Dr. Philippe Binder Joins CAFNRM Faculty

By: Talisa Caldwell

Dr. Philippe Binder was born and raised in Colombia, and later pursued a degree in Engineering at the University of Virginia, and then moved on to obtain his PhD in Applied Physics at Yale University. Although he just recently joined the CAFNRM staff in the Spring of 2016, Dr. Binder came to UH Hilo in 2001. He is currently a professor of physics at UHH and has taught over 25 different courses within the UH system including, but not limited to: Electromagnetism, Optics, Thermodynamics, Quantum Mechanics, Computational Physics, Chaos Theory and Mathematical Methods. Binder also offers tutoring for CAFNRM students in Math or Physics at CAB 101, Fridays 10:15 to 11:45. Dr. Binder is always looking for new ways to better the university by creating new and improved learning opportunities for students. In 2013, he successfully led a project to upgrade the UHH Physics Department’s freshman laboratories. He is currently working towards creating an Energy Science Program through the UHH College of Agriculture. In the fall, the CAFNRM plans to offer an Energy Science certificate that will open up more opportunities to the university and its students. The Energy Science program would be the only one of its kind on the islands of Hawaii.

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Professor Christopher Lu delivers keynote speech at Chinese Sheep and Goat Association Annual Meeting and Southwestern University

Dr. Christopher Lu, professor of Animal Science delivered a keynote speech at the Annual Meeting of Chinese Sheep and Goat Association in August 2015. More than 600 educators, researchers, and government officials from 29 provinces and autonomous regions in China attended the meeting. Dr. Lu presented the plenary paper with an assigned topic entitled Sheep and Goat Nutrient Requirements. The presentation provided an overview of history, international standards, evolution of methodology, limitation, and discrepancy of defining nutrient requirements in sheep and goats.

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Crop of the Month: **Coconut (Cocos nucifera)**  
*By: Blake Dinger*

When tourists first come to the tropics, typically one of the first thing they see are beautiful coconut palms, and are often heard asking…. Is that a coconut? They may have seen coconuts previously but do not understand the nut comes in a husk. Many people don’t know the difference between the young nut and a mature one, and have no idea that coconuts come in a myriad of colors, shapes, sizes, and flavors.

Early Spanish explorers called it coco, which means “monkey face” because the three indentations (eyes) on the hairy nut resembles the head and face of a monkey. Nucifera means “nut-bearing.” People from many diverse cultures, languages, religions, and races scattered around the globe have revered the coconut as a valuable source of both food and medicine. ‘COGENT’, the international Coconut Genetic Resources Network, has compiled a list of 718 varieties of coconut which are spread across the globe, and each year the list continues to grow. DNA analysis of more than 1,300 coconuts from around the world revealed that the coconut was brought under cultivation in two separate locations, one in the Pacific basin and the other in the Indian Ocean basin. What’s more, coconut genetics also preserve a record of prehistoric trade routes and of the colonization of the Americas. Although coconut is not actually indigenous to Hawaii, it has certainly become integrated deeply into Hawaiian traditions and culture. The coconut tree was first introduced to Hawaii by the Polynesians, hundreds of years ago when Hawaii was still uninhabited. Because coconut thrives in tropical climates, the trees were at home in Hawaii and propagated throughout the islands. Ancient Hawaiians recognized the nutritional benefits of coconut meat and coconut water, and consumed it frequently. They also used coconut fibers to cover their canoes and coconut shells to help create tools, and drums used in spiritual rituals. Coconut was also useful as a housing construction material and to make everyday items like buttons, brooms, baskets, mats, shingles, and more. It was so useful in almost every facet of life that it didn’t take long for it to become firmly rooted in the Hawaiian lifestyle, despite being a foreign plant. The coconut palm can tolerate wide range of soil conditions. But the palm does show certain growth preferences. A variety of factors such as drainage, soil depth, soil fertility and elevation heavily influence the growth of the palm. The major soil types that support coconut on the island of Hawaii are Mollisol, Andisol, Histosol, Inceptisol, and Aridisol. The palms will grow at elevations of up to 2000’ but typically only produce fruit below 1000’. To grow a coconut it is ideal to find a large nut that still has water in it. Soak the coconut for two to three days in water and then plant the nut pointy side down in well drained soil burying only the bottom third of the nut.

You can find coconut palms, coconut drinks, coconut beauty products, and coconut souvenirs on every island in Hawaii. In fact, many islands still have ancient coconut groves that have been around for centuries. If you want to witness authentic, ancient Hawaiian culture, you can visit historic coconut groves on the Big Island (Pu’uhonua O Honaunau) and Molokai (Kapuaiwa).

Deans Corner

An Organic Farming Revolution for East Hawai‘i Based on Nature/Natural Farming?

By: Dr. Bruce Mathews

There are ominous signs with respect to the continuing commercial cultivation of many horticultural fruit, nut, and root crops along the eastern (windward) coast of the Island of Hawai‘i. A primary threat is the economic constraints that make it difficult for the small-scale farmers to adequately access the expensive imported fertilizer, soil amendment, and pest control inputs regardless if they are classified as chemically synthesized or organic. There is also a shortage of inexpensive locally available animal manures, tankage, and other nitrogen (N) rich organic wastes/food processing by-products for imported input substitution. Farmer surveys (to be published) conducted during the past year by Ms. Chantal Vos of UH Hilo CAFNRM and Dr. Alyssa Cho of UH Manoa CTAHR in cooperation with Mr. Eric Weinert of Calavo clearly indicate that farmers in East Hawai‘i are reducing inputs to cut costs and this change in practice is resulting in significantly lower crop yields, lower soil pH and nutrient levels, and frequently an increased proportion of harvested product that is deemed unmarketable. Hence, a downward spiral occurs which is driving more farmers out of business.

It is not known if some farmers are lacking the optimum technical expertise to most effectively apply external inputs or how to prioritize inputs with respect to their potential economic returns. This being said, fertilizer was often the largest single expense in the field departments of the now defunct Hawai‘i Island sugar industry (Mathews and Senock, 1998). There is little doubt that we need to invest more in scientifically examining methods to manage soils and crop production more sustainably using a systems ecology approach and thereby become less dependent on imported non-renewable resources (Radovich et al., 2014). Radovich et al. (2014) recently completed a handbook that covers locally available resources such as green manures, mulches, composts, biochars, and seaweeds/algae to enhance soil function and plant health. There are presently quite a few farmers desperately seeking organic farming breakthroughs with religious-like fervor in order to improve their viability. Unfortunately these farmers may end up being naïve victims of input products and farming practices that exist as magical solutions only in terms of their proponent’s claims.

There are few (if any) examples of successful long-term continuous commercial cropping on the acidic, highly weathered (heavily leached), Fe- and Al-oxide rich, fine-textured soils or juvenile (lightly weathered) rock land soils in the high rainfall uplands of the tropics without external nutrient inputs. Careful attention must also be paid to soil organic matter management and associated soil physical properties, and application of liming materials to maintain an optimum pH (5.6 to 6.2) for healthy soil functioning, including optimizing the pH dependent cation exchange capacity (CEC) of organic matter and low activity (kaolinitic/oxidic) and allophanic clays (Tamimi et al., 1974; Juo and Adams, 1986; Mathews and Senock, 1998; Feller et al., 2012; Shoba and Chudnenko, 2014).

The pH dependent CEC is of vital importance to potassium, calcium, and magnesium retention in most soils of the humid tropics. The Fe- and Al-oxide rich soil types (Acrudoxic Hydrudands) dominate the Hilo-Hamakua Coast of East Hawai‘i while the rock land soils (Lithic and Typic Udifolists) dominate South Hilo and Puna (Mathews and Senock, 1998). In the case of lowland valley and gulch areas, alluvium and colluvium are deposited annually and this helps to replenish soil nutrients lost through leaching and removal in harvested crops. Under such conditions cropping with moderate yields can be sustained without external inputs as was demonstrated by the Native Hawaiians (Vitousek et al., 2014). Unfortunately, East Hawaii is not blessed with an abundance of accessible valley and gulch lands for farming. Nor is East Hawaii blessed with many sweet spot pockets of moderately weathered (not highly leached), inherently fertile, volcanic ash or fine cindery soils that are rich in available nutrients like those of the old Kohala, Kona, and Kau field systems formerly cultivated by Native Hawaiians. Due to rapid diminution of soil nutrients and organic matter evidence suggests that most of the limited Native Hawaiian upland agriculture in East Hawai‘i was a form of shifting short-term cultivation based on typical slash, burn, and mulch approaches used elsewhere in the tropics (Vitousek et al., 2014).

During the past decade there has been rapidly increasing small farmer and gardener interest in Hawai‘i regarding the various “nature” and “natural” farming methods and philosophies that have been actively promoted in the Orient (Sue, 2006; Cho and Cho, 2010; Cho, 2010; Nishibuchi et al., 2011; Cho, 2016) and Southeast Asia (Gonsalves and Kilk, 1993; Carandang, 2003; Mikkelsen, 2005; Nishibuchi et al., 2011) during the past 30 years.

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**Student Research: Over Expression of Petunia x Hybrid F3'5' Hydroxylase on Anthurium andreanum**

*By: Miguel Bravo Escobar*

Anthurium is a very attractive genus because of its long-lasting inflorescences making it a very popular ornamental. Anthurium spade colors have been a focus for conventional and marker assisted plant breeding to develop new varieties with novel colors. Blue color has never been seen on any Anthurium cultivar due to the lack of delphinidin accumulation. Delphinidin is a Anthocyanin responsible for plant pigment expressed in a blue color on flowers and fruits. Anthuriums are greatly appreciated around the world making it one of the main products sold in the Dutch flower auctions. Anthurium pigment production has been tested before by extracting the enzymes responsible for catalyzing the reaction that yields a final product of the flavonoid biosynthetic pathway. During this study it was confirmed that 8 different anthurium varieties with alternate pigment production lack the production of the 3’5’-Hydroxylase which is a precursor of Delphinidin accumulation in the spathe (Gopaulchan, 2013). My fascination with anthuriums and these discoveries has motivated me to do further research in this area. It is my hope, as a senior student in CAFNRM at UH Hilo, that this endeavor and the preliminary data and results I will generate can set the stage in gaining admission to a Masters program at UH Hilo. Passion is my main drive for spending extra time doing research and being determined to finish, in spite of the challenges in managing my time as a full-time student while having a part time job at the Evolutionary Core Genomics Laboratory. My main goal is in this research is to over express an enzyme extracted from a blue petunia in the Anthurium genome hoping that it will have a profound effect on delphinidin accumulation (blue flower production).

Growing up in Colombia, anthuriums have always been a part of my life as well as plants that can potentially produce blue pigments. Thanks to my current job in the UH-Hilo Core Genomics Facility I am able to utilize the equipment needed to properly conduct the molecular biology part of my experiments. Having support from researchers like my employer Anne Veillet and my teacher Dr. Michael Shintaku has been very valuable and important in order to properly conduct the research. 


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**Dr Binder….**

There is a high demand for alternative energy in Hawaii because energy costs in our state are the highest in the country. Dr. Binder addressed that “we have no native sources of fossil fuels. Coal and gas, we have to import. It’s expensive, it’s dirty. But at the same time, we have all this sun, water, wind, rain, all these wonderful things all around us.” Binder professed that it was his dream to eventually have an energy sustainable campus, in which students will have access to numerous resources and gain hands on experience. Successfully arranging renewable energy resources throughout the school would benefit the entire community by reducing the cost of energy, and promoting sustainable living. If the program has good enrollment, the school plans on expanding the certificate to a 4-year Energy Science program, in which students have the option of focusing on technological aspects of energy or Polcy and Management.

In a university setting, students can develop useful work habits and have access to countless learning opportunities. Binder stated, “This is the time to learn and work hard. If you don’t, then you never will. Take advantage of opportunities, find things you like to do, and most importantly work hard; harder than you thought you could.”
Professor Lu...

It also discussed the implication of precision nutrition, nutrigenomics, and molecular nutrition on nutrient requirements. The presentation concluded with perspectives of sheep and goat nutrition, and nutrition plus strategies. After the conference, he visited several sheep operations with various scales in the province.

China’s sheep and goat industry has been growing with a fast pace in recent years. With about 185 millions goats and nearly 187 millions sheep, China is the leading producing country in the world in both sectors. To meet the growing demand as a result of improved living standard, increased purchasing power, limited land availability, and population growth, large intensive operations with more than 100,000 animals in a single location have attracted investment in central China. Typically a completely mixed ration of forage and gain is fed with a feeding vehicle and animals are confined in a lot with slatted floor to filter through feces and urine that is collected by a mechanically operated scraper. There is normally a lot next to it for exercise.

The barns are ventilated and with shades or windows on the side. Occasionally forced ventilation is used. They resemble large intensive dairy cattle operations in the US. There are obvious advantages and disadvantage of these intensive operations. Feed and management cost per animal is normally less but risk of health and environment is increased. Nevertheless, these large sheep and goat operations play a pivotal role in maintaining a steady supply of mutton and goat meat to populated metropolitan areas. Like many other agricultural fronts, China is catching up rapidly with a large investment in animal science and technology.

Earlier in May 2015, Dr. Lu was invited to speak at Southwestern University in Chongqing, Sichuan. The Saturday morning presentation was well attended with a couple of hundred of administrators, faculty and students. The dean of College of Animal Science and Technology introduced the speaker. The presentation focused on graduation education in animal science in the US. Dr. Lu provided an overview of student life, career choices, earning potential and desired quality of graduates in the field of animal sciences. Professor Yongju Zhao and faculty accompanied Dr. Lu to visit a research station focused on the preservation and improvement of Black Goat, a superior indigenous breed that is in high demand. There is a large scale and popular restaurant in the heart of city of Chongqing specializing in dishes of black goat. It is a successful example of streamlining production, marketing and consumption.

During the trip the host Professor Gongyi Xu at Sichuan Agricultural University accompanied Dr. Lu on a journey to the historical “Red Plateau”, a part of Quinhai-Tibet Plateau. They visited minority villages and came to appreciate the source of Yellow River that was vital to Chinese civilization. Yak and Tibetan sheep were the two notable native ruminant species that have survived cold and harsh environment and are important to the local food supply. The government established separate research institute for these two vital species and invested in the genetic and nutritional improvement. Detail of the visited is described in a Chinese news release (http://www.scgrassland.cn/html/news/show_1_w1_691_zh.html).

China is one of the few countries in the world that has established a network of agricultural universities. These agricultural universities focus on the adoption and development of science and technology in various fields of agriculture. In just about each of the agricultural university, there is a college of animal science and technology. Investments in agricultural science and education position China with a strong future in maintaining competitiveness in agriculture and assure food security for its mass population.
Residents and most visitors to the Hawaiian Islands are familiar with the diversity and multitude of citrus common throughout the state. However, if one looks closely they may see the tell-tell signs of Citrus Scab or Elsinoe fawcetti. This fungal pathogen is often recognized by its light-brown circular scab-like growths, which is actually the body of the fungus, or stroma, plus swollen, host tissue, viewed on the stems, shoot apices, fruit, and leaves of many citrus types. Figures 1 & 2 depict the common visual symptoms of an infected tree. Unfortunately, the reason Hawaii is considered to be the “Paradise in the Pacific” is the very reason that E. fawcetti is able to flourish. The high temperatures (consistently above 55 degrees Fahrenheit) and humidity levels (consistently above 50 percent) throughout the state coupled by the seasonal high levels of rainfall allow the pathogen an acceptable living environment. Spore dispersal is accomplished via irrigation and splashing rain. Additionally, when this pathogen is identified, often by gardeners pruning affected trees, they fail to properly dispose of the infected cuttings and debris.

One may ask, after identifying the symptoms of E. fawcetti within your orchard or upon your favorite citrus tree, “How do I effectively manage this problem?” There are many methods of dealing with this pathogen, both directly and indirectly. First and foremost is to incorporate, when possible, citrus varieties that are not susceptible to this pathogen. Sweet orange, navel orange (C. sinensis), Pummelo, shaddock (C. grandis), Grapefruit, and pomelo (C. paradisi). Some lime and tangerine varieties are not symptomatic.

Additionally, if it is not possible or feasible to replant then there are other methods available. A proper location of tree planting can minimize chances of infection by allowing for a more sunnier and drier environment, which is both easy and effective against E. fawcetti. Growing young trees in an environment that is less prone or susceptible such as a greenhouse, as well as, alternating crops. By alternating crops, assuming the alternate crop is not susceptible, minimizes the continuation or spread of the pathogen. Weed control and pruning of unaffected trees allows for both enhanced air circulation within the center of the tree and drier green matter, thus further minimizing the chance of infection. Excessive weed growth around the base of a tree only serves to rob the tree of nutrients and water. Changing methods of irrigation from overhead to drip or flow can prevent spore dispersal and reduce the severity of the disease. I have selected fumigation as the last effective management of E. fawcetti. There may be reasons or degrees of severity in some citrus crops that demand a more general and broadly efficient method of control, such as a commercial reliance. There is a controlled list of acceptable fumigants offered by the state of Hawaii regarding citrus on the following website: http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-60.pdf. Though the particular type of fumigant is important, just as important is the method of use. Always use fumigants in accordance to the specific products given instructions. Helpful reference can be found at the following sites:

http://hawaiiplantdisease.net/

http://www.ctahr.hawaii.edu/

Happy gardening.
Organic farming…

Proponents of these non-conventional organic farming methods generally seek to replace all external nutrient and pesticide inputs by having the farmers make organic liquid foliar fertilizer solutions on farm through the fermentation tea based extraction of nutrients from crop and food residues, ground covers, and weeds. Similarly pesticides/pest repellants are made from certain plant tea extracts that are also self-prepared. In some instances the liquid fertilizers also contain resources from aquatic systems such as algae/seaweeds, and diluted seawater. Furthermore, a key component of these farming methods is the culturing of “beneficial” or “effective” indigenous soil microorganisms. These beneficial soil microbes are routinely applied to the soil as a microbial additive (biofertilizer) to allegedly increase plant nutrient release from soil organic matter through mineralization and to some extent from soil mineral dissolution through the release of organic acids and chelating agents, enhance root growth through bacterial phytohormone production, and also improved overall soil health, structure, and functioning (Altomare and Tringovska, 2011; Mohammadi and Sohrabi, 2012).

There is little scientific doubt that a high population density and diversity of microorganisms are necessary to maintain the turnover of essential plant nutrients in terrestrial ecosystems (Dobrovol’skaya et al., 2015). In healthy soils the microbes tend to bring the system into a near equilibrium state and a reserve dormant pool of very diverse microbes is always present for greater system stability (Dobrovol’skaya et al., 2015). Therefore it is highly questionable if healthy soils need to be repeatedly dosed with microbial additives and if observed plant responses on such soils are not just due to nutrients added in the substrate (Mayer et al., 2010).

There are few scientific data published in respected high-impact factor, peer-reviewed journals on these alternative beneficial microbe-based organic farming methods, especially from the tropics (Cóndor-Golec et al., 2007). Some esteemed tropical crop production scientists are openly very skeptical (Giller, 2008). A huge concern from the perspective of Giller (2008) and even Mikkelsen (2005) who is a beneficial soil microbe proponent in the Philippines is the lack of input quality control/consistency by the practitioners. Without well-designed crop production studies to verify claims the trends indicate that there will continue to be a spiral into occult agricultural dogma and risky production decisions based largely on the UFOs (unverified field observations) of well-intentioned, charismatic, counter culture, agricultural leaders.

A recently completed East Hawaii study of beneficial indigenous microorganisms (IMO 4) as a soil inoculant did not produce very encouraging results with corn (Zea mays L.) growing in a Hilo silty clay loam (Acrudoxic Hyluand) (Rushing, 2016). Rushing (2016) also found that just adding quality organic matter resulted in superior corn growth than IMO 4. Cóndor-Golec et al. (2007) and Giller (2008) wonder why beneficial soil microorganism based production practices continue to be (re)discovered yet few commercial growers of significant consequence or prominence implement the technology long-term. I suggest that quality of the debate needs to evolve and alternative farming methods be examined more scientifically and less from the perspective of marketing and zealous devotion to practices based largely on promises of farmer empowerment. How much organic nature/natural farming practices can contribute to improved economic viability for East Hawai‘i horticultural food crop production remains to be determined. The limited evidence suggests the following:

1. High frequency of organic liquid foliar fertilization, beneficial soil microbe application, and possibly pest repellants will likely be needed in the high rainfall zones of East Hawai‘i and especially the Fe- and Al-oxide rich soils that strongly tie up phosphorus (Master Cho Han-kyu, personal communication, January 13, 2016).

2. Responses to beneficial soil microbes can decline with time if active soil organic matter and mineral nutrients are not replenished with quality mulches and other suitable organic inputs to serve as a source of microbial energy for decomposition and associated nutrient release through mineralization (Carandang, 2003; Mikkelsen, 2005). A major constraint to the successful introduction of cultured microbes to soil is the ability of the introduced population to be sustained at levels above the population already present, including the reserve dormant pool (Murphy et al., 2003; Dobrovol’skaya et al., 2015).

3. Applications of beneficial microbial preparations will have to be compared with sterilized (autoclaved) preparations to determine if responses are caused by the microbes or nutrient inputs derived from the substrate (Mayer et al., 2010).

4. Nutrient mineralization by microbes may not be synchronized with the peak demand of cultivated crops and mineralized N may be nearly completely lost from the root zone as nitrate during intense rainfall events thereby necessitating timely N fertilization to meet the demand of rapidly growing crops (Maeda et al., 2003; Myers et al., 1997).

Continued next page...
Organic farming…

Only 200 mm (8 inches) of rain can leach 50% of the immediately available inorganic N from the top 40 to 50 cm (16 to 20 inches) of East Hawaii’s rock land soils (Mathews and Senock, 1998).

5. The efficacy of beneficial microorganisms will likely vary with soil type, existing fertility and health level, crop species, number of applications, and time (Javaid, 2010).

6. Applications of beneficial microorganisms may have their best effect when integrated with low to medium (half standard NPK) rates of fertilization (Javaid, 2010; Mohammadi and Sohrabi, 2012; Paul et al., 2013) which fits well with the concept of integrated soil fertility management (ISFM) that has gained popularity in many parts of the world (Vanlauwe and Sanginga, 2004; Moore and Nkonya, 2015).

7. Labor to prepare and apply the indigenous derived inputs may be an issue if the farmer is unable to avail of low cost assistance of family and friends (Vanlauwe and Sanginga, 2004). It is often asked if the organic price premium received for the harvested product will be enough to make the effort worthwhile.

8. Any new method of farming for East Hawai’i has to be economically and technologically feasible as well as being culturally acceptable (Alders et al., 1993).

9. Attempts should be made to demonstrate the potential feasibility of new farming methods with the interested farmers as participant observers (Alders et al., 1993).

10. Investigations are desirable with regard to soil microbial diversity and the potential exploitation of indigenous strains which possess better potential to promote local crop growth under the prevailing environmental conditions (Altomare and Tringovska, 2011).

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Organic farming...


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AG Club UPDATES

The New Set of Officers
President: Stephen Zilch
Vise: Miguel Bravo
Treasurer: Micheal Sthreshley
Secretary: Krisha Zane

Message from the President...
We have access to a greenhouse and a piece of land on the farm. We are open to suggestions from people interested in growing crops. We will be hosting senior awards night at the end of the semester and we need all the help we can get. Next semester (Fall 2016) we will have some leadership positions opening up. If you are interested email Stephen Zilch at stephenz@hawaii.edu.