilla Tristiany (26) decided to visit a group of farmers producing brown coconut sugar in the city of Purbalingga West Java. Cindy, the nickname of this active girl, was astonished to find that the farmers gain little from their meticulous and often dangerous labor. Cindy said that farmers had to climb twice a day several coconut trees which are 10 to 15 meters high to collect *neera.* The *neera* was then cooked for several hours to make it become thickened brownish syrup, coconut sugar. She described the work as dangerous because climbing accidents happened. Climbers often fall off from tall coconut trees which results in serious injuries or even death.

Later she also understands that the sugar has lower quality so will not get better price in the market. She gathers the Social entrepreneurship was in her mind when Sandilla Tristiany (26) decided to visit a group of farmers producing brown coconut sugar in the city of Purbalingga West Java. Cindy, the nickname of this active girl, was astonished to find that the farmers gain little from their meticulous and often dangerous labor. Cindy said that farmers had to climb twice a day several coconut trees which are 10 to 15 meters high to collect *neera.*

The *neera* was then cooked for several hours to make it become thickened brownish syrup, coconut sugar. She described the work as dangerous because climbing accidents happened. Climbers often fall off from tall coconut trees which results in serious injuries or even death. Later she also understands that the sugar has lower quality so will not get better price in the market. She gathers the farmers to help them

improve the quality and find a better market. Her work program plan is supported by more farmers who later decide to form a cooperative with 340 member farmers. The cooperative then organize training for good processing practice. The quality of coconut sugar slowly improves and it finds its way to be exported to Singapore. Few months ago through her help the cooperative gets an organic certification from Control Union. Cindy's passion to make a change in coconut sugar community also gets attention from Jolkona, a nonprofit organization in Seattle. In May 2016 she got fellowship to attend three-week training for young social entrepreneur in developing countries. She learned a lot from the training, knowledge that she hardly waited to share with her team.


Mudji Tasrip

Mudji Tasrip (26) still feels comfortable as coconut trader supplying several traditional markets in Jakarta, the capital of the country. He gets his coconut supply from Hainan and Lampung both in Sumatera then transported by truck all the way to Jakarta. In average 11 trucks containing 9,000 mature coconuts are transported per month to his warehouse near Pasar Minggu, one of the largest traditional markets in Jakarta. He is an IT graduate and worked in a financial company before focusing on the business that was run by his father before he was born thirty years ago.

Recent hike of coconut price in Indonesia due to previous year drought assures Mudji to keep work on coconut business. He intends to work on simple processing with less investment such as coconut milk and copra to get added value. Once in a while he goes to the source of the coconut to see the plantation and meet farmers or traders who supply coconuts for him. The purpose of his visit is not only to get to know them personally but also to understand the situation of the coconut sectors. He believes that now the country needs to boost its replanting program to replace senile trees.


Ahmad Annas

The list continues to Annas Ahmad (35) who produces and sells VCO under an established brand Vico Bagoes. His interest with the product emerged from his personal experience. His father dr. Zainal Gani is a medical doctor who lives healthy life from three-decade diabetes by consuming regularly virgin coconut oil. After running conventional marketing for several years, Annas starts to opt for a more efficient marketing through social media. This year he joins an e-commerce network to sell his VCO.

Vico Bagoes is exported to some developed countries but Annas plans to increase his domestic sales. The aim is to spread the healthy benefit of VCO within the country.

Another young business start-up is Abimanyu Lino (32) who opened a desiccated processing business last year. He chose to set his factory in Tobelo of North Maluku which he considers less developed than other places in Indonesia. He is an IT graduated from a reputable university in Australia and coming from a middle class family in Jakarta does not deter his passion on coconut sector. He was not comfortable enough to sit and work in an air-conditioned room as he did for several years before decided to enter coconut business. He then decided to quit and started to work on his plan.

After visiting and doing business in some places in Sumatera Abimanyu decided to settle in Tobelo a small peaceful town in North Maluku which is far from luxury he can enjoy in big city like Jakarta. Though he sells his product on domestic market he plans to upgrade his processing technology and aims for export.

Coconut will remain attractive and create new young entrepreneurs especially with the promising global trend for healthy and organic food products. Indonesia as the largest coconut producer witnesses a dynamic coconut industry development. Nevertheless one serious problem in the sector is the need for national replanting program. More than half of the total coconut plantations in Indonesia need to be replanted.

Keeping the current approach of replanting will take more than 90 years to complete the task. It is therefore new dynamic and technology savvy of the young is needed to lead the action. As Minister of Agriculture hopes that by involving in agriculture business the young can boost the agricultural development. Their power can re-energize the sector by developing agro economy and improve the livelihood of farmers. Economic gain is the incentive which is as strong as or as much as that of IT or financial sector and coconut sector most likely can provide it.

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[1]Mawardin M. Simpala is Chairman, Indonesian Friends of Coconut & Former APCC Market Development Officer.

UNPUBLISHED STUDIES DISPROVED SATURATED FAT—HEART DISEASE CONNECTION LONG AGO

Dr. Bruce Fife[1]

An unpublished study conducted four decades ago, but recently discovered in a dusty basement, raises new questions about the longstanding dietary advice regarding saturated fats. The research, known as the Minnesota Coronary Experiment, was a major double blind randomized controlled clinical trial conducted from 1968 to 1973. It studied the diets of more than 9,400 people at state mental hospitals and a nursing home. Although the study was conducted over 40 years ago it was not published until just recently. This study is a good example of what happens when the results of an investigation do not coincide with the prevailing scientific dogma of the time—it doesn't get published. Numerous studies were conducted from the 1960s through the 1990s that were designed to demonstrate the dangers of eating cholesterol and saturated fat, but proved otherwise and consequently were never published.

In his book, *Heart Fraruds*, Charles T. McGee, MD talks about this problem and shares the experience of a patient of his who participated in a feeding study.[1] "John worked in a regional primate center, one of several research centers funded by the federal government. One old baboon, named George, was selected to participate in the study because he had a mean disposition and none of the animal keepers liked him. "The staff dreamed up an experiment in which George was given the opportunity to give his life for science and not be around to bother them anymore. They fed the old baboon nothing but hardboiled eggs for one year, then put him down and performed an autopsy. "Because of the propaganda about the cholesterol theory, the staff confidently expected to find massive obstructions in the old baboon's arteries. They dreamed of seeing their names in large print on the top of a published scientific paper supporting the widely accepted and popular cholesterol theory." However, "…no evidence of atherosclerosis was found in George's arteries, no paper was written. The feeding study demonstrated once again … that studies that do not support an accepted theory usually don't get published."

In 2013, Dr. Ramsden and his colleagues published another controversial paper involving a large clinical trial that had been carried out in Australia in the 1960s which also had never been fully analyzed or published. Like the Minnesota study, the researchers never had their study published because the results were not what they had expected. The trial found that men who replaced saturated fat with omega-6-rich polyunsaturated fats lowered their cholesterol. But they were also more likely to die from a heart attack than a control group of men who ate more saturated fat.

Today, saturated fat is not considered the evil demon it was a few years ago. The medical community is now acknowledging that saturated fat may not be so bad after all. Fortunately the data from the Minnesota study has been found, analyzed, and published. The Minnesota Coronary Experiment, was paid for by the National Heart, Lung and Blood Institute and led by Dr. Ivan Frantz, Jr. of the University of Minnesota Medical School. Many diet studies have relied on the participants' memory in recalling what they ate over previous days or weeks. Such studies are limited by the accuracy of the subjects' memories, and therefore, are not totally reliable. This study was significant because the researchers were able to tightly regulate the diets of the institutionalized study subjects so that they knew exactly what the subjects ate. Half of those subjects were fed meals rich in saturated fats from milk, cheese, and beef.

The remaining group ate a diet in which much of the saturated fat was removed and replaced with corn oil, a polyunsaturated fat that is common in many processed foods. The study also had the benefit of detailed autopsies on 149 patients who had died during the study. The study was intended to show that removing saturated fat from people's diets and replacing it with polyunsaturated vegetable oil would protect them against heart disease and lower their risk of mortality.

So what was the result? Despite being one of the largest tightly controlled clinical dietary trials of its kind ever conducted, the data were never fully analyzed, and consequently never published. Why put so much effort and expense into a study and not publish it?

Several years ago, Christopher E. Ramsden, a medical investigator at the National Institutes of Health, learned about the long-overlooked study. Intrigued, he contacted the University of Minesota in hopes of reviewing the unpublished data. Dr. Ivan Frantz, Jr who died in 2009, had been a prominent scientist at the university, where he studied the link between saturated fat and heart disease. One of his closest colleagues was Ancel Keys, an influential scientist whose flawed research in the 1960s helped establish the belief that saturated fat was a dietary monster, prompting

the federal government to recommend low-fat diets to the entire nation. "My father definitely believed in reducing saturated fats, and I grew up that way," said Dr. Robert Frantz, the lead researcher's son and a cardiologist at the Mayo Clinic. "We followed a relatively low-fat diet at home, and on Sundays or special occasions, we'd have bacon and eggs." The younger Dr. Frantz made three trips to the family home, finally discovering the dusty box marked "Minnesota Coronary Survey," in his father's basement. He turned it over to Dr. Ramsden for analysis.

The results were a surprise. Participants who ate a diet low in saturated fat and enriched with corn oil reduced their cholesterol by an average of 14 percent. But the low-saturated fat diet did not reduce mortality. In fact, the study found that the greater the drop in cholesterol, the higher the risk of death during the trial. The fact that blood cholesterol levels decreased when corn oil replaced the saturated fat was expected, as this had been observed before. What wasn't expected was the drop in cholesterol was correlated with an increase in the number of deaths. The findings ran counter to the prevailing belief at the time that diets low in saturated fat reduces the risk of heart disease. This study indicated just the opposite.

Preliminary analysis of the data uncovered the apparent discrepancy with the prevailing belief at the time. While it is unclear exactly why the researchers did not complete the analysis and seek publication, but one possibility is that Dr. Frantz and his colleagues had a hard time getting it published. If they had sought publication they would have faced stiff resistance from medical journal editors who might have refused to publish the study because it questioned a popular and generally accepted belief that saturated fat promoted heart disease. Any study that did not support this position was simply out of step with established scientific belief and considered unreliable, and therefore, not worthy of publication. Many leading edge studies are not published simply because they suggest ideas that go contrary to accepted medical belief.

Another possibility, and the one that is most likely, is that Dr. Frantz and his colleagues were so convinced that saturated fat was the problem, that they couldn't believe their own data and decided not to seek publication. Maybe they thought the results were just a fluke or perhaps an undetected error had crept in that influenced the results. This reason is most likely because Dr. Frantz continued to strongly believe in the saturated fat heart disease connection even after this study was completed. The younger Dr. Frantz said his father was probably startled by what seemed to be no benefit in replacing saturated fat with vegetable oil. "When it turned out that it didn't reduce risk, it was quite puzzling," he said. "And since it was effective in lowering cholesterol, it was weird."

The new analysis of the Minnesota Coronary data was published, in the April 2016 edition of the *British Medical Journal*.[2] Based on the analysis, the authors concluded that although the replacement of polyunsaturated vegetable oils for saturated fat in the diet can lower blood cholesterol, it does not lower the risk of death from coronary heart disease or any other cause. Also, the prejudice against saturated fats over the years has contributed to the over estimation of the perceived benefits of replacing saturated fat with vegetable oils rich in omega-6 fatty acids (primarily linoleic acid). To investigate whether the new findings were a fluke, Dr. Daisy Zamora, a research scientist at the University of North Carolina at Chapel Hill and one of the main authors of the new study, and her colleagues analyzed four similar, rigorous trials that tested the effects of replacing saturated fat with vegetable oils rich in linoleic acid. Those, too, failed to show any reduction in mortality from heart disease. "One would expect that the more you lowered cholesterol, the better the outcome," Dr. Ramsden said. "But in this case the opposite association was found. The greater degree of cholesterol-lowering was associated with a higher, rather than a lower, risk of death." We have been looking at cholesterol levels the wrong way. Higher cholesterol reduces the risk of death in comparison to low cholesterol.

One explanation for the surprise finding may be omega-6 fatty acids, which are found in high levels in corn, soybean, cottonseed, and sunflower oils. While cooking with these vegetable oils instead of butter lowers cholesterol, the high levels of omega-6 can simultaneously promote inflammation—a major contributing factor to heart disease. In 2013, Dr. Ramsden and his colleagues published another controversial paper involving a large clinical trial that had been carried out in Australia in the 1960s which also had never been fully analyzed or published.[3] Like the Minnesota study, the researchers never had their study published because the results were not what they had expected. The trial found that men who replaced saturated fat with omega-6-rich polyunsaturated fats lowered their cholesterol. But they were also more likely to die from a heart attack than a control group of men who ate more saturated fat.

The Australian study was conducted from 1966 to 1973. One group of men with heart disease increased omega-6-rich polyunsaturated fat intake to 15 percent of calories, while reducing saturated fat intake to less than 10 percent. Another group of men with heart disease continued their normal diets. The men were followed for an average of 39 months, and those on the polyun-

saturated-rich diet lowered their cholesterol levels by an average of 13 percent. But they also were more likely to die, and in particular to die of a heart attack, than those who stuck with their usual diet, which consisted of about 15 percent saturated fat. This study — the results of which weren't fully analyzed when it was conducted in the early days of enthusiasm for polyunsaturated oils — adds to a growing body of data suggesting that consuming polyunsaturated oils, even though they reliably lower cholesterol, may nevertheless increase the risk of heart disease.

The science behind dietary fat may be more complex than nutrition recommendations suggest. Apparently we can get 15 percent or more of our daily calories from saturated fat without problem. However, we need to limit our omega-6 or polyunsaturated fat intake. Our bodies do require omega-6 fatty acids (linoleic acid) in small amounts, about 2 percent of calories. But emerging research suggests that excess linoleic acid may play a role in a variety of disorders including liver disease, chronic pain, diabetes, and heart disease. A century ago, it was common for Americans to get ries from omega-6 fatty acids by eating whole, natural foods. Today, Americans on average consume more than triple that amount, much of it from processed foods like lunch meats, salad dressings, desserts, pizza, French fries, and packaged snacks like potato chips. Natural sources of fat such as olive oil, butter, and egg yolks contain omega-6 fatty acids as well, but in much smaller quantities. Eating whole, unprocessed foods is the best way to get all the omega-6 fatty acids your body needs, without getting too much.

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COCONUT COMEBACK – A SEA CHANGE? INNOVATION TO REALISE THE POTENTIAL OF VIRGIN COCONUT OIL

Dr. Dan Etherington[1]

Coconut Comeback' was the title of the award-winning Australian Broadcasting Corporation's documentary in their Landline TV program aired in mid-July 2015. It told the story of the work of Kokonut Pacific in the Solomon Islands. The fundamental question posed in the title is whether this successful venture in the production of virgin coconut oil at a village level is just an exceptional event or whether this innovation provides a model that can be replicated in other countries.

Virgin Coconut Oil (VCO) is a relatively new product on world markets both in terms of supply and demand. The market is exciting in its enormous potential but there is also a significant danger of instability with wide price fluctuations. How can the copra experience be avoided as this niche product is 'commodified'? What are the fundamental differences between copra-oil and VCO?

Conventional coconut oil arose from the industrial demand for a vegetable oil that could replace animal fats in soap and cosmetics. This demand from urban industrial oil mills led to the supply from colonial plantations using copra as a raw material that could be bulked up to minimise freight costs. Copra became a large scale export commodity. After WWII the plantation sector dwindled through land reform and decolonisation. For many smallholders in the Pacific, copra production was their entry point into the cash economy. It provided an opportunity to earn cash almost whenever they wanted it: if they needed cash or the price was high, they made copra. If prices were low and no school or medical fees were required, coconuts were lefton the ground where they fell. The elasticity of supply of copra from the smallholder sector was much higher than from plantations. However, aside from cash, farmers received little benefit since they never saw either the oil or the copra meal. Considering the hard work and low returns, many considered producing copra to be a form of slavery.

Dr. Dan Etherington and his Son, Richard Etherington, with DME Machine and VCO Produced by DME Process

'Fair-trade programs have not yet reached as far into the coconut trade as they have with other commodities . . . In many cases, the middlemen are grabbing more of the profit and passing on little to the growers. . .For an industry in a growth spurt, that is trouble. . . .'
The particular 'trouble' of concern to the writer, Krista Mahr, was the impact of inadequate coconut supplies for the even more rapid boom in coconut water as a beverage. But this warning also applies to the emerging VCO market. In the monthly COCOMMUNITY Newsletters, VCO 'tops the charts' as the most rapidly expanding 'non-traditional' export for the Philippines and Sri Lanka.

While coconut farmers adjust to extreme price fluctuations, the macro implications for small Pacific island economies were and are serious due to their reliance on copra and/or coconut oil for their export earnings. Adding value to copra became an important government policy involving the introduction of mini-copra mills (in the Solomons, Fiji, Vanuatu and Kiribati). Unfortunately, few of these have continued to operate. The lack of domestic facilities to refine the crude CNO posed a problem in actually gaining additional value from the abundant coconut resource.

It has been private enterprise that took the initiative to examine the potential of raw natural coconut oil. Domestic kitchens used a range of processes to make coconut oil for edible, topical, ceremonial or religious purposes and for sale in local markets. It has been an adjunct to subsistence farming for centuries. There are many variants of three basic processes all of which start with grating fresh coconut flesh out of fully mature coconuts. The first two processes involve squeezing out coconut cream from the grated material with or without added water. In the most common 'kitchen method', the coconut cream is simmered in a large wok to break the emulsion of oil and water and the oil is scooped off when it rises to the top. An alternative is to add warm water to coconut cream and allow this to ferment over a couple of days after which clear oil can be removed.

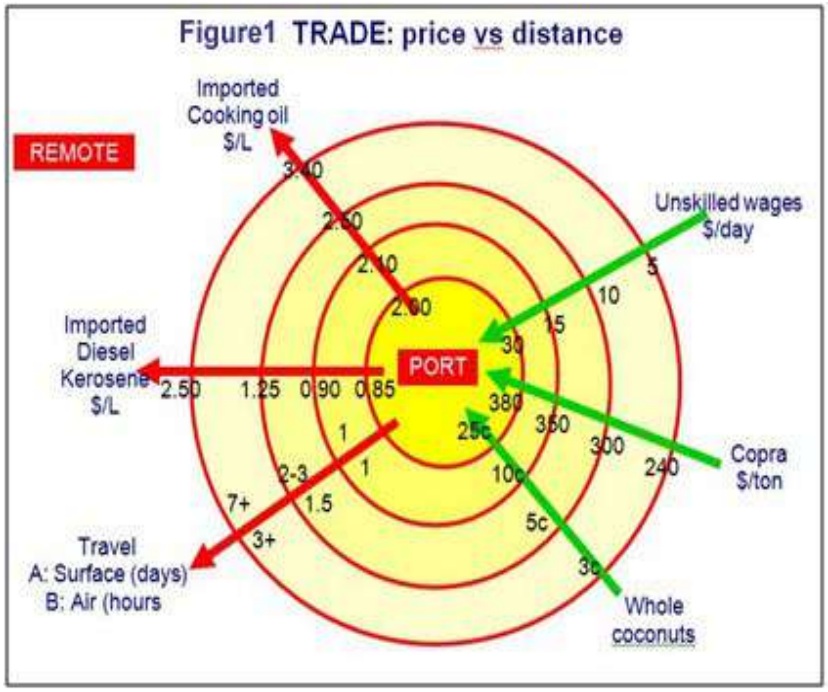
The third method involves drying the grated material to a specific

low moisture content at which oil can be pressed directly using low pressure. This traditional 'moisture-assisted' expelling method was first observed by westerners in the 1970s in the remote Pacific islands of Tuvalu. It was the subject of a presentation by the Natural Resources Institute of the UK at COCOTECH in Fiji in 1991. In 1993, I brought small samples of village oil from various Pacific islands to the last Bali COCOTECH conference. RBD oil was the comparator.

The colour, clarity and aroma of the 'virgin' oil impressed everyone and encouraged me to try to find a way to adopt this simple and appropriate household process for village-level production. The focus of the 1993 paper was on the potential use of this coconut oil as a diesel-fuel replacement in remote Pa-cific island locations. **Figure 1** illustrates the impact on prices as imports move from the central port to remote areas. Each concentric circle represents a staging or transport transition level. It also shows the increase in the value of export products and local resources as they move from the remote points of production towards the port.

Following a presentation in July 1994 in Changmai, Fiji's Ministry of Agriculture and Forestry (MAF) invited me to conduct field trials of our Direct Micro Expelling (DME) process. We received great technical / scientific encouragement from the CSIRO and my employer, the Australian National University in Canberra. In November 1994, 5 shareholders formed Kokonut Pacific as a Company.

I reported on the progress of the field trials in 1996 in Kuala Lumpur and to wider audiences in 1998 and further progress in 2001 and 2006. Initially, the results produced in the laboratory were not replicated in the field where communities were only able to extract 40 to 60% of the available oil and barely produced 5L in a



day. However, the vision for the villages was always clear: to have a technology that could give meaningful employment and produce high quality final products using their existing coconut resource. Kokonut Pacific's DME process was recognised at the 2000 World Expo as a pioneer in bringing VCO to the market.

Continuous improvements were made in the process, in the output and yield. Today, standard daily production by Direct Micro Expelling (DME) units is 40L per day extracting about 85% of the available oil. Many units, employing 4 to 6 people, are now processing up to 1,000 nuts/day and producing 60 Litres/day from just one manual press. Our aspiration is that DME introduces positive sustainable change.The highest output that has been reported to us for a single unit is from the island of Tanna in Vanuatu that produced over 100 L in 10 hours. This was shortly before Cyclone Pam devastated the island last year and closed this unit for nine months.

DME VCO is an ideal product to produce at a farm level. Not only does the producer have pure oil, the residue is edible and together with the coconut water makes an excellent stock feed. VCO, unlike milk (from animals or coconuts), retains its excellent qualities over a long shelf life. However, this is where the real problems start: an isolated village can produce far more oil than its small population can use and in the Pacific the national urban markets are also small.

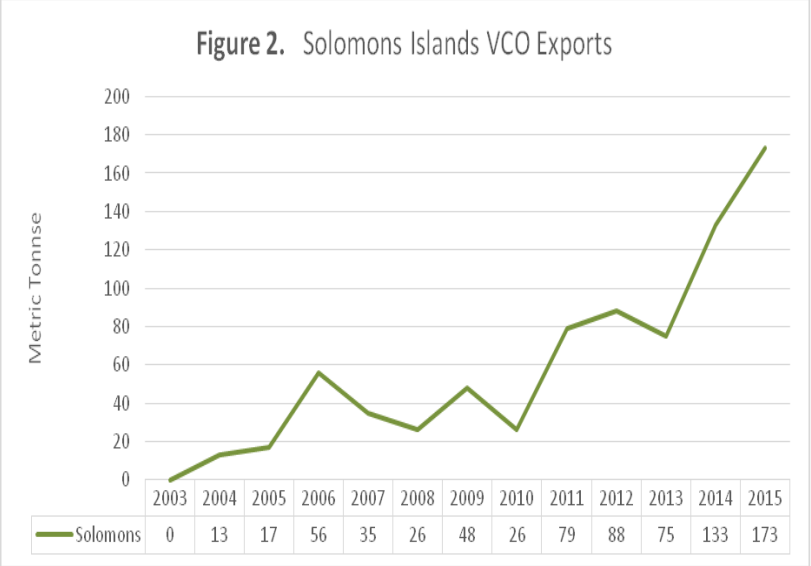
South Pacific VCO has to find export markets. Isolation in the islands has to be experienced to be believed. Just a decade ago communication with remote villages was either one-way by public radio or by the personal delivery of a message. The 'tyranny of distance' was measured in time (days and weeks) rather than in kilometres. But export markets require an assurance of quality. A reputation of having a remote pristine environment is not enough. Annual inspection of farms and VCO producers by an internationally accepted Organic Certifier became a necessary and expensive condition. Communication with producers was a nightmare until the advent of the mobile phone. In the South Pacific this revolution started in Fiji & Papua New Guinea and then rapidly moved to Samoa, Tonga and Vanuatu. The Solomons has been the last cab off the rank with two networks being rolled out over the last 5 years.

Next, there are the logistic challenges of getting the oil from an isolated village to the export port for consolidation with oil from numerous other producers. In the Solomon Islands, the preferred method of transporting the oil by canoe, ferry or truck is in 60L heavy-duty 'carboys' or barrels. The tasks of testing the oil for quality, filtering and bulking-up and packing into 200L drums or semi-bulk 1,000L IBCs has to be done on a factory scale.

The conclusion is that while smallholders can produce very high quality VCO, completing the marketing value chain from hundreds of coconut farmers, to multiple VCO producers, to their consolidator who aggregates and filters and adopts strict QA protocols, before shipping to multiple distant markets. There they then package the oil and pass it on to distributors who sell it to hundreds of stores who on-sell tothousands of consumers. This whole 'chain' requires a set of very specific institutional inputs.

Key components of the links in the chain include establishing and maintaining good relationships with farmers and producers, technology transfer, extension, credit and banking facilities, communications and logistic support. It involves many people at different stages as well as nurturing potential markets and supplying according to their needs. Coordination is critically important but expensive. **Figure 1** can be reinterpreted to view the outbound (red) arrows as the increased costs of exporting to distant markets while the inbound (green) arrows refer to the costs of bringing village VCO to the aggregation site.

Over the last 22 years regarding DME VCO production in the South Pacific and around the world, the least of the problems seem to be with the actual production process. For example, here in Bali, a new unit was installed last year and within 3 weeks we received 'proof of concept' confirmation. On the first day, with no prior experience and just working from the instruction Manuals, the team produced 10L. On day 3, 25L; on day 7, 30L; and by day 11, 35.6 L. By the end of their 3 week 'training time' the team was delighted to be producing 6L/hour for seven hours and producing each batch within an hour. This is indeed a gender-neutral technology that gives meaningful employment in a village context.



Meanwhile, high VCO prices in niche health-food stores have attracted large desiccated coconut (DC) factories which had very low barriers for entry into this market. The extra costs of passing DC through an expeller are negligible and provide companies with two new products: VCO and edible Coconut Flour. This has led to boom times with VCO becoming a new 'superfood'. Concurrently, coconut water has become a valuable beverage rather than a pollutant. This has been the experience of the Philippines, Thailand and, latterly, Sri Lanka.

But, is this just another coconut 'boom – bust' cycle or is it a 'sea change' for the industry? Asian suppliers have come on board in the last five years swamping the hard-won market with VCO at unbelievably low prices. The result is that western consumers, who accepted the high price for a niche health market product, now find that the price has dropped dramatically and VCO has become commoditized as a supermarket product. A new benchmark has been set – so that it is impossible for the producers and workers to receive a fair wage. Are we moving back into the unhappy circumstances of the copra trade? Is it possible that we are missing the opportunity to raise farm level prices to encourage replanting and the long term growth of the industry?

Figure 2 shows the apparent take-off of Solomon Islands VCO exports. I say 'apparent take-off' precisely because the supplies from Asia have entered the neighbouring markets (Australia and New Zealand) with full container loads (FCLs) of glass jars fully packed and labled ready for shop shelves at prices lower than the Islands can deliver bulk VCO.

As pioneers, how can the South Pacific keep a foothold in this market?

A significant motivation for persisting with the development of DME was the report of Dr Persley (1992) noting that over 90% of the coconut areas in the world are in the hands of smallholders. **Table 1** presents her data on Farm size and the estimate of the percentage of coconut production coming from small - holders in

Table 1. Coconut Farms & Population data for the APCC regions 2014								
Country	Area '000 ha	Average holding size (ha)	No. farm families ('000)	Estimated production from small-Holdings %	Rural Population (million)			Rural Population Growth Rate
	2014		1986	1986	1990	2000	2014	%
Asia- APCC								
India	2,141	2	5000	98	646.9	753.9	857.1	1.17%
Indonesia	3,610	4	3000	97	124	121.2	118.8	-0.18%
Malaysia	88	3.5	90	99	9.1	8.9	7.6	-0.75%
Philippines	3,502	3	1000	98	31.8	40.4	50.5	1.93%
Sri Lanka	440	0.5	715	99	14.3	15.9	18.2	1.00%
Thailand	206	n/a	n/a	99	39.9	42.9	43.5	0.36%
Vietnam	159	n/a	n/a	n/a	55	61.2	62	0.50%
Total - APCC Asia	**10,146**	1.5-3.5ha			921.0	1,044.4	1,157.7	0.95%
Fiji	62	n/a	n/a	50	0.4	0.4	0.4	0.00%
PNG	221	1.5	104	60	4.5	5.4	6.00	1.20%
Solomon Isl	38	4	60	80	0.1	0.1	0.2	2.34%
Vanuatu	92	4	50	70	0.1	0.1	0.2	2.30%
Samoa	99	n/a	n/a	90	0.1	0.1	0.2	1.01%
FS Micronesia	18	15	n/a	99	n/a	n/a	n/a	
Other Pacific	59	n/a	n/a	99	n/a	n/a	n/a	
Total-APCC Pacific	**589**	1.5 to 4.0 ha						

Sources: Column 2 APCC 2014. Column 3, 4, 5 Persley 1992 p.20. Columns 6, 7, 8. FAO Statistical Pocketbook 2015

1986 (I have not been able to find any recent data). Since many of the rural populations have increased significantly, farm sizes are likely to have become even smaller. The exceptions are Malaysia and Indonesia where rural populations have started to decline.

The dominance of smallholdings is the most striking commonality in the coconut industry across all APCC countries. The smallholder nature of the coconut industry was noted in the major 'Coconut Craze' article in TIME Magazine in 2012 (Dec 11 p.41-2). '*Coconut oil, once demonised for its high saturated-fat content, has been rehabilitated by research extolling its health benefits . . . It has all the makings of a health-food success story, but growers and processors are worried that the coconut craze may not be sustainable. The supply-chain is efficient globally but not locally*.' The article goes on to note that for years farmers have not been replanting because the prices they get are too low to justify increasing production. *'Fair-trade programs have not yet reached as far into the coconut trade as they have with other commodities . . . In many cases, the middlemen are grabbing more of the profit and passing on little to the growers. . .For an industry in a growth spurt, that is trouble. . . .'* The particular 'trouble' of concern to the writer, Krista Mahr, was the impact of inadequate coconut supplies for the even more rapid boom in coconut water as a beverage.

But this warning also applies to the emerging VCO market. In the monthly COCOMMUNITY Newsletters, VCO 'tops the charts' as the most rapidly expanding 'non-traditional' export for the Philippines and Sri Lanka. Coconut farms across Asia and the Pacific may be of small size but clearly their demographic circumstances are totally different. In Asia we have very large populations which are rapidly urbanising into large and mega-cities. **Table 2** reports on the total and urban populations in the Asian member countries. It also shows their per capita incomes and growth rates.

The facts are astounding: APCC countries have over 1/3 of the world population of 7 billion people with many large cities (> 5 million) and some mega cities (>10 million). There is rapid growth in urbanisation and, as significant, in per capita incomes. An educated middle class is expanding rapidly. It is this middle

Table 2 Total & Urban Populations & Per Capita Incomes and Growth Rates for APCC Countries

APCC Country	Measure	1990	2000	2014	Growth r %
India	Total (Mln)	868.9	1,042.3	1,267.4	1.57%
	Urban (Mln)	222.0	288.4	410.3	2.56%
	Per Capita Income (USD PPP)	*1,777*	*2,548*	*5,244*	*4.51%*
Indonesia	Total (Mln)	178.6	208.9	252.8	1.45%
	Urban (Mln)	54.6	87.7	134	3.74%
	Per Capita Income (USD PPP)	*4,295*	*5,552*	*9,254*	*3.20%*
Malaysia	Total (Mln)	18.2	23.4	30.2	2.11%
	Urban (Mln)	9.1	14.5	22.6	3.79%
	Per Capita Income (USD PPP)	*10,159*	*15,695*	*22,589*	*3.33%*
Philippines	Total (Mln)	61.9	77.7	100.1	2.00%
	Urban (Mln)	30.1	37.3	49.6	2.08%
	Per Capita Income (USD PPP)	*4,010*	*4,243*	*6,326*	*1.90%*
Sri Lanka	Total (Mln)	17.3	18.8	21.4	0.89%
	Urban (Mln)	3.0	2.9	3.2	0.27%
	Per Capita Income (USD PPP)	*3,340*	*4,946*	*9,426*	*4.32%*
Thailand	Total (Mln)	56.6	62.3	67.2	0.72%
	Urban (Mln)	16.7	19.4	23.7	1.46%
	Per Capita Income (USD PPP)	*6,369*	*8,939*	*13,932*	*3.26%*
Vietnam	Total (Mln)	68.9	80.9	92.5	1.23%
	Urban (Mln)	13.9	19.7	30.5	3.27%
	Per Capita Income (USD PPP)	*1,501*	*2,650*	*5,125*	*5.12%*
Total - APCC Asia	Total (Mln)	1,270.4	1,514.3	1,831.6	1.52%
	Urban (Mln)	349.4	469.9	673.9	2.74%

Sources: Calculated from FAO Statistical Pocketbook 2015

class which will become increasingly aware of their health and have incomes that allow for choice. In economic terms, this group will have a high 'income-elasticity of demand'.

I suggest that the domestic markets of 'APCC-Asia' provide the 'Sea change' that the coconut industry so desperately needs. These markets can afford high quality VCO. These markets are readily accessible, convenient and provide a more stable base for the industry than traditional export markets. These markets could soak up all the VCO that is produced in the same way in which India and Indonesia's existing coconut production caters mainly for their domestic markets.

The contrast with the South Pacific could not be starker. Most of the South Pacific nations are archipelagos consisting of dozens of islands each with relatively small populations but with an abundance of coconuts on the coastal fringe. From an international perspective, the South Pacific can be considered as virtually totally rural – few 'cities' exceed 50,000 and few 'nations' exceed 500,000 people. However, their rural populations are increasing rapidly with high birth rates and declining rates of infant mortality. Along with all coastal peoples they face rising sea levels with climate change plus more frequent and sever cyclones / typhoons. Biosecurity barriers are weak so pest and virial attacks could be devastating.

As small village-level VCO processes were improving productivity and quality, more revolutionary global technologies were coming into play: the internet was indeed becoming www, the 'world wide web', and mobile phone networks exploded around the globe. Together with the social media avenues of Facebook, Twitter and Instagram, these allowed an extraordinary expansion in access to information and its spread. For us, the knowledge revolution democratised the understanding of many medical and health issues. 'Hard-to-publicise' information could be shared easily so that the almost hidden work of Dr Mary Enig (Enig 1995 & 1998), which had to be self-published, could now be read by a wide audience.

A case study of one person suffering from Alzheimer's disease and the impact of VCO and ketones led to a book by Dr Mary Newport (Newport 2011 & 2013) and a world-wide response. The flood of books on the health attributes of coconut oil can now be readily purchased on the internet. For example, the many books of Bruce Fife (starting with Fife 2001), the work of Dr Conrado Dayrit (Dayrit 2005) and the recent exposé by Tina Teicholz (2014) of the politics behind dietary recommendations on fats, are not confined to physical libraries but are readily available from 'on -line' shops and often in digital form. This 'formal' source of literature has been complemented by many reputable websites.

The overarching technical revolution is dynamic. Access to broad band internet is speeding up communication; mobile phones are getting smarter with more apps; satellite TV transmission promises 100% coverage of large countries (India and Indonesia) with multiple domestic and international channels; new set top boxes and small receiver dishes with only a modest one-off capital cost are also coming to Indonesia this year. A recent lead article in The *Guardian* Weekly (29 July – 4 August) asks "Can technology reboot Africa?" The potential of the "fourth industrial revolution" is for millions to bypass traditional infrastructure stages 'such as landlines and branch banking, skipping straight to cellular telephony and mobile money. The potential for further great leaps forward in medicine, education and public administration is high.' VCO is one beneficiary of the knowledge revolution. Knowledge has led to demand. As VCO became known as a raw, natural food product that was clear, white, flavoursome, aromatic, non-greasy and, most significantly, healthy, it appealed to a health - conscious international market. Potentially higher prices will lead to the ultimate objectives of enhancing rural incomes and reviving, rehabilitating and replanting 'The Tree of Life'. As the 'Coconut Craze' article warns, for this to happen it is essential that the benefits of higher prices flow right down to the farm level. Does the winner take all, or do all become winners?

Drying grated coconut before being pressed using DME machine for VCO extraction

Conclusions

This paper has explored many significant global changes that radically alter the potential market for VCO in the 21st Century. It is a very different world from the one that birthed the copra industry. Rapid growth of population, urbanisation and income levels and the rise of the middle class in many APCC-Asian countries are likely to increase the do-mestic demand for VCO. Demand in many non-coconut councountries is also increasing rapidly. The changes in global communications through the internet and mobile phones now allow the widespread and speedy dissemination of information.

South Pacific VCO has to find export markets. Publicity could help. Is it time for the APCC to vigorously challenge outdated claims that coconut oil is a health hazard? A very recent example of this was the warning by the Heart Foundation of Australia (HFA) in a fund-raising brochure. The warning was in red:

> **Watch out for coconut oil claims**
>
> *You've probably seen claims about coconut oil being a healthy food or perhaps even a 'superfood'. Coconut oil is 92% saturated fat, so, like butter, coconut oil is something to use only sometimes and in small* amounts.'

Should the APCC mount a diplomatic and social media campaign demanding that the HFA present modern scientific evidence that VCO has a negative impact on heart health in Australia? This challenge could be made to Heart Foundations in other high income countries that continue to demon-

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COCONUT VARIETAL IMPROVEMENT IN INDONESIA

Hengky Novarianto[1], Budi Santosa, Meity Tulalo,
Sukmawati Mawardi and Ismail Maskromo[2]

Introduction

Coconut breeding programs in Indonesia aims to produce plant material on a large scale having the following characteristics: high yield of copra and early bearing of fruits. Besides, it is desirable to follow up on the characters that might be incorporated in genepool, such as: the high content of coconut oil, resistance to rot of shoots and deciduous fruit, tolerance in tidal land, drought tolerance, high lauric acid content (C12: 0) in oil and high protein content in the fruit meat. It is important to have varieties of coconut which are superior in terms of speed to bear fruit, fruit production lots, the result of copra and oil, the production of sap for palm sugar high, and has a particularly short trunk making it easy to harvest the fruit and easier to climb to tap the sap.

Coconut varieties commonly cultivated by smallholders are type of tall coconut, which is about 98% of the total area of coconut. In general, tall coconut are mostly aged over 60 years and has a trunk with a height of over 20 m. Over the last 10 years, it has been difficult to get workers/ coconut climbers to harvest fruit every 2-3 months or sap tappers for the production of palm sugar, where a tapper had to climb a tree twice a day, in the morning and evening. As a result, the cost price of the harvest has become high, and if followed by low copra prices, the income of farmers would become very low. The coconut sugar produced from fresh coconut sap is always showing an increase in market demand, nationally and internationally. The production of coconut sugar decreased, because of stagnant production, while demand is increasing every

year. It is necessary to plant palm that has a short stem so that it can be easily harvested, ensuring at the same time that fruit production remains high and similar with the tall coconut fruit type and also easiness in tapping sap. One of the strategies to produce coconut materials which has characteris-tics of early bearing, high yielding of fruits and copra is by hybridization of Dwarf x Tall.

Assembly of hybrid coconut that has been done in the Indonesian Palm Crops Research Institute (IPCRI) since the early 1980s is a cross between Dwarf x Tall and Tall x Tall. The released varieties of hybrid coconuts from 1984 to 2009 include (a) the four hybrids of Tall x Tall : KB-1, 2, 3 and 4 and (b) the five hybrid coconut Genjah x In, : KHINA-1 (NYD x TAT), KHINA-2 (NYD x BIT), KHINA-3 (NYD x PUT), KHINA-4 (RBD x MTT), and KHINA-5 (BYD x MTT).

Heterosis effect is seen in the production of copra of the three hybrids Dwarf x Tall. But all types of hybrid coconuts, despite the early start of production and high copra production have fast growing trunk which grows high. KHINA hybrid coconut-1, 2 and 3 planted in 1975 are now 40 years old and have turned out to have a stem height of about 20 m, and almost as high as their male parent, such as: Tenga tall (TAT), Bali tall (BIT) and Palu tall (PUT). That is, to get the hybrid trunked palm varieties with short and slow growing trunk with less height, in addition to the female parent of Dwarf coconut having short trunk, the selected male parent should also have a short trunk and slow growth in height.

Exploration of coconut germplasm *in situ* in early 2016 led to the discovery of Bido coconut in Morotai island, North Maluku Province. The Bido coconut begins flowering at the age of 3 years, produces many fruits with large fruit size with the fresh meat weight of 534 g/ nut, stems are very short and the rate of growth in height of the trunk is slower than the local tall coconut. In situ characterization of coconut Bido has been done and the seeds were collected for conservation of germplasm. Besides, the collection of male flowers of coconut Bido was done and processed into pollen . Bido coconut pollen has been used as male parent and crossed with 3 superior Dwarf coconut varieties. It is expected in future to obtain hybrid coconut varieties that are superior.

Materials and Methods

Exploration of coconut germplasm was conducted in Morotai island on March 2016, which is one of the main coconut areas distributed in North Maluku Province. Most of coconut varieties planted in this region are local tall, and a few dwarf varieties are planted in the yards of the farmer's house. Approximately 20 palms of Bido coconut variety

were used forrecording the variables: Shape of crown, number of leaf, Girth measurement at 20 cm and 1.5 m above soil level (cm), length (cm) of stem with 11 leaf scars, colour of petiole, petiole length (cm), petiole thickness (cm), petiole width (cm), rachis length (cm), number of leaflets, leaflet length (cm), leaflet width (cm), number of bunches, length of peduncle (cm), diameter of peduncle (cm), thickness of peduncle (cm), length of central axis (cm), number of spikelets, number of spikelets with female flowers, number of spikelets without female flowers, length of first spikelet bearing female flower, shape of fruit (polar view), shape of fruit (equatorial view), shape of husked nut, fruit colour, and number of fruit per bunch (nut). Fruit component analysis, such as: Fruit weight (g), nut weight (g), weight of split nut (g), husk weight (g), shell weight (g), nut water weight (g), meat weight (g), and endosperm thickness (cm) was also done. . Observation of morphology data, production and fruit component analysis was according to COGENT Standardization. All of these data were analyzed for the average, standard deviation, and coefficient of variance.

The Bido coconut has been used as pollen resource to produce hybrid coconut by crossing with selected mother palms. The female parents were selected from the good mother palms of Nias Yellow Dwarf (NYD), Yellow Dwarf Bali (BYD) and Raja Brown Dwarf (RAD), and as a control hybrid coconut KHINA1 (NYD x TAT) hybrid is used (Table 1). The pollen of Bido coconut is collected from Morotai island, North Maluku Province, and the dwarf palms of NYD, BYD, and RAD is selected from Mapanget Experimental Garden, North Sulawesi Province. The hybridization of the coconut palms started on May 2016. In Malaysia, the breeding programme emphasized in the creation of Dwarf x Tall hybrids aimed at exploiting the large nut size from the tall and high nut number from the dwarf, for example: MATAG (Malayan Dwarf x Tagnanan Tall), and other new hybrids.

Table 1. Hybridization pattern of selected dwarf varieties

Female parents ♀	Male parents ♂	
	Bido coconut (BIDO)	Tenga tall (TAT)
Nias Yellow Dwarf NYD)	NYD x BIDO	NYD x TAT
Bali Yellow Dwarf (BYD)	BYD x BIDO	-
Raja Brown Dwarf (RBD)	RBD x BIDO	-

Result and Discussion

1. Characteristics In Situ and Collection Ex Situ of Bido Coconut from Morotai

The morphological characteristics of Bido coconut are presented in Table 1 which include the character shape/appearance of crown, stem morphology, inflorescence and fruit. The shape of the crown of Bido coconut is generally spherical and the average number of leaf strands is 30.45 petioles. Characters of girth measurement at 20 cm above soil level averaged at 118.35 cm, and girth measurement at 1.5 m height is about 79.60 cm. The variability among trees shown in the case of girth of the trunk at 20 cm above soil level had Coefficient of Variance (CV) value of 27.98 %, while the up girth trunk is more uniform with the value of CV 11.83 %.

The most interesting character in Bido coconut is its trunk height, where the length of stem with 11 leaf scars was only 50.80 cm, with a Standard Deviation (SD) value of 9.56 cm and CV of 18.82% or less than 20 %. These results show that the growth of Bido coconut trunk is slow, and this fact is shown by the short distance between the leaf scars which are placed very tightly. The observations on leaf morphology gathered from the sample leaves show that colour of petiole of Bido coconut is green and green-yellow with a petiole length of 138.61 cm, rachis length of 372.34 cm, number of leaflets at 103.65 and leaflet length at 131.34 cm. The characters of inflorescence and flower morphology shows that the number of bunches average at 14.25 bunches, length of peduncle at 63.89 cm, length of central axis at 42.89 cm, number of spikelets at 31.00, number of spikelets with female flowers at 21.06 and number of female flowers is at 26.33 per bunch. Bido coconut has big sized fruits, where the fruit polar circumference is around 60.70 cm and the fruit equatorial circumference is about 46.90 cm. The fruit has a round and egg-shaped in fruit polar view and round shaped in equatorial view, and is green in colour. The shape of husked nut is almost round. The average number of fruits per bunch is found to be around 8.70 nuts.

The observations for the various components of Bido coconut fruit is presented in Table 2. It can be seen that the average fruit weight is 2,502 g, nut weight is 1,306.50 g and weight of split nut is 835 g. Further husk weight was obtained at 1,195.50 g, shell weight at 301 g, nut water weight at 471.50 g, meat weight at 534 g and endosperm thickness at 1.20 cm. The percentage weight of the fruit components of Bido coconut obtained is as follows : husk weight 47.78%, shell weight 12.03%, nut water weight 18.84% and meat weight 21.34 % of fruit weight. The meat weight of fruit, if found above 400 g/nut, is classified as good coconut. Solangi, *et al*. (2014) concluded that the application of organic (NSP + GSL) amended with

Table 1. Average, standard deviation (SD), coefficient of variance (CV) of morphology and production data of Bido coconut (n=20)				
No.	Characters	Average	SD	CV (%)
1	Shape of crown	Spherical	-	-
2	Number of leaf	30.45	2.68	8.82
3	Girth measurement at 20 cm above soil level (cm)	118.35	33.12	27.98
4	Girth measurement at 1.5 m height (cm)	79.60	9.42	11.83
5	Length (cm) of stem with 11 leaf scars	50.80	9.56	18.82
6	Colour of petiole	G/GY	-	-
7	Petiole length (cm)	138.61	14.27	10.30
8	Petiole thickness (cm)	2.94	0.30	10.14
9	Petiole width (cm)	7.37	0.48	6.50
10	Rachis length (cm)	372.43	34.82	9.35
11	Number of leaflets	103.65	6.64	6.41
12	Leaflet length (cm)	131.34	10.36	7.89
13	Leaflet width (cm)	5.19	0.65	12.48
14	Number of bunches (bunch)	14.25	2.65	18.62
15	Length of peduncle (cm)	63.89	5.95	9.31
16	Diameter of peduncle (cm)	4.37	1.31	29.84
17	Thickness of peduncle (cm)	2.13	0.38	17.78
18	Length of central axis (cm)	42.89	4.47	10.42
19	Number of spikelets	31.00	4.46	14.38
20	Number of spikelets with female flowers	21.06	5.17	24.57
21	Length of first spikelet bearing female flower	47.50	6.89	14.50
22	Number of female flowers	26.33	10.80	41.02
23	Fruit polar circumference (cm)	60.7	5.55	9.15
24	Shape of fruit (polar view)	R/ES	-	-
25	Fruit equatorial circumference (cm)	46.90	9.85	21.00
26	Shape of fruit (equatorial view)	Round	-	-
27	Nut polar circumference (cm)	42.67	1.54	3.61
28	Nut equatorial circumference (cm)	42.33	4.47	10.55
29	Shape of husked nut	AR	-	-
30	Fruit colour	G	-	-
31	Number of fruit per bunch (nuts)	8.70	1.84	21.09

Note: R/ES = Round/Egg-shape; AR = Almost round

Inorganic fertilizer (NPK), enhanced the growth and nut production of coconut, such as: Shell weight (g) 278.11 ±05.56; kernel weight (g) 434.22 ±13.75; and quantity of nut water (ml) 188.77 ±6.27 compared to other treatments. The meat weight ofBido coconut gained an average of 534 g (± 71.77) and ranked high because it was above 400 g/nut. If made into copra, it is estimated that approximately 280 g/nut could be obtained and to obtain 1 kg of copra, about 3.6 nuts is required.

Coconut Bido has the good trait of early flowering, early harvest, short trunk and slow growth, number of bunches and nuts and copra production. In Table 3 it can be seen that the first flowering of Bido coconut is faster than other coconut varieties at 3 years after planting, and as fast as the varieties Bali Yellow Dwarf, hybrids of KHINA1 (Nias Yellow Dwarf x Tenga Tall), KHINA-2 (Nias Yellow Dwarf x Bali Tall) and KHINA-3 (Nias Yellow Dwarf x Palu Tall), except Salak Green Dwarf which begins flowering at the age of 2 years. Rivera, *et al*. (2008) reported that the development of Synthetic variety of coconut resulted in flowering that occurred as early as 2.5 years from field planting in two entries, BAYT x TAGT (2 palms) and WAT x TAGT (1 palm).

Table 2. Average, SD, CV of fruit component Bido coconut (n=20)				
No.	Characters of fruit component	Average	SD	CV (%)
1	Fruit weight (g)	2502.00	403.78	16.14
2	Nut weight (g)	1306.50	169.00	12.94
3	Weight of split nut (g)	835.00	83.38	9.99
4	Husk weight (g)	1195.50	325.11	27.19
5	Shell weight (g)	301.00	63.07	20.95
6	Nut water weight (g)	471.50	136.08	28.86
7	Meat weight (g)	534.00	71.77	13.44
8	Endosperm thickness (cm)	1.20	0.12	9.79

At the age of 3.5 years, the hybrid WAT x RIT showed 50% flowering. At the age of seven and a half year from field planting, 97% of the palms (15 crosses combination) have reached the reproductive stage. Batugal, *et al*. (2005) reported that the multilocation trials result of coconut hybrids in several countries found that 16 of 34 coconut hybrids showed production at the age of 2.5 – 3 years after planting in Brazil, Jamaica, and Mexico, but more lately in Benin, Cote d'Ivoire, and Tanzania because of drought effect. In the Bido coconut, the trait of early bearing is followed by first harvest, and could be harvested first at the age of 4 years after planting. Bourdeix, *et al*. (2006) reported that MATAG (Malayan Red Dwarf x Tagnanan Tall) coconut hybrid were planted in Malaysia and produced fruits at 5 years old.

Coconut farmers need coconut varieties that have a short stem and slow growth in height. This specific character is found in Bido coconut which has stem length of only 51 cm with 11 leaf scars and is closer to character showed by palm varieties Nias Yellow Dwarf (55 cm), Raja Brown Dwarf (41 cm), and Bali Yellow Dwarf (44 cm). On the tall coconut varieties, usually the stem length at 11 leaf scar stage are generally above 100 cm, such as: Mapanget Tall (118 cm), Tenga Tall (104 cm), Bali Tall (109 cm), Palu Tall (125 cm), Sawarna Tall (116 cm), Kima Atas Tall (135 cm), Adonara Tall

Table 3. Characteristic of Bido coconut compared to varieties of Talls, Dwarfs, and Hybrids						
Varieties	Characteristic					
	First flowering (years)	First harvest (years)	Stem length of 11 leaf scars (cm)	Number of bunch/ palm/year	Fruit/palm (nuts)	Copra/ha/ Year (ton)
Bido	3.0	4.0	51	14	124	4.0
Mapanget tall	5.0	6.0	118	13	90	3.3
Tenga tall	5.0	6.0	104	13	75	3.0
Bali tall	5.0	6.0	109	13	75	3.0
Palu tall	5.0	6.0	125	13	75	2.8
Sawarna tall	4.0	5.0	116	14	75	3.5
Lubuk Pakam tall	5.0	6.0	91	14	75	2.8
Kima Atas tall	5.0	6.0	135	15	95	3.2
Kramat tall	4.5	5.5	93	13	102	2.8
Adonara tall	5.0	6.0	114	13	94	3.0
Buol ST-1 semi tall	3.5	4.5	99	14	139	3.5
Salak Green Dwarf	2.0	3.0	61	14	100	20,500*)
Nias Yellow Dwarf	3.4	4.0	55	14	90	17,500*)
Raja Brown Dwarf	3.4	4.0	41	14	95	13,500*)
Bali Yellow Dwarf	3.0	4.0	44	14	85	17,500*)
KHINA-1 hybrid	3.0	4.0	100	13	80	4.0
KHINA-2 hybrid	3.0	4.0	100	12	75	4.0
KHINA-3 hybrid	3.0	4.0	90	11	75	4.0
KHINA-4 hybrid	3.8	4.10	82	13	104	3.5
KHINA-5 hybrid	3.9	4.10	86	14	98	3.0

*Note: *) Nuts*

(114 cm); even hybrid coconut KHINA-1 and KHINA-2 has a stem length around 100 cm at 11 leaf scar stage. The rate of growth in height of Bido coconut was less than 50% compared to talls and hybrid coconut, and comparable with some dwarf varieties. Bido coconut has the character of short stem and slow incremental growth in height.

Furthermore, in Table 3, it can be seen that the character of production components like number of bunches and number of fruit per palm, as well as copra production estimates turned out to be quite high. In the character of number of bunches/palm, it can be seen that the Bido coconut produces anaverage of 14 bunches/ palm/ year, and this number is equal to that produced by coconut Dwarf varieties in general, and coconut Sawarna Tall, Lubuk Pakam Tall, Buol ST-1 semi-tall, and KHINA -5 hybrid, except Kima Atas Tall where it is more at 15 bunches/ palm/year. In case of fruit production, the highest value was obtained for coconut Buol ST-1 semi tall at 139 nuts/palm/year and Bido coconut had a production as much as 115 nuts/palm/ year. Other superior coconut varieties recorded production between 75-104 nuts/palm/year. Based on observation of the characters like number of bunches, fruit number, weight of the fruit components to the weight of freshnut, it can be analyzed that the estimated potential production of copra of Bido coconut is 4 ton/ ha/year. This result is as same as with hybrid coconut KHINA-1, KHINA- 2 and KHINA-3, while other tall varieties in general have the potential to produce copra at 2.8-3.5 tonnes/ha/ year. Bido coconut has very high expectations as one of the coconut varieties of the future with its more productive, early bearing, and especially short trunk characteristics along with slow growth in stem height. These characteristics make Bido coconut very suitable for coconut farmers for more easy harvest, tapping sap for palm sugar and higher yields.

Collection of Bido coconut germplasm was undertaken and

10 Years old Bido Coconut

5 Years old Bido Coconut

and around 216 seednuts collected in March and June 2016, and around 70 are germinated and planted as seedlings in polybag. This coconut material of Bido will planted as germplasm *ex situ* in Mapanget Experimental Garden, North Sulawesi Province. Besides, a seed garden of Bido coconut as well as a seed resource at least 1000 trees will be established.

Coconut Bido has been on the list at the head office of Plant Variety Protection, Ministry of Agriculture as a government-owned of Morotai Island Regency, North Maluku Province. At the end of 2017 Bido coconut will be released as one of the national superior coconut varieties.

2. Coconut Hybrid Dwarf x Bido Coconut

Research done to prepare the plant material in the form of crossing females controlled using the 20 palms of each coconut Dwarf variety as the female parent. Female parent coconut is used Nias Yellow Dwarf (NYD), Yellow Dwarf Bali (BYD) and Raja Brown Dwarf (RAD). Male parent used are coconut palms of Bido coconut (BIDO) and Tenga tall (TAT) as a source of pollen, which is selected from selected palms as much as 20 trees. Pollen from the male flowers of Bido coconut taken at the location of origin, namely the island of Morotai, North Maluku was brought to Manado, and processed into pollen in the laboratory Breeding of IPCRI.

In accordance with the number of potential female parents, the number of hybrid coconut planting materials prepared material are mainly 4 types of hybrid coconut which are NYD x BIDO, BYD x BIDO, RAD x BIDO, and as a comparison used hybrid coconut KHINA-1 (NYD x TAT). Controlled cross was conducted on five consecutive bunches of every female parent tree. Observations were carried out on the fruit setting aged 4-8 months after pollination. This crossing for hybrid coconuts have been conducted since May 2016 in Mapanget Experimental Garden, North Sulawesi Province. In the year 2008, the Genetic and Plant Breeding Division of the Coconut Research Institute of Sri Lanka launched dwarf x dwarf hybridization programme aiming to develop a coconut cultivar suitable for urban home garden, while the dwarf x tall hybrids are recommended for home garden which are bigger than urban home garden.

Conclusion

There is high expectation on Bido coconut as one of the coconut variety of the future which is more productive, early bearing and especially having short trunk character and slow growth in stem height. These characteristics possessed by Bido coconut is very suitable for coconut farmers for more easy harvest, tapping sap for coconut sugar and high yield of copra. Coconut Bido has been on the list at the head office of Plant Variety Protection, Ministry of Agriculture as a government-owned of Morotai Island Regency, North Maluku Province. At the end of 2017 Bido coconut will be released as one of the national superior coconut varieties . Bido coconut has been used as pollen resources to produce hybrid coconut, such as: NYD x BIDO, BYD x BIDO, RAD x BIDO.

Acknowledgments

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DEVELOPMENT OF ADVANCED VENEER AND OTHER PRODUCTS FROM COCONUT WOOD TO ENHANCE LIVELIHOODS IN SOUTH PACIFIC COMMUNITIES

Associate Professor Gregory Nolan[1]

Introduction

This paper presents key findings of the ACIAR-funded CocoVeneer project FST/2009/062. The project team includes researchers and collaborators from the University of Tasmania, the Queensland Department of Agriculture and Fisheries (DAF), Pacific Community (SPC), the Fiji Ministry of Fisheries & Forests; the Ministry of Natural Resources and Environment, Samoa; Solomon Islands' Ministry of Forestry and Research, and industry in Australia and Pacific Islands. Shown in Figure 1, the project's objectives include:

- Identifying the most promising product options for the veneer from coconut stem.
- This is included a value chain study.
- Providing viable protocols for effective and sustainable log supply.
- Establishing experimental veneer-peeling capacity in the South Pacific.
- Determining the optimum processing parameters and protocols for peeling
- coconut stems and the properties of the recovered veneer.
- Assembling a product suite and establish its characteristics.
- Developing uses for the residues remaining after logging and peeling.

The available coconut resource

Coconut plantations are a valuable economic and social resource for many communities and private estates in South Pacific Islands. However, many plantations are senile, have lost much of

Figure 2: Senile coconut stand in Fiji

Figure 3: Harvesting coconut stems for trials in Fiji

their vitality and productivity, and act as a major constraint on improved agricultural production. See Figure 2. Yet, they present a significant opportunity for a sustainable increase in coconut wood production. In the three South Pacific countries in the project Fiji, Samoa and Solomon Islands, over 65,000 hectares of coconuts are believed to be senile. This is over 6.3 million senile stems. With regular harvest, these stems represent a resource of over 64,000 m3 of saw or peeler log per year for 50 years in Fiji alone, plus large amounts of coconut wood residues. If the harvested stems are replaced with productive palms, current net coconut productivity can more than double over time.

The character of coconut wood

While senile coconut stems are potentially a valuable resource for wood production, their use for 'wood' products is unconventional due to the palm's properties. The coconut palm (Cocos nucifera) is not a true wood. As a monocotyledon (grass), the stem's vascular structure is largely different to that of traditional timber products.

The coconut stem has a high density zone towards the stem periphery while the inner zone is much lower in density due to a significant reduction in vascular bundles and an increase in parenchyma, a spongy, low-density tissue foam-like in texture. See Figure 4. With this soft inner core and large radial variation of properties, traditional sawn board production presents significant efficiency challenges.

Peeling coconut stems for veneer and veneer-based products presented a potentially more efficient method of processing and using the stems. However, prior to this project, high density senile coconut stems could not be peeled into usable veneer and the properties of the recovered veneer and their variability were unknown.

Figure 1: Relationship of project objectives

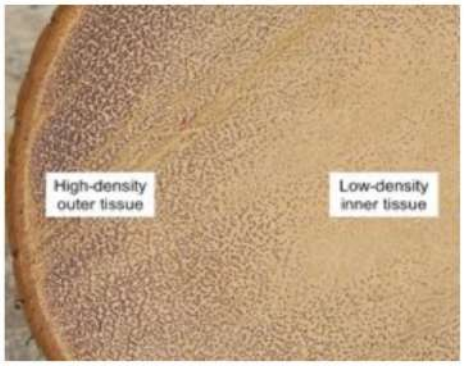


Figure 4: Mature coconut stem showing variation in vascular bundle density

Figure 5: Harvested coconut stems being peeled using a spindle-less lathe

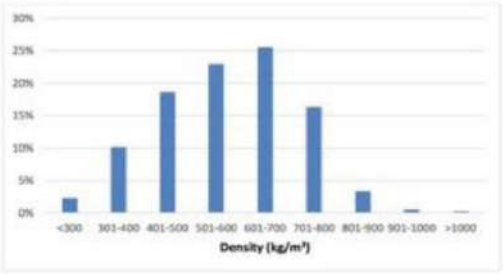


Figure 6: Trial 4 - Distribution of recovered veneer dry density

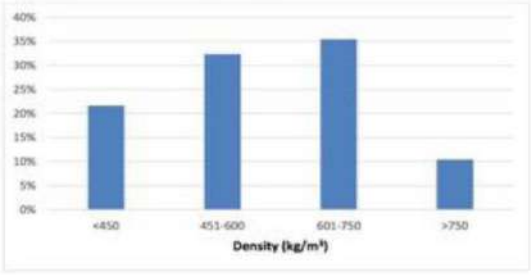


Figure 7: Trial 4 - Distribution of veneer dry density grouped into density bands.

Figure 8: Peeled coconut veneer displays significant colour diversity from dark to light/pale brown

Figure 9: Coconut laminated veneer lumber (LVL) being tested for stiffness and strength.

Project outcomes

Outcome 1: Senile coconut logs can be peeled

High-density senile coconut logs with suitable preconditioning can be reliably peeled on spindle-less lathes operating with appropriate log preparation and machine settings. See Figure 5. The veneer produced differs from the material recovered from traditional wood species. Its minimum production thickness is 2 mm and its surface has a natural roughness that requires careful gluing and moderate sanding of the final product. With further commercial development, high quality veneer could be reliably produced in commercial production facilities and dried and handled using standard industry equipment. The dry density of the recovered veneer varies considerably along the veneer ribbon. The density distribution recovered in trials is shown in Figure 6 and Figure 7.

Outcome 2: Recovered veneer can be used for products

The coconut veneer produced can be used for a range of architectural and structural products. Optimum veneer utility and value is likely to be achieved by batching the veneer by colour and density, and grading it in line with a standard adapted to suit coconut veneer's particular properties and market characteristics. To assist industry with this, a draft grading standing has been proposed. The veneer produced can be reliably glued onto a substrate, or made into plywood, LVL or similar veneer-based products. The most profitable markets are likely to be in architectural surfaces, linings and joinery. The structural properties of panels are limited by low shear strength. However, uses may be found for all recovered material by combining coconut and wood veneer in composite structural products.

Table 1: Five enterprise options with different production configurations.

Enterprise Options	Production Capacity	Product price required to achieve benchmark Internal Rate of Return (IRR) at a 12% target at five-years. (AUD/m^3)
Option 1. A single low cost 8-foot (2.4 m) spindle-less rotary peeled veneer (RPV) processing line installed at an existing sawmill operating on a single day-shift.	Processing 15,000 m^3 of peeler logs to produce 8,250 m^3 of green coconut veneer product per annum.	$174.5 (green veneer)
Option 2. One 8-foot (2.4 m) and one 4-foot (1.2 m) high-grade spindle-less RPV processing line installed at an existing sawmill and operating on two day-shifts.	Processing 50,000 m^3 of peeler logs to produce 27,500 m^3 of green coconut veneer product per annum.	$176.5 (green veneer)
Option 3. Independent veneer drying and grading facility. At an existing peeler mill, with a quality built continuous veneer dryer and upgraded heat plant operating one day shifts.	Processing 35,000 m^3 of delivered green veneer to produce 28,000 m^3 of dried coconut veneer product per annum.	$355 (dry veneer)
Option 4. An extra shift at an existing peeler mill. Costs have been included for staff night shift loadings and upgrading of the heat plant and buildings for the additional production output.	Processing 35,000 m^3 of delivered green veneer to produce 28,000 m^3 of dried coconut veneer product per annum.	$291 (dry veneer)
Option 5. A new integrated mill installed at a greenfield site with an 8-foot (2.4 m) and a 4-foot (1.2 m) high-grade spindle-less RPV line, a new heat plant and one new quality build continuous dryer operating two shifts for peeling and one for drying. This is included mainly for Solomon Islands and Samoa.	Processing 50,000 m^3 of peeler logs to produce 27,500 m^3 of dried coconut veneer per annum.	$396 (dry veneer) with a new boiler and heat plant. $328 (dry veneer) with a refurbished boiler and heat plant.

Outcome 3: The coconut veneer value chain is likely to be financially attractive

Economic modelling of the coconut veneer value chain indicates that it is likely to be financially attractive for existing veneer industry producers and potentially additional small-scale processing facilities to develop a viable coconut veneer industry. The modelling also indicates that larger scale processing options may be viable as the industry develops and grows. The options modelled and product price required are shown in Table 1.

Outcome 4: Uses for harvest and processing residues were developed

While producing saw and peeler logs, coconut stem harvesting will produce large quantities of residue on the harvest sites and concentrated volumes at processing facilities. Given this, a robust by-products suite is needed. The use of coconut wood chips to provide a direct growing medium for either mushrooms or as plant growing mediums was trialled but found to be largely unsuccessful. Better commercial alternatives exist. Coconut biochar was produced from residue chips but agricultural field trials were inconclusive. However, the use of coconut palm residues for fuel, particularly for industrial use and electricity generation bodes well, provided demand can be developed and transportation costs are acceptable. Further, the composting of harvest residues for soil amendments appears to be a cost effective means of utilising coconut palm harvesting residues.

Figure 10: Sweet corn growth in coconut compost incorporated with soil, compared to a commercially available compost.

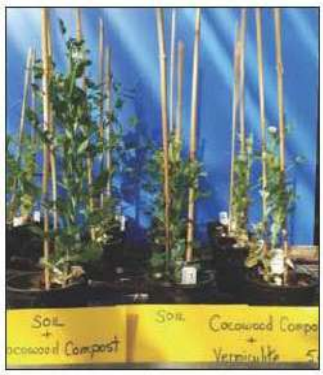


Figure 11: Coconut compost incorporated with soil, compared to soil and compost with vermiculite in pea growth trials.

Greenhouse scale research trials indicated that coconut woodchip is suitable for composting into a nutrient rich medium that can be readily used for improving future crop yields. See Figure 10 and Figure 11. Little additional investment is required to generate a product that could be directly beneficial to local communities through increasing local agricultural productivity.

Outcome 5: Reliable log supply can generate significantly increased nut production.

For industry to invest in establishing a coconut veneer value chain, a regular log supply has to be available to producers over time. To assess potential log supply and nut production increase, the impact of an orderly replacement process over time for senile stem was modelled. Figure 12 shows the estimated potential change in nut productivity and log production from Fijian coconut estate renewal over a 50-year period. Figure 12: Estimated change in nut and log production from coconut estate renewal over 50 years in Fiji, based on a constant estate area and partial harvest every 5 years

Outcome 6: Log supply from communities needs support.

Fragmented community ownership of many coconut estates presents a risk to regular and adequate log supply and this may prove to be a significant impediment to establishing a coconut veneer value chain. Support processes need to be developed that encourage communities to critically assess and then renew their coconut estates in an orderly manner, and, by doing so, provide a reliable log supply to a growing coconut veneer-based industry. Extension tools providing guidance on community planning, and sustainable log harvest were developed to help address this risk. They include:

- A Guide to Community Development of Estate Coconut Renewal Plans
- Guidelines for Harvesting Coconut Palms.

Outcome 7: Research capacity was developed.

In addition to these technical and extension outcomes, the project-sought to establish independent research capacity in veneer-based wood production. A rotary veneer

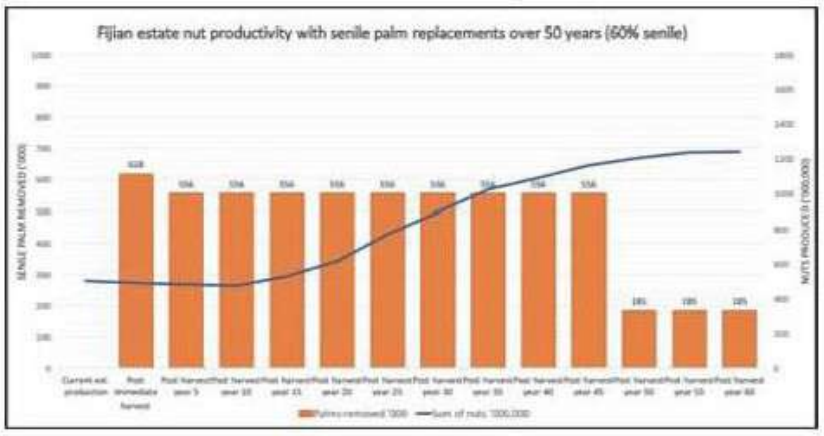


Figure 12: Estimated change in nut and log production from coconut estate renewal over 50 years in Fiji, based on a constant estate area and partial harvest every 5 years

Figure 13: Cocoveneer lather in Fiji

Figure 14: Adjusting the lathe blade in Fiji

processing equipment suite was established at the TUD facility in Suva, Fiji, and key staff were trained in its operation. This facility can be the base for future work on coconut and other small diameter wood resources in the region. See Figure 15 and Figure 16.

Contacts and further information

Technical reports detailing the methodologies and outcomes of each research area are available with other support outputs at www.cocowood.net. Figure 15: Inspecting peeled coconut veneer Figure 16: Inspecting peeled coconut veneer

Contacts for further information include:

- In Australia about the general project: Associate Professor Gregory Nolan,
- University of Tasmania, E: gnolan@utas.edu.au P: +61 3 6226 7282
- In Australia about peeling and product technology: Dr Rob McGavin, Agri-
- Science Queensland, Department of Agriculture and Fisheries, Salisbury Research Facility E: Robbie.McGavin@daf.qld.gov.au P: +61 7 3277 8574
- In Fiji: Mr Rafaele Raboiliky, Principal Utilisation Officer, Fiji Ministry of Fisheries & Forests E: rafaele_raboiliku@yahoo.com P: +679 339 3611

Figure 15: Inspecting peeled coconut veneer

Figure 16: Inspecting peeled coconut veneer

- In other Pacific Islands: Mr Sairusi Bulai, Coordinator, Forest and Trees
- Programme, SPC E: SairusiB@spc.int P: +679 337 0733

Acknowledgements

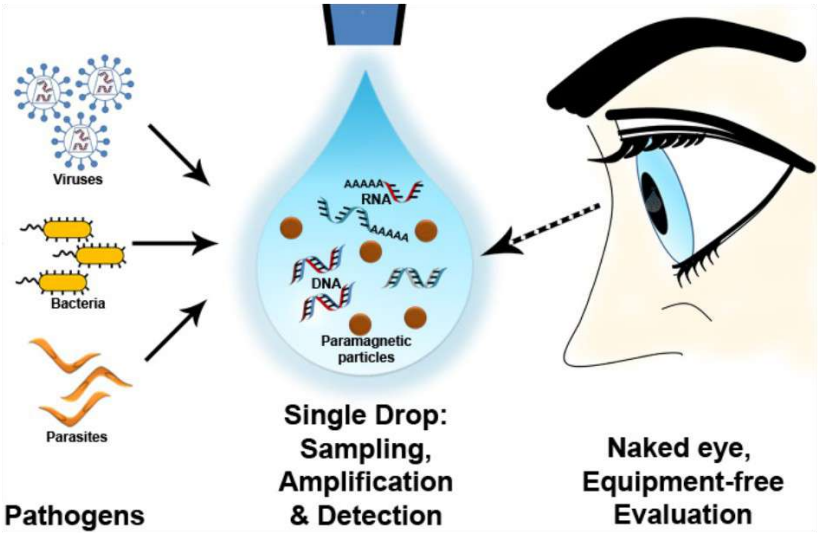
The Australian Government funded this project through the Australian Center for International Agricultural Research. For further information, see http://aciar.gov.au/.

[1]*Director, Centre for Sustainable Architecture with Wood School of Architecture and Design University of Tasmania, Australia*

DEVELOPMENT OF INNOVATIVE TECHNOLOGIES FOR EARLY IDENTIFICATION OF PHYTOPLASMA OCCURRENCE

Jose R. Botella[1]

A number of characteristics are highly desirable for disease diagnostics in order to be useful for the farming community. Sensitivity is essential since early disease detection is paramount to containment of the disease before it spread to adjacent agricultural areas. Accuracy is also needed to distinguish among sometimes closely related microorganisms as it is essential to distinguish between pathogenic and non-pathogenic strains. For an assay to be useful it needs to be reliable, providing consistent results.



Single Drop Genomics (SDG) Technique

Misdiagnosis caused by false positives can lead the farmer to use unnecessary chemical treatments while false negatives, i.e. failure to detect a pathogen can lead to the loss of the entire crop. Quickness is also highly desirable. The classic Kosch's postulates to identify the causal agent of diseases can be inherently slow taking weeks before a definitive answer is obtained. Finally, it is important for diagnostics technologies to be flexible with the capacity to be quickly adapted to new pathogens or even new strains of the same pathogens.

In addition to the above mentioned attributes, diagnostics developed for resource-poor countries have additional requirements. They need to be simple, avoiding the need for multiple steps and complicated sample manipulation. Specialized technical personnel is readily available in industrialized countries but not in developing economies, therefore diagnostics in these countries should be amenable to non-specialized personnel, although a minimal level of training will always be required for reliability and quality control. Agricultural areas are often located in remote regions, away from main cities, making sample collection and transport to analytical laboratories a complicated logistic exercise. This problem is compounded in tropical developing countries where the lack of laboratories increases transport distances and the high humidity and temperature can rapidly deteriorate the samples.

It would be therefore desirable to develop point-of-care technologies that could be transported and used in the fields. Ideally, diagnostics in developing economies should be as free as possible of sophisticated equipment since it can be expensive and require high maintenance by the commercial provider, which usually do not have offices on those countries. Diagnostic reagents should be easy to store, if possible at room temperature. Finally, rather than using common lab ware and reagents for multiple assays, it would be desirable to have single-use self-contained kits to avoid cross-contamination and allow easy transport.

Classic pathogen identification techniques rely on recognizing the disease symptoms, followed by growth and isolation of the pathogen and finally re-inoculation of the plants for confirmation purposes. Although highly reliable, this approach requires expert plant pathologists and a laboratory setup. The development of antibody-based technologies such as Elisas and lateral flow allowed faster result turnaround and has been widely adopted for agriculture and health applications.

The main drawback of this approach is the need for a reliable supply of good quality antibodies. Antibody production is expensive and there can be strong inconsistencies between different batches. Development of an antibody for a new pathogen is quite costly and unless the market is quite large manufacturers will not be interested in investing on a high risk-low return product. This is an extremely important issue for agriculture where many pathogens affect relatively small crops. The advent of molecular biology has revolutionized the field with the development of DNA-based diagnostic technologies. Most of these diagnostics are based on a single technology:

the Polymerase Chain Reaction (PCR). PCR can reliably detect the presence of pathogenic DNA in a plant sample by undergoing a number of amplification steps. In each step (cycle) the amount of pathogen DNA is doubled. In this way, a single molecule of pathogen DNA will be amplified to 1 billion molecules in 30 cycles. With every cycle lasting and average of 2 minutes, a 1-2 hours PCR reaction is usually enough to detect pathogenic DNA with extremely high sensitivity. But this extreme sensitivity is a blessing as well as a curse since it brings a new problem: the threat of contamination. PCR-based diagnostics require complicated sample preparation before amplification as well as specialized equipment for the amplification reaction as well as the visualization of the results.

In general DNA-based diagnostics have three main steps:

1. **On-field sampling to obtain disease tissues and extract nucleic acids from the samples with enough purity for the amplification reaction**.

On-field sampling. DNA-based methods requires to collect field samples and transport them to a laboratory in order to extract nucleic acids. Plant extracts contain a large amount of chemicals some of which, such as polyphenols and carbohydrates, are strong inhibitors of the PCR reaction. Although DNA purification from plant samples is always problematic, some species contain additional metabolites that increase the difficulty. Most DNA extraction protocols have been developed for leaves. Extraction of DNA from other organs such as roots and fruits bring additional problems due to the presence of high levels of sugars and acids

We have developed a simple method for isolation of nucleic acids form plant tissue samples using Solid Phase Reversible Immobilisation (SPRI) technology (REF). Our method uses paramagnetic particles that bind the DNA and RNA in the sample and only requires a magnet, two pipettors and their respective tips. The method produces clean DNA and RNA to a precise concentration that can then be directly used in the amplification reaction.

In Field Disease Diagnosis Using Single Drop Genomics (SDG) Technique

2. amplification using PCR

Amplification by PCR is performed by a thermocycler as each cycle is made of three steps at different temperatures. Even though prices have gone down, thermocyclers are still expensive with the cost of a medium machine ranging from one to two thousand dollars and requires periodic maintenance by specialized technicians. The reagents for the PCR reaction are relatively inexpensive and readily available in countries like Australia and the US but in developing countries they usually need to be imported, leading to long delays and large price increases.

We have opted to use newly developed isothermal amplification technologies for our approach. As the name indicates, isothermal amplification is performed at a single fixed temperature, thus obviating the need to perform different temperature steps and therefore the use of a thermocycler. There are a number of isothermal technologies available using different chemistries and requiring different temperatures. We have developed amplification protocols based on two technologies: Recombinase Polymerase Amplification (RPA) and Loop-Mediated Isothermal Amplification (LAMP).

Both technologies have advantages and disadvantages and the final choice is dictated by a number of factors including the disease, the environment for the test and the visualization method to be employed after amplification. The RPA reaction is usually performed at 37°C, offering the possibility to either use a battery powered heat block or even human body heat to incubate the reaction. LAMP re
actions are performed at 65°C, a temperature that can also be achieved by a battery powered heat block.

An additional and important advantage of isothermal amplification versus PCR is its speed. While PCR needs to go through three temperature steps in each amplification cycle, isothermal amplification is continuous making it extremely fast.We have performed LAMP reactions in the field by boiling water in a fire and mixing it with cold water in a Styrofoam container until the 65°C was achieved. The water

maintained the temperature within 3 degrees for the 30 minutes required for the reaction.

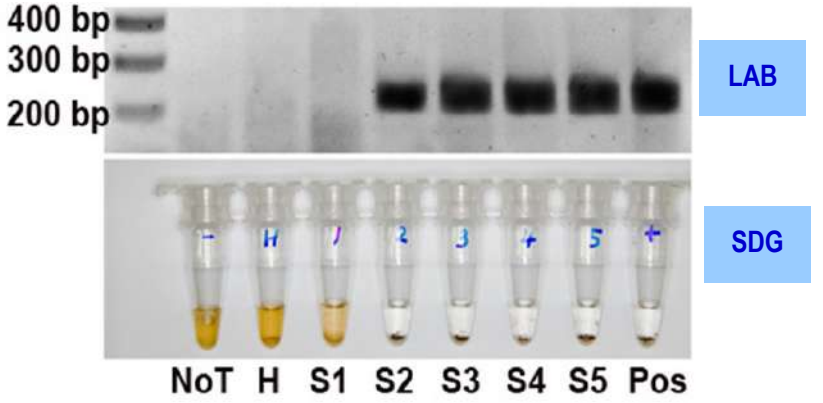
Finally, we have been able to develop a protocol to lyophilize the LAMP reaction into individual tubes that can then be transported at room temperature without affecting the efficiency of the reaction. We have so far stored the reaction tubes at room temperature in our laboratory for up to 3 weeks and have carried them in our luggage to Lao PDR and Cambodia for the detection of food-borne pathogens in market vegetables (*E. coli*). Individual lyophilized tubes are easily reconstituted by adding water immediately before the reaction.

We have developed RPA-based protocols for the detection of fungal, bacterial and viral crop pathogen (*Fusriumoxyxporum* f.sp. conglutinans and f.sp. cubense*, Pseudomonas syringae, botrytis cinerea*and cucumber mosaic virus); livestock pathogens (Bovine herpesvirus 1) and human diseases (HIV, malaria, tuberculosis and influenza virus H1N1). Thanks to ACIAR funding, we have developed extremely simplified protocols for the detection of food-borne pathogens in green vegetables and other fresh foods (*Escerichia coli 0157:H7, Salmonella enteritidis, Listeria monocytogenes*and *Campylobacter jejuni*).

3. visualization of the results to confirm or deny the presence of pathogen in the initial sample.

We have used a combination of molecular biology and nanotechnology to streamline each of the three steps in order to adapt them for resource-poor settings.

Independently of the amplification method used (PCR or isothermal), the final result is the presence or absence of pathogen DNA. A number of methods are available to visualize nucleic acids but most of them rely on relatively complicated technology that needs constant electric supply and specialized equipment such as electrophoresis and fluorescence.



Comparison of Single Drop Genomics (SDG) & Laboratory Test

SDG Test Kit

In order to facilitate the detection of DNA with the naked eye we have developed a novel technology based on the phenomenon known as 'bridging flocculation'. The amplification reaction produces a relatively large amount of long molecules of pathogen DNA. We use nanoparticles in order to visualize this DNA with the naked eye. Each DNA molecule wrap around several nanoparticles and the combined result of many DNA molecules is that all nanoparticles are trapped in a mesh causing them to spontaneously flocculate (sink) to the bottom of the tube. Our nanoparticle solution is black and the flocculation causes the solution to become transparent.

In summary, the combination of our DNA isolation method for on -field sampling, isothermal amplification for detection of pathogen DNA and bridging flocculation for naked-eye visualization of the result provides an extremely simple method to perform diagnostics in the field or in very basic laboratory settings.

This technology can be easily adapted to a large variety of pathogens and it is especially indicated for the detection of Phytoplasmas such as the one responsible for the Bogia Coconut Syndrome.

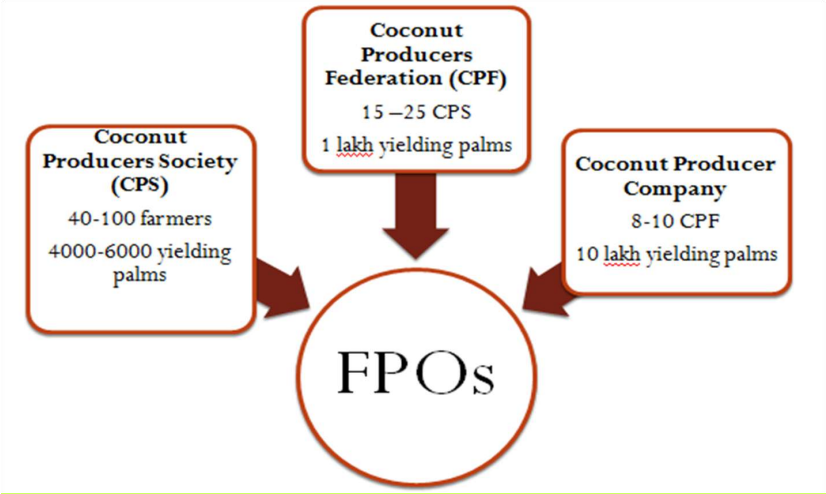
In my opinion, the development of diagnostics for the early detection of phytoplasmas faces a number of challenges. The first and more important is the need to have enough good quality genomic sequence information to allow the design of specific primers for the amplification reaction. Also of capital importance is to know the biology of the disease, which tissues do the pathogen colonize and in which order. Finally, it is important to identify the vectors of the disease, as it will allow to set up a monitoring regime in risk areas.

[1]*Plant Genetic Engineering Laboratory, School of Agriculture & Food Sciences. University of Queensland, Australia.*

THE SCOPE OF FARMER PRODUCER COMPANIES – BEYOND CONVENTIONAL WISDOM

Vinod Kumar[1]

Farmer producer organisations is not a new found concept in the World. In India AMUL model of milk farmer'ssocieties simply revolutionized milk industry. But generally they are seen as a more effective implementation vehicle to roll out new programmes by national or donor agencies. Coconut Development Board (CDB) is an autonomous body under the Ministry of Agriculture in India. They tried the model of farmer's clusters from 2006 onwards to make the fertilizer distribution more effective and transparent with good results. The clusters were constituted by farmers under a byelaw and CDB supported them with funds for organizing surveys and later gave inputs based on the survey results.



The Structure of Farmer Producer Organizations

In 2011, CDB tried to institutionalize the above clusters to do something more, a three tier farmer producer organization. The basic building block is the Coconut Producer Society (CPS) – about 40 to 100 famers in a locality having about 4000 to 10000 palms. The locality should have four clearly defined boundaries, the CPS should have a byelaws and registered under charitable societies act and later with CDB. As per the byelaws farmers inside the boundary cannot be denied membership for whatsoever reason, the officials should not have any business interests related to coconut. A person having 10 bearing coconut palms is treated as a farmer. Whenever about 25 CPSs are formed under a local government with an aggregate of 100,000 palms a federation of CPSs are formed. On the similar vein whenever federations with 1 million palms are formed in a district or sub district a Farmer Producer Company is registered.

This institution building was achieved through several processes. One was the three day residential training given the CPS officials where they were exposed to entire gamut of coconut cultivation and industry with hands on exposure to available technologies. These officials cascaded the effort to multiple levels. Another is the procurement of coconut at the support price from farmers during the low seasons. Initially there was no protocol, assets or know how to carry out such a huge task. But the farmer's entities tackled the issues head on and mastered the situation. Then came the tapping of unfermented coconut sap through nontraditional methods. A mass education campaign was launched to educate members about this and to develop the infrastructure. CDB routed the inputs through the entities giving them unprecedented status and respect among farmer community. The process of surveying the farmer's assets, needs etc. and managing the inputs given by the CDB also increased the capacity of the entities.PCPCL is now dealing with two major coconut products and own a unique marketing with an asset base of 1.25

Tender Coconut Procurement

Tender Coconut Stall

million USD. It procures coconut from the member farmers on a price higher than market, processes it in a state of the art coconut dryer with a capacity of 20 TPD. The dryer converts coconut in to copra within 30 hours using hot air at temperatures less than 80°C ; thus making copra devoid of all conventional anti-fungal agents, dirt, smoke etc. and the clean copra is cold pressed, filtered, bottled and marketed through novel avenues – mainly through social media. This cold pressed and chemical free coconut oil is sold at rates higher than market – by about 30% - through the CPSs, urban residential associations and own coconut points. About 40 coconut points –shops dealing exclusively on coconut products - in the district, (60 more are being planned) is the back bone of marketing and branding of the products of PCPCL. This mix of marketing avenues reduces the margin generally spent on distributors and retailers.

The second major product is the unfermented sweet coconut sap, locally known as Neera. The tapping of coconut palms might have started millenniums back, but the technology remains same. In the conventional method, sap coming out of the inflorescence is exposed to atmosphere and have a very high microbial and insect load by the time of harvesting. CPCRI (Central Plantation Crops Research Institute, India) developed a technology to harvest the sap in an insulated ice box and PCPCL adopted this know how.

PCPCL further scaled up the knowhow to a complete cold chain with a capacity of 10,000 LPD and made innovations to reduce the cost and eliminate the insect access totally. The result is honey coloured coconut sap with the fragrance of inflorescence at a pH of 7, without preservatives and additives. The brix value ranges from 15 to 18 whereas the microbial load is reduced by 90%. This is now dispensed through refrigerated dispensers at coconut points as fully organic,

Leased Copra Dryer

isafe, fresh and nutritious health drink. The farmers are getting about 15 USD per palm per month whereas a tapper managing 15 coconut palms is getting about 450 USD per month. The fresh sap is sold at 2.25 USD per liter.

CFTRI (Central Food Technological Research institute, India) initiated PCPCL to the vacuum evaporation technology to make the concentrate of coconut sap, which is commonly marketed as coconut nectar, honey etc. The usual process is to boil the coconut sap at atmospheric conditions for few hours to make the concentrate. But boiling at 100°C is cooking lot of the nutrients present in the sap. In PCPCL's vacuum evaporation plant, the virgin sap at 10°C is pre heated to 45°C and evaporated under vacuum conditions, at about 70°C for about 45 minutes to produce high quality concentrated coconut sap at a brix of 80. This concentrate is of unprecedented superior quality due to the high quality of raw material and the vacuum evaporation technology. This sap is now marketed through the above mentioned channels

Neera Tapping, Using CPCRI Techonology

PCPCL is now producing Palm sugar from the vacuum evaporated concentrate and marketing it. Another product is the cookies made using palm sugar and concentrate. Efforts to launch chocolates and ice creams using palm sugar are in the final stage. Natural vinegar proceed from low pH sweet coconut sap is another premium product of PCPCL. Cold processed hair oil with herbal additives and curry powder with coconut as the main constituent are two other major products.

During the first three years of inception, this young FPC faced (and still facing) many challenges but successfully built a vibrant, democratic and transparent farmer organisation, produced and scaled up two different and innovative coconut products in partnership with premier research institutions and built a unique marketing infrastructure. These multiple achievements is giving an insight about the potential of a Coconut Farmer Producer Or-

[1]*Chief Executive Officer, Palakkad Coconut Producer Company Limited, Little Tree, Urkulam, Govindapuram Post, Palakkad, Kerala, India.*

An Interview with Mr. Efli Ramli, President Director of Mahligai Indococo Fiber, Ltd. and Chairman of Indonesian Coir Industry Association by Muhartoyo[1]

Mr. Efli Ramli is President Director of Mahligai Indococo Fiber Ltd. which is a well reputed exporters and suppliers of Coco fiber & Coco Peat based in Lampung, Indonesia. Various coir products produced by this company has been exported to different countries such as China, USA, Italy, and Korea. His company is quite labor intensive involving more than 3000 people. Mr. Efli Ramli is also Chairman of Indonesian Coir Processing Industry Association (AISKI). This organization was established in 2010 under the auspices of Indonesian Coconut Board. The members of AISKI are coir processors in all coconut growing regions in Indonesia. Mr. Muhartoyo, Managing Editor of Cocoinfo International has an opportunity to interview Mr. Efli Ramli, below is the excerpt of the interview.

Cocoinfo International (CI): M r. Efli, could you share with us the brief history of your coir processing business?

My interest in coir industry began when I joined in Indonesia Single Show 2007 in Shanghai China and I met a buyer from China who encouraged me to embark on coir processing business in Indonesia. He also taught me directly about the cococonut fiber production system.

(CI): Why are you interested in coir processing and not other coconut products?

Coir processing is attracting me much because of some reasons:

- *Not many business men knew about pocessing coconut fiber and cocopeat in Indonesia*
- *Unprocessed husks is abundant and abandoned in many places causing environmental problems.*

(CI): How many coir processing units do you have? And what is the production capacity in each site? Is coconut husk as raw materials of your processing company easily obtained?

We have 11 coir processing units, one unit is located in Aceh Province, 4 units in Padang Pariaman, West Sumatra Province,

Mr. Efli Ramli (in red) with his Importers from China

and 6 processing units are in Lampung Province. Each processing unit is capable of producing 25 40-Feet High Cube containers /month of coconut fiber as well as 20 40-Feet High Cube containers /month of cocopeat. So far we don't have any problem is sourcing raw materials as they are easily obtained around the processing units.

CI): How do you collect the raw materials from coconut far -mers?

We collaborate with peoples around the processing units. They collect and bringthe raw material to the nearby processing unit. Local people have shares to the processing unit so they feel obliged to maintain the operation and sustainability of the processing unit.

CI): What kind of coconut fiber products is produced by your company?

Currently we have three products, they are Coconut Fiber, Cocopeat Block, and Cocopeat grow bag.

CI): What kind of coconut fiber products is produced by your company?

Currently we have three products, they are Coconut Fiber, Cocopeat Block, and Cocopeat grow bag.

(CI): Are your products only for export market? Could share with us which countries are your main importers ?

No, our products are also for local market. However most of them are for export market, about 90% of our products are exported to many countries. Some of the importing countries are: China, Japan, Belgium, Italy, Korea, And USA.

(CI): Is the coir processing machinery locally produced or imported?

All machineries operated in our processing units are produced locally as they are more cost effective.

(CI): How many people are involved in production process? Are they permanent or seasonal workers?

All in all there are 1,500 people involved in the production process of our coir processing units with different working agreements. Some of them signed a joint operation scheme, and some others are under sub-contract agreement with our company.

(CI): Quality control is very important for product sustainability. How do you maintain the quality of your products?

We strictly maintain the quality control of our products by following agreed guidelines for every production step, starting from receiving raw materials, grinding, sieving, drying, pressing, weighing, and packaging for cocopeat grow bags.

(CI): As the Chairman of Indonesian Coir Processing Industry Association, could share with us the Vission and mission of the organization?

The Vision of Indonesian Coir Processing Industry Association (AISKI) is to make Indonesia as the biggest exporter of Coconut fiber and cocopeat in the world.Meanwhile the Mission of the organization is to create job opportunities in villages through the establishment of coconut fiberand cocopeat processing units in coconut growing areas.

Sun-drying Cocopeat

Loading Cocopeat Block for Export Market

(CI): How many members are now registered in the Association?

At the moment 78 companies are registered as our members spreading over 12 provinces in Indonesia.

(CI): What is the benefit of being members of the Association?

We give the members knowledge about processing of coconut fiber and cocopeat in order that they can produce best quality products which could be accepted by International market. The Association is also ready to help in selling products produced by its members when they have difficulties in marketing their products.

(CI): What efforts that have been done to make coir processing industry more viable?

The Association has organized programs to make coir processing industry more viable. Some of the programs are: participating actively in various exhibitions locally and internationally, developing quality standards to be implemented by members, and developing efficient production system in order to confront the fluctuating coir prices.

(CI): Is there any assistance extended by Government for the Association?

The Association is working closely with government, especially in conducting trainings on coir processing in Indonesia.

(CI): What do you think of the prospects for coir processing industry in Indonesia in the years to come?

The prospect of coir processing industry in Indonesia is very promising and it will grow fast because Indonesia has the biggest areas under coconuts in the world.

CI: Thank you very much Mr. Efli Ramli for sharing your experience in coir processing business and the Indonesian coir processing industry with our valued readers. We wish you well in your coconut business venture and that you become more productive and profitable in years to come.

Coir in bales and Cocopeat Grow Bag Ready for Shipment

Importers from European and Korea are inspecting the products

[1]*Managing Editor and Documentalist of Asian and Pacific Coconut Community.*

EXPERTS' FINDINGS ON THE HEALTH BENEFITS OF COCONUT WATER

Prof. Rabindarjeet Singh
Director, Sport Science Unit,
University Science Malaysia

A study on the effectiveness of fresh young coconut water (Malayan Tall Coconut Variety) for whole body rehydration, following exercise-induced dehydration shows that although plasma glucose was high when coconut water was ingested, it was significantly higher with CEB (Carbohydrate-Electrolyte Beverage) due to its higher glucose content. With coconut water having similar rehydration index with same trend for per cent rehydration and restoration of plasma volume with the CEB, it can be concluded that coconut water could be used for whole body rehydration after exercise-induced dehydration. In addition, consumption of coconut water caused less nausea, fullness and no stomach upset and it is also easier to consume larger amount of coconut water when compared with carbohydrate-electrolyte beverage or a sports drink.

(Source: Prof. Rabindarjeet Singh, 2009. Coconut Water: A Rehydrating Drink after Exercise *Cocoinfo International*, 16 (1): 19-20, and in Proceedings, Malaysia National Coconut Conference 2009, Perak, Malaysia)

DR. D.P. Athukorale
Cardiologist, Pharmacologist,
Academician, Colombo
Sri Lanka

Green Coconut has much water and is rich in proteins, minerals, vitamins, calcium, phosphores, iron, iodine, chlorine, sulphur, potassium, carbohydrates and vitamins, B1, B2, B5 and magnesium. The water also helps the hydration of the body. The green coconut has a ratio of amino acids arginine, alanine, cisteína (essential) and serina, greater than those found in cow's milk. It is perfect and natural isotonic to restitute energies in the human body.

Tender coconut water has been used in other areas of the world where intravenous solutions cannot be obtained. Japanese have used tender coconut water (T.C.W.) intravenously in Sumatra, Indonesia in World War I. Pradera et. al. have used intravenous T.C.W. for pediatric patients in Havana, Cuba without any serious reactions

(Source: Dr. D.P. Athukorale 2008. Tender Coconut Water – Its Health Benefits *Cocoinfo International*, 15 July: 14-16)

Dr. Bruce Fife
Certified Nutritionist and Doctor
of Naturopathic Medicine, USA

One of the secrets to coconut water's success as a rehydration fluid is its mineral or electrolyte content. Coconut water contains the same major electrolytes as those in human body fluids. It has proven to be a superior rehydration fluid when taken both intravenously and orally.

Today coconut water is used worldwide as a home treatment for dehydration-related diseases such as cholera and influenza. Death rates from cholera are high. Death, however, is not caused by the infection itself, but by dehydration resulting from the loss of body fluids. Giving cholera patients adequate amounts of coconut water results in a remarkable 97 percent recovery rate.

(Source: Fife, Bruce *Healthy Ways Newsletter, Vol. 4 No.4)*

Dr. (Mrs.) E.R.H.S.S. Ediriweera
Senior Lecturer, Department of
Nidana Chikithsa, Institute of Indegenous Medicine, University of
Colombo, Rajagiriya, Sri Lanka

- Young coconut water could be drunk to alleviate the burning sensation during micturition
- Young coconut water, breast milk, treacle of *Saccharum officinarum* (F.Graminae) and sugar are mixed together and given for hiccough
- Leaves of *Dregia volubilis* (F. Asclepiadaceae) are to be pounded and mixed with tender nut water. The juice is extracted and given in treatment of poisoning of *Nerium indicum* (F. Apocyanaceae)
- Water of young king coconut (before flesh is formed inside) is given for fever and it can be consumed as a diuretic in dysuria.
- A King coconut is to be opened by slicing off the top.30 gms of powdered fruits (without seeds), of *Terminalia chebula* (F.Combretaceae) are added to the King coconut water inside and stirred. Sliced top is then replaced (as a cover) and kept outdoors in the dew overnight. Following morning, the mixture inside is to be filtered and drunk as a purgative. This is called El Vireka by Sri Lankan traditional physicians. The number of bowel motions will increase as the person continues to drink cold water from time to time during the morning. He should not consume hot or warm food and liquids. This is good for purifying blood and cooling the body.

EXPERTS' FINDINGS ON THE HEALTH BENEFITS OF COCONUT WATER

Vermen M. Verallo-Rowel, M.D.
Award-winning, American Fellow Dermatologist and Medical Researcher based at the Makati Medical Center, Metro Manila Philippines

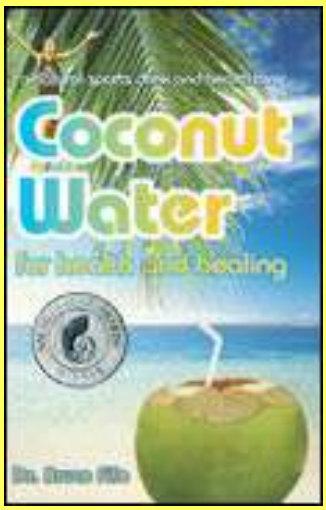
- Coconut water contains growth factors that function much like a culture broth and that get used up in the process of growth of the meat.
- Whether in human beings or in plants, growth factors are produced to regulate growth. These chemicals are very potent. Even tiny amounts produce major growth effects. These plant growth factors have bewitching, Merlin-the-Magician-like names: *gibberelin, auxin*, and *cytokinin*. Each promote growth.
- One of most studied of the *cytokinins* is *kinetin* which is also found especially abundant in coconut water.
- Because of its size, the growth factors in the coconut are abundant compared to other nuts in plant kingdom. They are kept in a stable environment (the coconut itself), continue to be active, and withstand the rigors of heat and storage – perhaps because throughout its life the coconut is exposed to the sun and the elements at 30 meters or more above the ground.
- Kinetin, one of the coconut's growth factors, has been shown to retard the aging of fruit flies and of human cells in culture, and finally, of people using a cream containing kinetin.

(Source: Verallo-Rowell, V.M. 2005. *RX: Coconuts! (The Perfect Health Nut). Bookman, Inc, Manila, Philippines)*

Dr. Eufemio Macalalag
Director of Urology, the Chinese General Hospital, Metro Manila, Philippines

- Dr. Macalalag has proven the effectivity of administering coconut water in treating renal disorders and in reducing or dissolving all kinds of kidney stones. The process involved the endoscopic procedure of multiple urethral stenting (MUS) or tubatuin (MUS-T), inserting two to twelve urethral catheters into the kidney ureter and irrigating it with coconut water from seven to nine-month old coconuts or buko nectar concentrate powder (BNCP) for a period of 3-19 days. Daily "bukolysis" and renoclysis with BNCP efffects approximately 10 percent reduction in the size of all types of stones treated.
- Dr. Macalalag said that the water from one mature coconut consumed daily, which is equivalent to about two full glasses per nut, could almost guarantee that the formation of stones in the urinary tract would be prevented. Dr. Macalalag asserted that the biggest plus factor in "bukolysis" is its capacity to dissolve kidney stones and arrest their growth.

Coconut Water for Health and Healing



This book describes the many health benefits of this remarkable beverage. It includes a fascinating account of how coconut water has been used as an emergency IV fluid around the world and why it is becoming one of the most popular sports rehydration drinks today.

Coconut water isn't just for rehydration, however. Studies show it provides numerous health benefits, some of which are the following: dissolving kidney stones, protecting against cancer, balancing blood sugar, providing ionic trace minerals, improving digestion, feeding friendly gut bacteria, relieving constipation, reducing risk of heat disease, improving blood circulation, lowering high blood pressure, helping prevent atherosclerosis, possessing anti-aging properties, and enhancing immune function.

Coconut water tastes delicious straight from the coconut, but can also serve as the base for a variety of foods and beverages. Included are 36 tantalizing coconut water recipes. With 80 percent less sugar than fruit juice or soda, coconut water makes a healthy, refreshing drink for you and your kids.

EXPERTS' FINDING ON THE HEALTH BENEFITS OF COCONUT OIL

Marry G. Enig, Ph.D.
Director, Nutritional Sciences Division, Enig Associates, Inc.12501 Prosperity Drive, Suite 340, Silver Spring, MD, 20904-1689 USA

The lauric acid in coconut oil is used by the body to make the same disease-fighting fatty acid derivative monolaurin that babies make from the lauric acid they get from their mothers' milk. The monoglyceride monolaurin is the substance that keeps infants from getting viral or bacterial or protozoal infections. Until just recently, this important benefit has been largely overlooked by the medical and nutritional community.

(Source: Enig, G.M. 2001. *Health and Nutritional Benefits from Coconut Oil: an Important Functional Food for the 21st Century*. Coconuts Today, Special Edition for the 13th Asian Pacific Congress of Cardiology, October 2-3, 2001, EDSA Shangrila Hotel, Manila, Philippines).

Dr. Jon J. Kabara
Emeritus Professor, Michigan State University, and Technology Exchange Inc. Galena, Illinois 61036, U.S.A

Never before in the history of man it is so important to emphasize the value of lauric oils. The medium-chain fats in coconut oil are similar to fats in mother's milk and have similar nutriceutical effects. In the past four decades misinformation and disinformation provided by certain politically biased agricultural groups and repeated in professional and lay press have led people to believe that all saturated fats are unhealthy. Little attention is focused on the fact that saturated fatty acids are not single family of fats but comprise three subgroups: short (C2-C6), medium (C8-C12) and long (C14-C24) chain fatty acids. The medium chain fats are found exclusively in lauric oils.

Source: *Kabara, J.J. 2000. Nutritional and Health Aspect of Coconut Oil In: Proceedings of the XXXVII COCOTECH Meeting/ ICC 200, 24-28 July 2000, Chennai, India, pp. 101-109) .*

Vermen M. Verallo-Rowel, M.D.
Award-winning, American Fellow Dermatologist and Medical Researcher based at the Makati Medical Center, Metro Manila Philippines

The Coconut is the Perfect Health Nut. The coconut can help you avoid obesity, boost your immunity, protect you from bacteria, fungus, and viruses – all while keeping you heart-healthy and moisturizing your skin to a natural glow and beauty, even treating acne, and providing beneficial antiseptic, tumor-protecting, and antioxidant effects.

Source*: Verallo-Rowell, V.M. 2005. RX: Coconuts! (The Perfect Health Nut). Bookman, Inc, Manila, Philippines..*

Dr. Conrado Dayrit
Emeritus Professor, University of the Philippines, College of Medicine, Former President, National Academy of Science & Technology, Metro Manila, Philippines

With all the opprobrium cast against it, it bears repeating again and again that no evidence has ever been presented to prove that coconut oil causes coronary heart disease in humans. The human epidemiologic evidence proves that coconut oil is safe. Coconut eating peoples like the Polynesians and Filipinos have low cholesterol, on the average, and very low incidence of heart disease. All evidences now point to inflammation and low HDL as the principal instigators of plaque formation. The chemical properties of coconut oil (CNO) and its biologic actions as a medium chain fatty acid make CNO superior to other oils for cooking and health use. Its anti-inflamatory and immune-regulatory actions as shown by its remarkable control of diabetes, hypertension, heart disease, autoimmune diseases and cancer, make coconut oil unique.

Source: *Dayrit, Conrado S. 2006. Coconut Products and Virgin Coconut Oil (VCO) for Health and Nutrition – A strategy for Making Coconut Globally Competitive. In Proceedings of the XLII Cocotech Meeting, 21-25 August 2006, Manila, Philippines.*

Dayrit, Conrado S. 2005. The Truth About Coconut Oil: The Drugstore in a Bottle. Anvil Publishing, Inc. Manila, Philippines.

EXPERTS' FINDING ON THE HEALTH BENEFITS OF COCONUT OIL

Dr. Bruce Fife
Certified Nutritionist and Doctor of Naturopathic Medicine, USA

If there was an oil you could use for your daily cooking needs that helped protect you from heart disease, cancer, and other degenerative conditions, improved your digestion, strengthened your immune system, and helped you lose excess weight, would you be interested? This is what coconut oil can do for you. The oil from the coconut is unique in nature and provides many health benefits obtainable from no other source. Coconut oil has been called the healthiest dietary oil on earth. If you are not using coconut oil for your daily cooking and body care needs, you are missing out on one of nature's most amazing health products.

Source: *Fife, B. 2004. The Coconut Oil Miracle. Penguin Books (USA.) Inc. New York, USA.)*

Walujo Soerjodibroto, MD, Ph.D.
Nutrition Department, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia

The clinical study on the effects of virgin coconut oil (VCO) on immune responses among HIV positive patients in Dhamais Hospital, Jakarta concludes that the macro-nutrient intake, mostly in terms of energy, fats and protein were significantly improved among the VCO supplemented group. In addition, the weight and nutritional status of the subjects, especially among the VCO supplemented group, were maintained well throughout the study. By maintaining body weight and nutritional status, it is expected to have significant increases in CD 4 concentration because nutritional status is frequently associated with immune status, both humoral and and cell-mediated.

Source: *Research Report on the Effects of Virgin Coconut Oil on Immune Responses among HIV Positive Patients in Dharmais Hospital, Jakarta, 2006:21*

DR. D.P. Athukorale
Cardiologist, Pharmacologist, Academician, Colombo, Sri Lanka

Coconut milk and coconut oil are consumed by the majority of Sri Lankans and rural people which comprise 70% of our population. They get a significant portion of their calories from coconut. It has been found that the majority of people in the rural areas get about 35 gram of fat per day from coconut and they consume very little food containing fats such as milk, butter, cheese, beef, pork, and corn oil as they cannot afford these expensive dietary items. From our clinical experience, we know that serum cholesterol level of people in rural areas is very low. When we investigate patients with ischaemic heart disease (IHD) from rural areas, we find that their serum cholesterol is normal or low. The commonest risk factor for heart attack in rural areas is smoking.

Coconut has been used in Sri Lanka for over 1000 years but the epidemic of IHD is of recent origin. Before 1950, heart attacks were not common in Sri Lanka.

Source: *D.P. Athukorale 1996. The Truth About Coconut Oil. In Facts About Coconut Oil, Jakarta: APCC, pp. 52-54* .

Raymond Peat Ph.D.
A lecturer at some universities such as the University of Oregon, Urbana College, Montana State University, National College of Naturopathic Medicine, etc

Most of the images and metaphors relating to coconut oil and cholesterol that circulate in our culture are false and misleading. I offer a counter-image, which is metaphorical, but it is true in that it relates to lipid peroxidation, which is profoundly important in our bodies. After a bottle of safflower oil has been opened a few times, a few drops that get smeared onto the outside of the bottle begin to get very sticky, and hard to wash off. This property is why it is a valued base for paints and varnishes, but this varnish is chemically closely related to the age pigment that forms "liver spots" on the skin, and similar lesions in the brain, heart, blood vessels, lenses of the eyes, etc. The image of "hard, white saturated coconut oil" isn't relevant to the oil's biological action, but the image of "sticky varnish-like easily oxidized unsaturated seed oils" is highly relevant to their toxicity.

Source: *Coconut Oil by Dr. Raymond Peat, http://www.efn.org/%Eraypeat/coconut.rtf*

EXPERTS' FINDING ON THE HEALTH BENEFITS OF COCONUT OIL

Dr. Mehmet Cengiz Oz
Director of the Cardiovascular Division, New York Presbyterian Hospital

If you're going to choose just one product to add to your health arsenal, coconut oil may be your best bet. Coconut's chemical compounds make this natural ingredient a powerful tool to solve a whole handful of health issues, including aging, weight balance and infection. Full of antioxidants, this healthy fat is an Oz-approved essential for a healthier you.

Source: *www.coconutresearchcenter.org)*

Prof. B.M. Hedge
M.D. FRCP (London) FRCP (Edinburg), FRCP (Glasgow), FRCPI (Dublin) FACC, FAMS

Little over 50 per cent of coconut oil is medium chain fatty acid, Lauric acid and another 7-10 per cent is medium chain Capric acid. Lauric acid gets converted inside the human system into Monolaurins, the best fat that mother's milk has. Other than mother's milk monolaurins are found only in coconut oil. New born babies and infants depend on the monolaurins for their immune system development and their capacity to withstand any infection. In addition, coconut oil can be digested by the salivary lipase, getting obsorbed very fast to give energy like carbohydrates. All other fats need the pancreatic lipase for digestion that the infants do not have. The coconut oil is the best alternative food fat for the infant when mother's milk is not available.

Coconut oil is low calorie fat and as such helps control body weight. Changing the food fat to coconut oil could help reduce weight in obese individuals. It also helps to control blood fat levels in diabetics. Coconut oil's regular use in diet would regularize blood fats and is known to increase the HDL cholesterol fraction while decreasing the LDL and triglycerides significantly; disproving the myth that coconut oil increases cholesterol and triglycerides.

Source: *"Coconut Oil-Ideal Fat Next Only to Mother's Milk" in www.bmhegde.com*

Naiphinich Kotchabhakdi, Ph.D.
Neuroscience, Research Center, Institute of Molecurlar Bioscience, Mahidol University, Salaya, Nakornpathom 73170, Thailand

Coconut oil is a rich natural source of Medium-Chain Fatty Acids (MCFAs) which contain highest percentage (up to 92%) of saturated fatty acids with 6-12 carbons, such as Caproic or Hexanoic acid (C6:0), Caprylic or Octanoic acid (C8:0), Capric or Decanoic acid (C10:0) and Lauric or Dodecanoic acid (C12:0). These MCFAs usually form esters of glycerol to become Medium-Chain Tryglycerides (MCTs). Like all triglycerides (fats and oils), MCTs are composed of a glycerol backbone and three fatty acids. In the case of MCTs, 2 or 3 of the fatty acid chains attached to glycerol are medium-chain in length. Many recent studies have demonstrated that MCTs can potentially help in the process of burning excess calorie, and thus reducing weight gain and promoting loss. MCTs also promote fat β-oxidation and reduced the need for more food intake. Compared with long-chain fatty acids (LCFAs), MCFAs are substantially different in their chemical and physical properties on metabolism. MCFAs do not seem to require binding to proteins such as fatty-acid binding protein, fatty acid transport protein, and/or fatty acid translocase (FAT, homolog to human CD36). MCFAs are a more preferred source of healthy energy (β-oxidation). Recent studies have shown that MCFAs are usually incorporated into adipose tissue triglycerides, and can influence adipose tissue and other systemic functions more substantially than previously known.

Source: *The International Conference on Coconut Oil 17-20 March 2015, Bitec Conference and Exhibition Center, Samut Prakan, Thailand*)

DR. S.M. Sadikot
Hon. Endocrinologist, Jaslok Hospital & Research Center, Bombay. Hon. Diabetologist, All India Institute of Diabetes, Bombay

Ghee, coconut oil and mustard oil are traditional cooking media which have been used in India and other developing countries for thousands of years. Although they are saturated fats, they do not show a wide Omega-6 to Omega-3 fatty acid ratio which is quite high in polyunsaturated oils. The desirable ratio is less than 10:1. Increasing prevalence of diabetes and other related diseases are found correlated with increasing Omega-6 to Omega-3 ratio. On the other hand, consumption of coconut oil which is deficient in polyunsaturated fatty acids has been found to enhance secretion of insulin and utilization of blood glucose. It is beneficial to consume the traditional edible fats such as coconut oil along with polyunsaturated fats to reduce the Omega-6 intake and maintain optimum Omega-6 to Omega-3 ratio in the diet.

Source: *Coconut Oil for Health and Nutrition, APCC 2004*

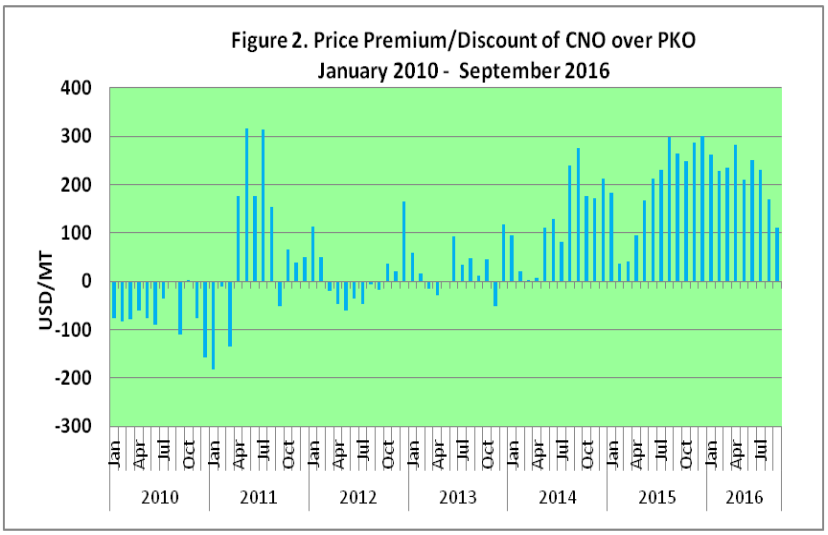
SLIGHTLY BULLISH COCONUT OIL MARKET IN THE SECOND HALF OF 2016

Alit Pirmansah[1]

Amid a tight global supply of coconut oil and relatively stable demand of lauric oils, price strength of coconut oil is expected to prolong in the second half of 2016. In January-June 2016 the average price of coconut oil was US$/MT 1,402 in Rotterdam. The price strengthened in the three following months with average price of US$/MT 1,528 or increased by 9%. As the price of coconut oil remains independently strong, the unusually large price premium over palm kernel oil, which has been persisting in the last two years, lingers. In 2015, the average price premium was US$/MT 487 and the price premium widened in 2016. From January to September 2016, the average price of coconut oil was 761 above palm kernel oil.

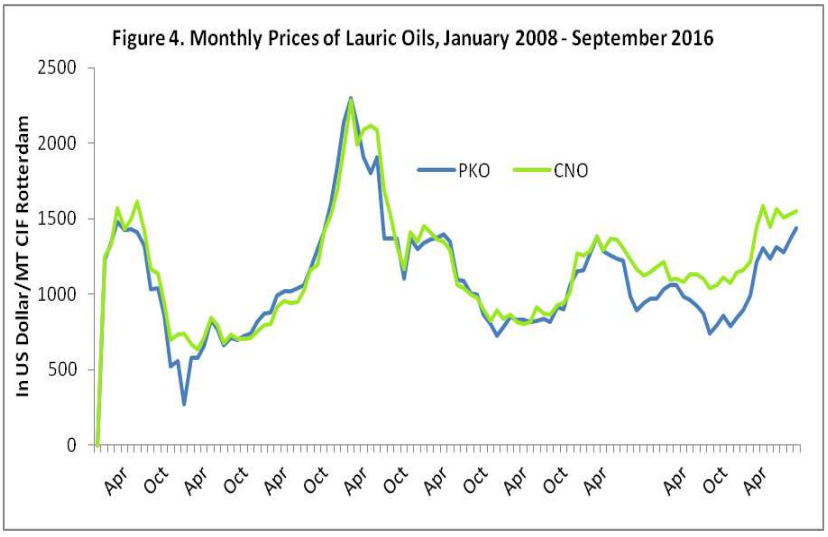
Production of coconut oil would be expected to be lower following a shortage of copra supply and coconut production. Copra production in the Philippines, the top coconut oil producer, in 2016 is predicted continue to decline by 9% compared to the previous year following the decrease in production of coconut. The shortfall of coconut production in the Philippines is mainly due to severe dryness besides a persistent impact of typhoons and pest attacks.

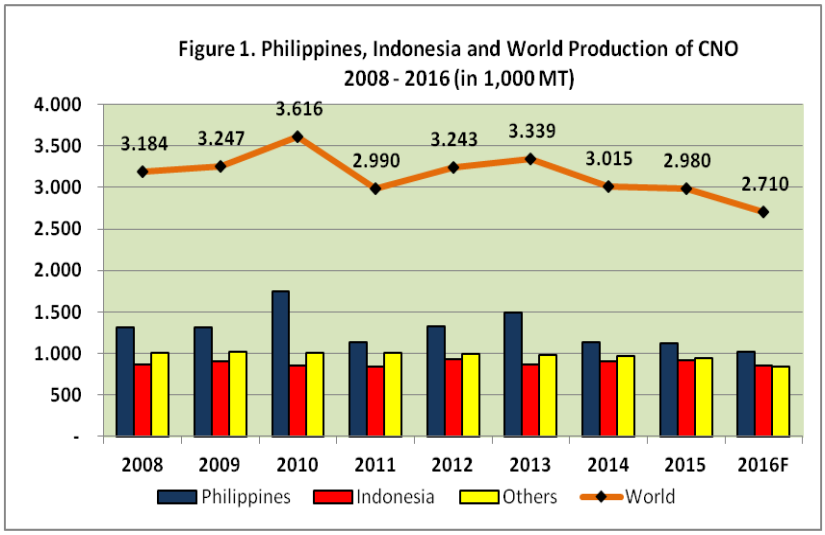
As for Indonesia, copra production is predicted to decline by 7.1%. The decrease in copra production in Indonesia is mainly due to a lagged effect of a long drought in 2015 which is expected to lower coconut production up to 40% in some provinces. Apart from the severe dryness, the decline in copra production is also attributed to the competition for raw materials with other coconut products such as desiccated coconut and also a sharp increase in exports of fresh coconut. Meanwhile, reduction in area, the senility of coconut palms and a slow progress in replanting programs have also contributed to the drop in coconut production. While in India, Coconut Development Board reported that there could be a 5% year-on-year decrease in production of coconut in the country because of deficient rains and pest attacks.



While in Sri Lanka, another key producing country, the production of coconut seems to be stagnant for years.

As a result, a slide in exports volume of coconut oil to the global market was observed in the first half of 2016. The export volume was recorded at 0.77 million MT in the period of January-June 2016 which shrunk by 23% opposed to the last year's volume for the corresponding period. Following the decline in exports of





coconut oil, total supply of lauric oils to the world market also dropped by 12% from 2.59 million MT in January-June 2015 to 2.28 million MT in January-June 2016.

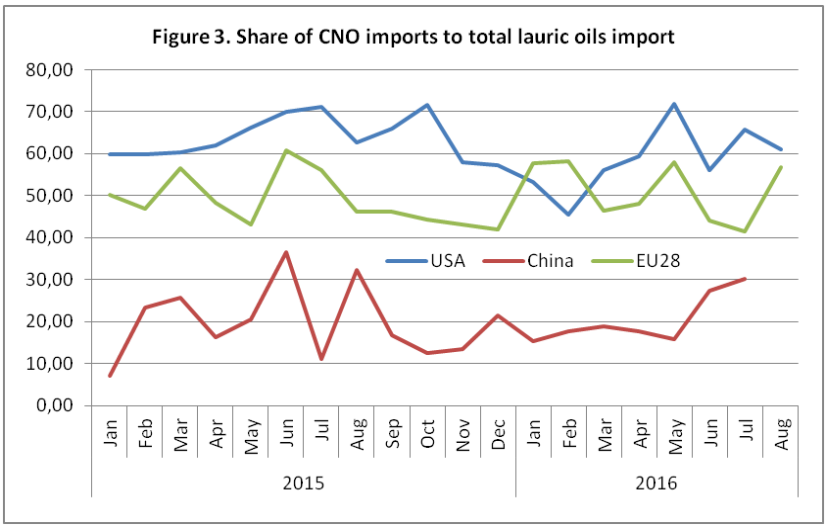
The Philippines and Indonesia remained two major coconut oil exporters in the world. The countries contributed for more than 80% of global supply in 2015. Exports of coconut oil from the Philippines, as expected, declined in 2015 following the decrease in coconut and copra production. Exports of coconut oil from the Philippines were recorded at 0.853 million tons in 2015 which were 0.4% lower than the previous year. The export, however, seems to remain weak as latest data show a noticeable decrease in the first half of 2016. Data from Philippines Statistics Authority shows that from January to June 2016, export of coconut oil was 0.29 million MT which dropped by 31% compared to 0.42 million MT of last year. The decrease in shipments of coconut oil from the Philippines in 2016 has been predicted as the Philippines' industry is facing a shortage in raw materials though some companies have been adapting the situation by importing raw material and crude coconut oil from other origins.

Meanwhile, Indonesia, as the second largest exporting country, has also been affected by the shortage of copra production. In addition, the competition for raw materials with other coconut products such as desiccated coconut and also a sharp increase in exports of fresh coconut has put more pressure on coconut oil supply. The official data from BPS-Statistics Indonesia show exports of coconut oil from Indonesia from January to June 2016 were recorded at 0.33 million MT or dwindled by 21% compared to that of last year's volume.

The shortage in the global production has, furthermore, restrained an increasing trend in the global demand. The import demand of coconut oil in the world market was squeezing from 1.01 million MT in January-June 2015 to 0.79 million MT for the corresponding period in 2016. In the same period, the other lauric oil, palm kernel oil, also reduced by 5% to level of 1.63 million MT as opposed to 1.55 million MT. As a result, total imports of lauric oils decreased by 11.4% to a level of 2.34 million MT as against 2.64 million MT of last year for the same period. Apart from a shortage in copra production, an unusual price premium over palm kernel oil has also been prompting a pronounced shift of demand at the expense of coconut oil at least in some countries.

The US is one of countries where the buyers of lauric oils indicate to shift their preference at the expense of coconut oil. A decline in imports of coconut oil was observed in the US during the first half of 2016. The US imports of the oil was 0.23 million MT or shrunk by 14.6% compared to 0.27 million MT in the previous year. Meanwhile, imports of palm kernel oil in the same period were increasing. The oil rose from 0.16 million MT in January-June 2015 to 0.18 million MT in the same period of 2016. Hence, share of coconut oil to the US total imports of lauric oils reduced to 59% from 64% in the corresponding period of 2016.

The shift in preference of lauric oils due to a high price premium of coconut oil over palm kernel oil at the expense of coconut oil was also observed in China. In the period of January-June 2016, the share of coconut oil to the



Chinese total imports of lauric oils was 20% which was 2% lower than its share in 2015 for the same period. Shipments of coconut oil to China were 0.07 million MT which shrunk by 12.4% opposed to that of last year. In total, imports of lauric oils eased by 4.9% following a shortfall in Chinese economy.

Unlike in the US and China, the cross-price substitution effect of the two oils did not appear in European countries. The share of coconut oil to total imports of lauric oils in the first half of 2016 remained at 51% the same as that of last year. The demand of the oil also increased from 0.41 million MT in 2015 to 0.42 in 2016 or grew by 2.6%. The increase in demand was also witnessed for palm kernel oil. The oil slightly rose by 1.6% in the period of January-June 2016 compared to the same period in 2015. Hence, the total imports of lauric oils to European countries strengthened by 2.1% for the said period.

For the second half of 2016, it is forecasted that a combined effect of a shortage in the global coconut oil supply and a price premium over palm kernel oil will bring about lower demand of the oil. The latest data from Philippines Statistics Authority show that export volume of coconut oil from Philippines until July 2016 declined to 0.37 million MT or dropped by 26% opposed to 0.49 million MT of last year. In Indonesia, in the period of January-August 2016, exports of coconut oil plunged by 23% to a level of 0.41 million MT against 0.54 million MT of the previous year. Price of coconut oil is expected to remain strong at least until the end of 2016 amid a shortfall in coconut oil supply and relatively stable demand of lauric oils and it will maintain its price premium over palm kernel oil.

[1]*Alit Pirmansyah is Market Development Officer, Asian and Pacific Coconut Community.*

Malaysia's National Coconut Workshop, Kuala Lumpur, 9 August 2016.

The National Coconut Workshop 2016 that was conducted under the theme of "Coconut: The Sunrise Industry" organised by the Universiti Putra Malaysia (UPM) and the UPM Alumni Association (PAUPM) on 9th August 2016.

The Conference was inaugurated by the Hon. Yb. Dato' Sri Ahmad Shabery Cheek, Minister of Agriculture and Agro-based Industry, Government of Malaysia. APCC Executive Director, Mr. Uron Salum, took the opportunity to meet and discuss briefly with the Minister during lunch together with senior officials of the Government of Malaysia. Mr. Uron Salum also participated as keynote speaker and presented the APCC paper on "The Coconut Global Trade and Network: Opportunities for Malaysia." The Workshop had discussions on the overview of the coconut industry in Malaysia, the production, economics and the current issues faced. Sessions were also organised on downstream products of coconut and the health benefits of coconut.

Discussion Meeting and Press Conference on "National Seminar on Prospects of Coconut", Alapuza, India, 28 August 2016

A preliminary discussion meeting on the conduct of the "National Seminar on Prospects of Coconut Sector" was held at Alappuzha on 28-08-2016. The meeting was chaired by Sri K.C. Venugopal, Hon'ble Member of Parliament, Alappuzha and he informed that the National Seminar will be held at ICAR-CPCRI, Regional Station, Kayamkulam on September 29, 2016. Shri Radha Mohan Singh, Hon'ble Union Minister for Agriculture and Farmer's Welfare has consented to be the chief guest and will inaugurate the programme. Prof. P.J. Kurien, Hon'ble Deputy Chairman Rajya Sabha and Shri V.S. Sunil Kumar, Hon'ble Minister for Agriculture Development and Farmer's Welfare of Kerala will be guests of honour. The meet will showcase technological updates in coconut sector with special emphasis on value addition and product diversification and flag off national issues to boost minimum support price and highlight techniques to narrow down yield gap in coconut.

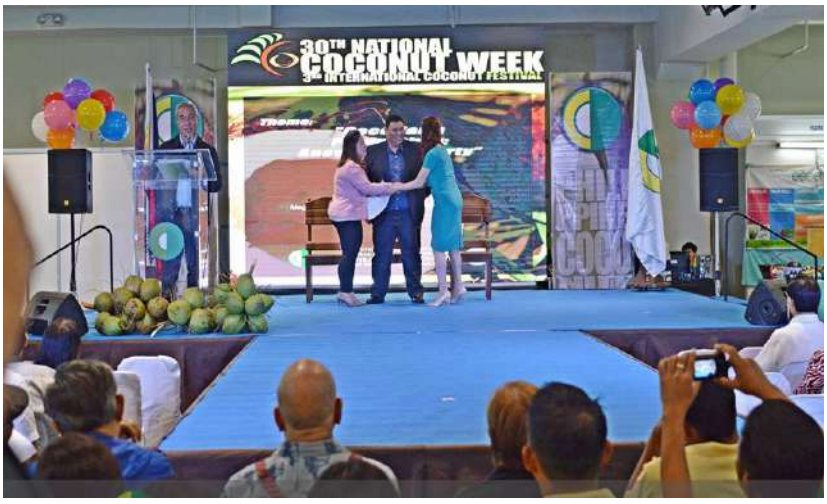
Dr. P. Chowdappa, Director, ICAR -CPCRI, Kasaragod highlighted the research accomplishments of the Institute on the centenary year and opined the Meet will be linking coconut as Pan India crop augmenting its utilization through value added products (*Kalpa chocolate, Kalpa krunch*) at National level. Dr. V. Krishnakumar, Head, ICAR-CPCRI, Regional Station, Kayamkulam outlined various arrangements made as part of the National meet to be held at Kayamkulam. The meeting was attended by representatives from various ICAR Institutions (ICAR-CTCRI, ICAR-IISR, ICAR-CMFRI, ICAR-CIFT), Kerala Agricultural University, Coconut Development Board, Directorate of Arecanut and Spices Development, Principal Agricultural Officers (Alappuzha & Kollam) and they had assured wholehearted support for the success of the programme through display of technologies and products as exhibits. Later, a press conference was held at Press Club, Alappuzha and gist of the programme about the "National Meet on Prospects of Coconut Sector" was shared with the media personnel by Sri K.C. Venugopal, Hon'ble MP and Dr. P. Chowdappa, Director, ICAR-CPCRI, Kassaragod *(www.*

COCOLINK 2016, an International Coconut Conference in Davao, Philippines, 27-29 July 2016.

APCC participated in the COCOLINK 2016, a first time International Coconut Conference conducted under the theme of Bridging Industries, held from 27-29 July 2016 at the SMX Convention Centre, Lanang, Davao City, Philippines. The Conference was organised under the auspices of the Davao Region Coconut Industry Cluster, Inc. (DRCICI) in Philippines. Mr. Uron N. Salum, Executive Director, APCC presented on "The State of the World Coconut Industry". The other presenters included officials from Philippine Coconut Authority (PCA), scientists and researchers from Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), private sector companies and other stakeholders. The Conference included sessions on coconut industry development, expanding opportunities for coco coir and catapulting the Philippine coconut products for the global market.

30TH Annual Coconut Week Celebration, Third International Coconut Festival, Manila, 18-21 August 2016.

APCC participated in 30th Coconut Week Celebration that coincided with the Third International Coconut Festival on August 18-21 at the SM Megamall, Megatrade Hall 1. This event was or



ganized by The Philippine Coconut Authority (PCA), in partnership with Department of Agriculture (DA), Department of Trade and Industry (DTI), Department of Interior Local and Government (DILG), and private stakeholders. With the theme "Coconut Farm Productivity, Answer to Poverty," the event aims to converge industry stakeholders to explore opportunities and address the challenges through cooperation among industry players and enablers. The celebration is a venue to showcase technologies and best practices that promote coconut productivity and increase material base for the production of value-added export products, such as coconut water, activated carbon, coco coir and coconut oil.

The "Investment Forum and Livelihood/ Enterprise Development" of the Agribusiness and Marketing Assistance Service of Department of Agriculture (DA-AMAS) highlighted the event. Topics discussed during the forum were business opportunities for coconut-based, coconut health and wellness care, green charcoal, market access and trends for new coconut exporters, tufting technology and support products, furniture making, and cement-bonded ecoboard making. Key note speakers were experts of the industry. Dr. Venus C. Genson, CEO of ART N Nature Manufacturing Corporation stressed, during her discussion on "Coconut-based Handicraft Business: Entrepreneurship for Inclusive Growth" that local coconut products have a bigger chance in the international market. Celebrity chef Boy Logro graced the event and prepared recipes using coconut.

Indonesia Agricultural Research and Development Agency Officially Released High Yielding Coconut Varieties, Lampung, 28 October 2016.

On 28 October 2016 Indonesian Agricultural Research and Development Agency officially released two high yielding coconut varieties, i.e. *Kalianda Puan* Coconut, and *Sri Gemilang* Coconut of Indragiri Hilir. *Kopyor* or *Puan* coconut is known as coconut with abnormal coconut meat which is soft, and detached from its shell. It tastes delicious, and is usually consumed directly, mixed with ice and syrup, or is used as ice cream ingredient. The number of this unique coconut is relatively low, therefore the selling price of this type of coconut is high, four or five times higher than normal coconuts.

Official Release of New High Yielding Coconut Varieties in Lampung, Indonesia

The release of *Kalianda Puan* Coconut adds the 3 previously released varieties of quick bearing *kopyor* coconut from Pati Central Java which have 3 different fruit colors i.e. yellow, chocolate, and green. The superior features of *Kalianda Puan* Coconut are: having big fruits, higher volume of endosperm, and containing higher unsaturated fatty acids and lauric acids. Meanwhile the superior features of *Sri Gemilang* coconut are that this coconut variety can be planted in littoral zones, high yielding, and containing high proteins. The research and development of *Kalianda Puan* coconut takes more than five years, while research and development on *Sri Gemilang* coconut takes about four years.

Kalianda Puan coconut variety is the result of collaborative works among Indonesian Palm Research Institute (IPRI), South Lampung Office for Estate Crops, and Bogor Agricultural University. Likewise, *Sri Gemilang* coconut is the result of collaborative works between IPRI and Indragiri Hilir Office for Estate Crops.

Director of IPRI, Dr. Ismail Maskromo, explained that the breeding technique for *Kalianda Puan* coconut is by using negative selection which means normal coconuts grown between *Kalianda Puan* coconuts were felled. Another method used was by selecting mother palms based on a set of predetermined criteria, then compared with the previously released high yielding varieties. He further explained that although the development of *kopyor* coconuts are centered in Java and Sumatra islands, it can be developed in other areas. Meanwhile *Sri Gemilang* coconut varieties has a great potential to be developed in any other littoral zones in Indonesia. (*http://balitka.litbang.pertanian.go.id*)

Focused Group Discussion on Coconut Replanting, Manado, Indonesia, 16 November 2016.

Considering the urgency of rejuvenating senile and unproductive coconut stands in Indonesia, Indonesian Palm Crops Research Institute organized Focused Group Discussion on coconut replanting. The meeting was held in Swiss Bell Hotel Manado, Indonesia. Various coconut stake holders and related government officials attended the meeting. Some programs actions were proposed to speed up the replantin program in Indonesia.

Statistics

Table 1. WORLD Exports of Coconut Oil, 2010– 2015 (In MT)

Country	2010	2011	2012	2013	2014r	2015p
A. APCC Countries	**2,236,400**	**1,544,776**	**1,836,442**	**1,895,808**	**1,894,445**	**1,824,951**
Fiji	9,700	10,200	3,794	1,494	1,630	1,837
India	3,000	4,251	7,830	6,829	7,067	7,114
Indonesia	692,500	540,050	802,947	630,568	771,419	759,381
Malaysia	131,600	141,963	136,783	131,068	177,225	152,249
Marshall Islands	0	0	3,956	3,330	124	3,000
Papua New Guinea	45,300	54,349	19,847	13,466	11,068	18,467
Philippines	1,342,500	781,411	852,234	1,096,861	814,206	853,153
Samoa	0	0	3,961	1,428	1,452	1,020
Solomon Islands	0	0	172	2,384	2,000	951
Sri Lanka	2,300	1,931	2,499	3,821	11,254	22,032
Tonga	1,000	1,000	0	0	7	3
Thailand	800	1,200	366	651	1,273	2,670
Vanuatu	6,900	7,200	212	2,067	642	561
Vietnam	800	1,221	1,841	1,841	991	4,252
B. Other Countries	**314,803**	**317,028**	**297,510**	**347,712**	**297,382**	**327750**
T O T A L	**2,551,203**	**1,861,804**	**2,145,108**	**2,247,144**	**2,097,740**	**2,154,440**

p: preliminary figure ***r****: revised figure*

Table 2. Prices of Coconut Products And Selected Vegetable Oils, Oct 2015-Sep 2016 (US $/MT)

Products	2015			2016								
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Copra	736	716	759	763	813	990	1,045	963	1,048	1,008	1,018	1,025
Coconut Oil	1,108	1,073	1,147	1,155	1,216	1,448	1,586	1,445	1,563	1,507	1,529	1,547
Copra Meal[2]	203	210	218	240	243	266	269	256	243	236	248	231
Desic. Coconut[2]	1,968	2,021	2,159	2,099	2,060	2,155	2,398	2,497	2,481	2,458	2,442	2,398
Mattress Fiber[1]	142	153	190	196	199	173	182	182	182	182	182	182
Shell Charcoal[2]	353	355	365	365	365	334	342	341	341	339	340	342
Palm Kernel Oil	860	785	847	894	988	1,213	1,304	1,234	1,312	1,277	1,360	1,436
Palm Oil	583	558	568	566	640	686	722	706	683	652	736	756
Soybean Oil	742	726	761	727	758	761	796	791	798	788	814	829

[1] *FOB, Sri Lanka*

[2] *FOB, Philippines*

Statistics

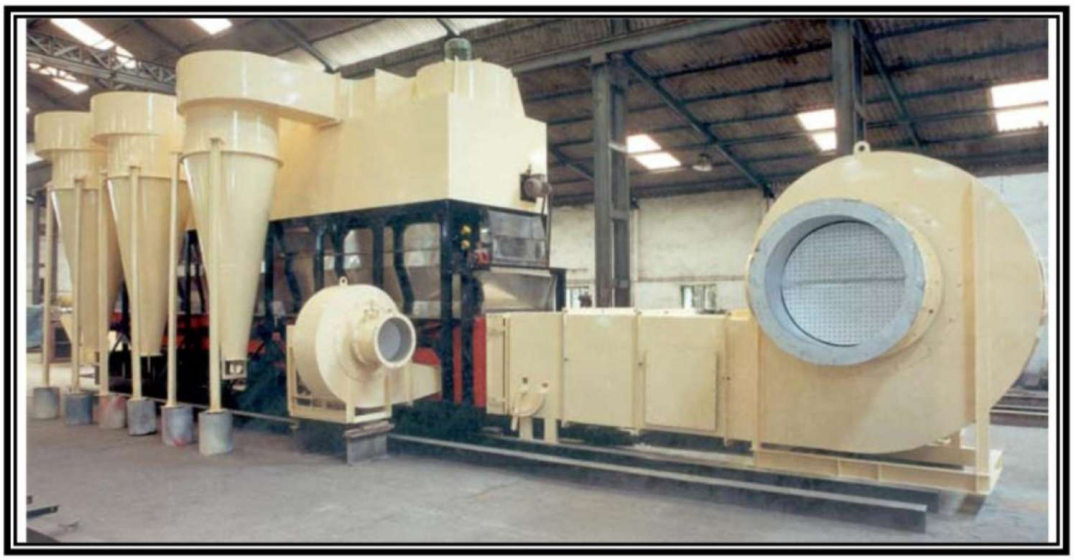
Table 3. World Oil Balance 2014-2016 (1,000 Tons)

Oil/Year	Jan/Dec 2014	Jan/Dec 2015	Oct/Sept 2016[F]
Palm Oil			
Opening Stocks	10,790	11,120	12,940
Production	59,740	62,510	60,630
Imports	44,370	47,710	46,640
Exports	44,370	48,260	46,600
Disappear	59,410	60,930	62,470
Ending Stocks	11,120	12,160	11,140
Soybean Oil			
Opening Stocks	4,310	4,290	5,140
Production	45,250	48,810	50,990
Imports	9,860	12,240	13,160
Exports	9,720	12,610	13,190
Disappear	45,410	47,780	50,610
Ending Stocks	4,290	4,950	5,500
Groundnut Oil			
Opening Stocks	380	250	230
Production	3,920	3,690	3,610
Imports	220	270	230
Exports	240	260	240
Disappear	4,020	3,710	3,640
Ending Stocks	250	250	190
Sunflower Oil			
Opening Stocks	2,100	2,380	1,840
Production	16,160	15,110	15,600
Imports	8,250	7,370	8,050
Exports	8,180	7,600	8,110
Disappear	15,940	15,150	15,570
Ending Stocks	2,380	2,110	1,820
Rapeseed Oil			
Opening Stocks	5,040	5,580	5,200
Production	27,000	26,270	25,530
Imports	4,000	4,160	4,250
Exports	3,990	4,200	4,210
Disappear	26,460	26,840	26,250
Ending Stocks	5,580	4,970	4,520
Cotton Oil			
Opening Stocks	450	450	340
Production	4,910	4,700	4,200
Imports	180	180	150
Exports	180	180	150
Disappear	4,910	4,720	4,260
Ending Stocks	450	430	290
Palm Kernel Oil			
Opening Stocks	870	970	1,040
Production	6,540	6,850	6,670
Imports	3,160	3,260	3,260
Exports	3,150	3,310	3,260
Disappear	6,450	6,690	6,790
Ending Stocks	970	1,080	920
Coconut Oil			
Opening Stocks	350	360	410
Production	3,020	2,950	2,730
Imports	1,880	1,880	1,730
Exports	1,870	1,930	1,730
Disappear	3,020	2,880	2,800
Ending Stocks	36 0	390	350

Table 4. World Oil Meals Balance 2014-2016 (1,000 Tons)

Meal/Year	Jan/Dec 2014	Jan/Dec 2015	Oct/Sept 2016[F]
Soybean Meal			
Opening Stocks	6,110	7,150	7,960
Production	190,950	206,630	215,100
Imports	61,660	64,920	66,850
Exports	61,280	64,390	67,170
Disappear	190,300	206,860	215,020
Ending Stocks	7,150	7,450	7,720
Cotton Meal			
Opening Stocks	20	50	50
Production	20,970	20,060	17,940
Imports	490	380	380
Exports	460	410	390
Disappear	20,970	20,020	17,940
Ending Stocks	50	70	50
Groundnut Meal			
Opening Stocks	10	20	30
Production	5,490	5,250	5,090
Imports	110	60	70
Exports	110	60	240
Disappear	5,480	5,230	5,100
Ending Stocks	20	30	30
Sunflower Meal			
Opening Stocks	530	450	230
Production	17,600	16,660	16,840
Imports	6,400	5,830	6,390
Exports	6,500	5,900	6,400
Disappear	17,570	16,670	16,830
Ending Stocks	450	370	240
Rapeseed Meal			
Opening Stocks	280	260	240
Production	38,260	36,820	35,840
Imports	6,620	6,110	5,760
Exports	6,620	6,030	5,760
Disappear	38,240	36,910	35,840
Ending Stocks	280	280	240
Palm Kernel Meal			
Opening Stocks	520	600	680
Production	7,920	8,320	8,050
Imports	6,700	7,300	7,000
Exports	6,760	7,260	150
Disappear	4,910	4,720	6,990
Ending Stocks	600	520	520
Copra Meal			
Opening Stocks	50	60	80
Production	1,720	1,700	1,550
Imports	760	750	680
Exports	820	720	660
Disappear	1,660	1,720	1,570
Ending Stocks	60	70	70
Fish Meal			
Opening Stocks	860	560	850
Production	4,260	4,550	4,150
Imports	2,960	2,740	2,710
Exports	2,980	2,710	2,680
Disappear	4,540	4,290	4,310
Ending Stocks	560	850	720

GEM - Vibratory Fluid Bed Dryer for Desiccated Coconut



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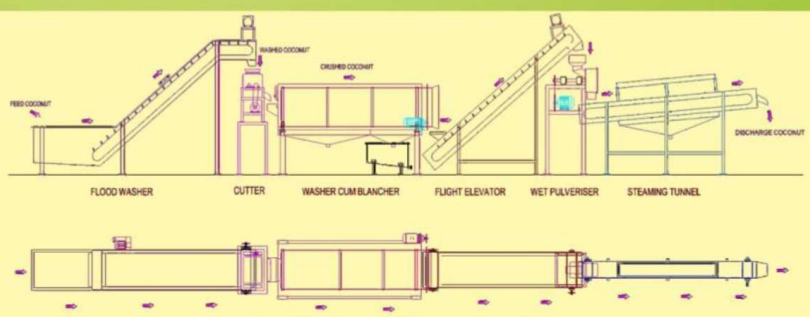

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