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UNIVERSITY of HAWAI'I® HILO

CAFNRM/Agriculture Club Newsletter

Inside this issue:

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Sweet Potato Production on the Hamakua Coast: It's time to test your soil!

By
Chantal Vos and Norman Arancon

Sweet potato (*Ipomoea batatas*, L.) production along the Hamakua Coast can be increased by addressing nutrient imbalances in the soil. Sweet potato is an important crop in Hawaii both for local consumption and as an export crop and more than 90 percent is produced along the Hamakua Coast on the island of Hawaii (Miyasaka and Arakaki, 2010). Most commercial sweet potato farmers on Hawaii Island do not test their soil or crops on a regular basis for potential nutritional problems. Fertilizers are often applied indiscriminately based on prior experience or current practice from other growers, whether these areas have been cropped for many years or are newly cleared for cultivation. Soil fertility is often not optimal, even on land that has never been cultivated with sweet potato (virgin land). During crop production, available nutrients are lost through leaching, run-off, and crop harvest. Nutrient balances are distorted, and fallow periods have demonstrated limited capacity to adequately restore and build soil fertility. This being said, fallows will generally reduce many disease and pest problems (Bennett *et al.*, 2012).

A sweet potato field operated by Mitch Anderson (*Photo by: Chantal Vos***)**

Continued next page

CAFNRM Celebrates Annual Ag Fair 2018

By Justin Ziminsky

The College of Agriculture Forestry and Natural Resource Management at UH Hilo opened its annual Ag Fair on April 27, 2018. The fair was very educational for students and visitors alike. There was a lot of information on sustainable agriculture, farming, animal production, bee harvesting, and aquaponics available for everyone by the students of horticulture, animal science, entomology, beekeeping, sustainable agriculture, value-added products and aquaculture.

Continued on page

CAFNRM's Ag Fair, April 27, 2018

Sweet potato continued…

Access to lands not previously cultivated with sweet potato or fallowed long enough to break disease and pest cycles (weevils, nematodes, etc.) is increasingly becoming a problem for growers. This challenge is magnified by new land owners who are unwilling to lease their lands for row crop production. Developing improved post-harvest field sanitation and short rotation management strategies will be key in addressing disease and pest issues (Bennett *et al.*, 2012). Large increases in sweet potato yields can be obtained from a modest increase in nutrient supply to address mineral deficiencies (O'Sullivan *et al.*, 1997). The potential yield for sweet potato under optimum conditions can reach 80-100 t/ha (O'Sullivan *et al.*, 1997). In Hawaii, the average yield was 17 t/ha in 2011 (NASS, 2013), however, good yields on commercial farms range from 34 to 39 t/ha (Valenzuela *et al.*, 1994). Diagnosis and correction of nutritional problems are essential for the sustainable production of sweet potato production. Both deficiencies and toxicities of mineral nutrients can affect crop production and unbalanced or excessive use of fertilizers can cause environmental pollution and is an unnecessary expense (O'Sullivan *et al.*, 1997).

Between April and October 2017, a total of 16 commercial sweet potato fields were surveyed by CAFNRM researchers Chantal Vos and Norman Arancon to obtain insight into the current soil and tissue nutrient status of these fields along the Hamakua Coast and to elucidate if the current fertilization practices can be augmented using nutrient data from the soils and plant tissue collected from these sites. Composite soil samples were randomly collected from at least 30 different locations throughout each field using a hand shovel at a depth of 0-6 inches. Tissue samples were collected from farms growing the Okinawan purple sweet potato variety, which is the principal variety grown for export to the US Mainland (Miyasaka and Arakaki, 2010). The most recent fully-developed leaves without petioles were harvested randomly from 20 to 30 sweet potato plants throughout the planted fields. All soil samples were analyzed by the Agricultural Diagnostic Service Center (ADSC) of the College of Tropical Agriculture and Human Resources of the University of Hawai'i at Manoa for pH (saturated paste method), organic carbon (modified Walkley-Black method), total nitrogen (micro-Kjeldahl method), extractable phosphorus (modified-Truog method), and exchangeable calcium, magnesium, potassium, and sodium (by extraction with ammonium acetate (1*M*, pH 7.0)) as described by Hue *et al.* (2000). Leaf samples were analyzed by Waters Agricultural Laboratories (Camilla, GA). Plant minerals phosphorus, potassium, magnesium, calcium, sulfur, boron, zinc, manganese, and iron were analyzed by open vessel wet digestion using an inductively coupled argon plasma spectrometer (ICAP, DigiBlock 3000). Total nitrogen was determined using a nitrogen gas analyzer (LECO). Results show adequate concentrations of nitrogen (N) and sulfur (S), low phosphorus (P) and potassium (K), and very low calcium (Ca) and magnesium (Mg) levels. Applications of dolomitic limestone are recommended to increase soil pH and plant available Ca and Mg. Increasing soil exchangeable potassium to at least 200 ppm may increase the quantity and quality of sweet potato yields. Muriate of potash or alternatives such as sulfate of potash and sulfate of potash magnesia can be used to increase available K. Fertilizer recommendations were shared with sweet potato farmers based on soil reports per field. Average fertilizer costs to address nutrient deficiencies with conventional fertilizers at the 16 sampled fields are estimated at US $3,000 per acre per cropping cycle. Lime (coral limestone or dolomitic limestone) and calcium fertilizer (gypsum) comprise 60% of these fertilizer costs. Adequate fertilization can increase overall yields and improve the shape of the sweet potato storage roots. Annual soil testing is highly recommended to determine if current fertilization practices are sustainable and can maintain the production of sweet potato tubers. Funding for this study was provided by the USDA-PBARC Integrated Cropping System Project. Agreement No. 5320-43000-016-17S/agreement 58 -5320-016-17S under Dr. Bruce Mathews, Dean, CAFNRM, UH Hilo.

References:

Bennett, A.J., Bending, G.D., Chandler, D., Hilton, S., Mills, P., 2012. Meeting the demand for crop production: the challenge of yield decline in crops grown in short rotations. Biol. Rev. 87, 52-71.

Hue, N.V., Uchida, R., Ho, M.C., 2000. Sampling and analysis of soils and plant tissues: How to take representative samples, how the samples are tested. In: Silva, J.A., Uchida, R.S. (Eds.), Plant Nutrient management in Hawaii soils: Approaches for tropical and subtropical agriculture. CTAHR, University of Hawaii at Manoa., Honolulu, HI, pp. 23-30.

Miyasaka, S., Arakaki, A., 2010. A Sweetpotato Variety Trial on Hawai'i: Preliminary Results. University of Hawaii. CTAHR.

NASS, 2013. Statistics of Hawaii Agriculture 2011. National Agricultural Statistics Service, USDA and Agricultural Development Division, Hawaii Department of Agriculture.

O'Sullivan, J.N., Asher, C.J., Blamey, F.P.C., 1997. Nutrient Disorders Sweet Potato. Australian Centre for International Agricultural Research, Canberra, Australia.

Valenzuela, H., Fukuda, S., Arakaki, A., 1994. Sweetpotato Production Guides for Hawaii. College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa.

Wang, J.d., Wang, H., Zhang, Y., Zhou, J., Chen, X., 2015. Intraspecific variation in potassium uptake and utilization among sweet potato (Ipomoea batatas L.) genotypes. Field Crops Research 170, 76-82.

Dr. Norman Arancon collecting leaf samples from sweet potato field.
Photo by: Chantal Vos

AG230 Students Give Garden Tour to 205 Pre-K to High School Students

By Norman Arancon

Some 205 students from local pre-K and high schools all over the Big Island toured the gardens by the Library Lanai during the celebration of this year's Earth Day. The gardens were showcased by the Ag230 students of Spring 2018. This has been a regular contribution of the class to Earth Day celebrations since these gardens were established in 2009 by former students . Each semester students are given the challenge to design and maintain a garden that grows food and incorporate principles of sustainability: ecologically sounds, economically viable, socially just and equitable, technologically appropriate, culturally sensitive, based on holistic science and promote human development. This year's garden designs are not short of practices that demonstrate these principles. Garden plots are established with permanent structures following elements of permaculture such the use of rocks, spiral garden designs and establishment of perennials. Soil fertility practices include the use of composts and vermicomposts produced from food and paper wastes from the UH Hilo Dining Hall and incorporating nitrogen-fixing plants such as legumes, intercropping of crops with synergistic relationships. Pest management techniques include the use of baits for slugs and snails and establishing sacrificial and flowering crops to attract beneficial insects. Weed management practices employed are mostly non-chemical including hand-weeding and mulching using wood chips. Annual crops that were either raised in the greenhouse before transplanting or seeded directly into the gardens include cucumber, leafy greens, pepper, tomatoes, sweet pea and legumes among others. Some perennials established by former students and are now at bearing stage include banana, mountain apple, star fruit, citrus, cacao and kava. In the middle of two gardens lie a demonstration set-up of aquaponics using black soldier flies as the main food composter. The system was originally built by a former student of Ag230, Wesley Owens, in 2015 and since then maintained by the succeeding students in the class. It is a closed system that uses food wastes composts as the main source of plant nutrition. The composted food wastes drop into a 100-gal water container, feed fishes that further enrich the water which is eventually pumped into grow beds powered by solar cells. The system, a household prototype, has produced a variety of vegetables including peppers, lettuce, tomato, basil and beans. The garden tour marked the culminating activity of the class leading to a peer-evaluation on the last week of classes. The student visitors seem to have enjoyed the plants and hopefully motivated by the fact that these gardens are low input. It certainly was an excellent opportunity for the students of AG230 not only to showcase the product of their hard work but also an opportunity to inspire the younger generation. Ag230 class is taught every semester and open to all UH Hilo students. It is a GenEd course for World Culture, Global Community Citizenship and Natural Science. The course is also supported by USDA NIFA ANNH grant. For more information, please contact Dr. Norman Arancon (normanq@hawaii.edu)

Lehua Patnaude, student of AG230 led the tours in the gardens by the UH Hilo Library lanai during Earth Day

Photo by Norman Arancon

Ag Fair continued…

There were amazing homemade products and different organic foods made by students from Ag 205 that were also available to attendees. Dr. Bruce Mathews, Dean of CAFRNM and Dr. Lorna Tsutsumi formally welcomed guests and exhibitors during the opening ceremonies at the CAFNRM breezeway. Although, there were great products being presented by everyone, one in particular stood out for me. The table on vermicompost tea (composting using earthworms) made and exhibited by Antonio Vera from AG 205 class, was the most intriguing. Tony made an organic 'tea' for plants from his vermicompost that was a topical solution administered by standard spray bottles. The vermicompost solution he had made helped plant development, root growth, and seed germination. He had a control plant next to the one he used the solution with and the difference was extremely noticeable. Tony's vermicompost was incredibly inspirational to me, and I will look into producing my own very soon.

All in all, the agricultural fair at UH was a success. Attendees from all of Hilo took with them a little more knowledge than they have arrived with, and that in itself is a great success. From learning about livestock, the dangers in chemicals used in commercial products, such as, sunblock and other topical solutions that are widely used throughout the community, to learning how to make your own organic honey from by bee harvesting, the agricultural students and professors put on a great fair! We look forward to next year's fair!

Dr. Eiben and students in entomology showcased insect collections

Animal science students and farm animal exhibits

Dean Mathews and Dr. Lorna Tsutsumi gave welcome remarks at the opening ceremonies

Kawika Carduz, Ag 205 student, showcased value-added product using eco-friendly ingredients

Dean's Corner

Mālama ʻĀina and Future Cropping Systems

By: Dr. Bruce Mathews

Hawaiʻi rightly takes great pride in its rich agricultural history, the mālama ʻaina (deep care, stewardship, and respect for the land) of the Native Hawaiians, and no doubt much can be learned from the past. This being said most conservation and resource management discussions in Hawaiʻi pertaining to the revitalization of local agriculture tend to be far too insular, and focused on Eden-like interpretation of the past and anecdotal commentary for impactful progress to be made on viable paths forward. Yes, pre-European contact agriculture was self-sufficient, organic by practice, and did not rely on external inputs however many bio-cultural, technological, and socio-political parameters have changed since that time. And there is strong evidence that pre-European contact agriculture and aquaculture had much greater impacts on Hawaii's environment than previously thought (Kirch, 1982; Anderson et al., 2017). Native Hawaiian upland field systems based largely on intensive 'uala (sweet potato) cultivation in the highly valued locations of greater natural soil fertility would have eventually run into sustainability challenges induced by gradual soil nutrient depletion (Vitousek et al., 2004; Hartshorn et al., 2006). In this regard it is also worth noting that no till aboriculture/agroforestry based on cultivation of ʻulu (breadfruit) trees had some distinct environmental and subsistence agriculture advantages and should be further investigated (Rolett, 2008).

Contrary to popular belief regarding the overall importance of kalo (taro) production in the valley lowlands (freshwater marshlands) and loʻi (terraced pondfields irrigated with diverted stream water), there is data suggesting that the dryland food production systems in the uplands provided about half the dietary calories for pre-European contact Hawaiians (Dr. Natalie Kurashima, Integrated Resource Manager, Kamehameha Schools, personal communication, April 9, 2018). It is also interesting to note that by the early 1900s intensive rice cropping with two crops per year to feed Hawaii's growing plantation workforce was leading to soil nutrient depletion (especially potassium) in the valley lowlands which used to sustainably support significant taro production by the Native Hawaiians (Kelley, 1914; Figures 1 vs 2). Without efficient and responsible use of external nutrient inputs the highly productive agriculture of the modern era does not stay productive for long and its land sparing benefits for forests and grasslands are lost.

Indigenous agriculture elsewhere in the world has found adaptive paths to persist and often expand during the present era via eclectic sustainable intensification that is economically viable enough for small and mid-sized farmers to make farming a career option. Sustainable intensification is an agro-ecological approach which does not limit farmers to solely local indigenous practices and crops but rather integrates them with the best modern approaches in an environmentally and socially responsible manner. Hence, it allows for an agriculture that can meet the needs of the present while being as closely aligned to the Mālama ʻĀina stewardship ethic as possible.

Figure 1. He'eia Valley, Oʻahu, 1910. Notice the intensive production of kalo (taro), rice, and maiʻa (banana). The uplands were deforested and suffered much soil erosion due to fuelwood harvesting and the impact of grazing livestock. And amazingly the waterfowl survived!

Figure 2. He'eia Valley, Oʻahu, 2010. The beginnings of taro paddy restoration in the wetlands now dominated by invasive California grass. The surrounding uplands are facing challenges coping with invasive species as well.

Dean's Corner continued….

Recent cropping systems research by CAFNRM's Ms. Chantal Vos (Research Associate) and Dr. Norman Arancon (Associate Professor of Horticulture) has shown that many of Hawaii's farmers are struggling with how to optimally use agricultural inputs from both economic and agro-ecological perspectives. We need long-term planning for economically resilient agricultural systems that can work within the prevailing environmental, technological, and socio-political systems. The Official Motto for the State of Hawai'i is "Ua Mau ke Ea o ka 'Āina i ka Pono" (The Life of the Land is Perpetuated in Righteousness) however finding a path forward for significant food crop production has remained elusive in recent decades and this trend was already well apparent by the 1950s (Ripperton et al., 1955).

Quite a few well-intentioned academics, more often than not in the social and ecological sciences, do us no favor by over-romanticizing the pre-European contact past of Hawaii's agriculture. These people typically provide little discourse on the adaptive agricultural practices of Native Hawaiians during the past two centuries and do not show much vision in terms of looking beyond Hawai'i for ideas on how to pave a path towards a productive and resilient future. We also face the challenge that many of the naturally more fertile lands used for food production in past eras are no longer easily accessible due to their now being zoned for conservation (mainly in the valleys and gulches), used for private ranching and subdivisions (fertile uplands in moderate rainfall zones), and in some cases the surface water sources for irrigation were diverted long ago. There are also other bureaucratic constraints like cumbersome policies and the challenges of securing long-term land leases at reasonable cost, etc. This being said we have a kuleana (responsibility) to promote a greater local food self-reliance as it can be argued that importing most of our food results in a form of eco-imperialism. If we want to be a model of sustainability and resilience for other island nation states we must do better. A key component of doing better must be support for good science which allows for reasoned and reasonable explanations of responses to agricultural management practices. And good science is based on well-designed research experiments with appropriate controls, replication, and randomization.

Interestingly in the quest for improved local food security some regions of the tropics/subtropics in South and SE Asia, and Sub-Saharan Africa are now actively exploring expansion of agriculture along the hydromorphic fringes of riverbanks, valley bottoms, and the bases of valley walls through integrated approaches with reduced risk for agricultural pollution. These are the very types of landforms where much of indigenous agriculture originated, including that of the Native Hawaiians and many Native Americans. Factors driving a resurgence of interest in farming these bottomlands include a reduced need for expensive fertilizer inputs for the soils derived from alluvium and colluvium, reduced risks associated with drought and climate change, the ability to more easily integrate aquaculture, and a less frequent need for fallowing. A holistic knowledge-intensive agriculture is the Mālama 'Āina way forward. For more information the reader is referred to Wakatsuki and Masunaga (2005); Gurung et al. (2012); Obalum et al. (2012); Rodenburg (2013); and Chong (2017).

Partial list of References:

Anderson, B., L. Zhang, H. Wang, T. Lu, F.D. Horgen, J. Culliney, and J. Fang. 2017. Sedimentary carbon and nitrogen dynamics reveal impact of human land-use change on Kawainui Marsh. O'ahu, Hawai'i. Pac. Sci. 71:17-27.

Chong. E.S. 2017. Riverbank farming: An unutilized resource in the quest for food security. Penang Inst., Penang, and The Malaysian Insight, Kuala Lumpur, Malaysia.

Gurung, G.B., P. Koirala, D.P. Pande, D.B. Basnet, and O. Kafle. 2012. Promoting rural livelihoods through riverbed vegetable farming in the Tarai Region of Nepal. J. Int. Dev. Coop. 18:113-121.

Hartshorn, A.S., O.A. Chadwick, P.M. Vitousek, and P.V. Kirch. 2006. Prehistoric agricultural depletion of soil nutrients in Hawai'i. Proc. Nat. Acad. Sci. 103:11092-11097.

Kelley, W.P. 1914. Rice soils of Hawaii: Their fertilization and management. Hawaii Agric. Exp. Stn Bull. 31. USDA, Washington, DC.

Kirch, P.V. 1982. Impact of prehistoric Polynesians on the Hawaiian ecosystem. Pac. Sci. 36:1-14.

Obalum, S.E., M.M. Buri, J.C. Nwite, Hermansah, Y. Watanabe, C.A. Igwe, and T. Wakatsuki. 2012. Soil degradation-induced decline in productivity of Sub-Saharan African soils: The prospects of looking downwards to the lowlands with the *Sawah* ecotechnology. Appl. Environ. Soil Sci. 2012: Article 673926.

Ripperton, J.C., M. Takahashi, and E.Y. Hosaka. 1955. Field crops and pastures. p. 165-203. *In* M.G. Cline (ed.) Soil survey of the Territory of Hawaii: Islands of Hawaii, Kauai, Maui, Molokai, and Oahu. USDA Soil Conservation Service, Washington, DC.

Rodenburg, J. 2013. Inland valleys: Africa's future food baskets. p. 276-293. *In* M.C.S. Wopereis et al. (ed.) Realizing Africa's rice promise. CAB International, Wallingford, Oxfordshire, UK.

Rolett, B.V. 2008. Avoiding collapse: Pre-European sustainability on Pacific Islands. Quarternary Intl. 184:4-10.

Vitousek P.M., T.N. Ladefoged, P.V. Kirch, A.S. Hartshorn, M.W. Graves, S.C. Hotchkiss, S. Tuljapurkar, and O.A. Chadwick. 2004. Soils, agriculture, and society in precontact Hawai'i. Science 304:1665–1669.

Wakatsuki, T., and T. Masunaga. 2005. Ecological engineering for sustainable food production and the restoration of degraded watersheds in tropics of low pH soils: Focus on West Africa. Soil Sci. Plant Nutr. 51:629-636.

CONGRATULATIONS TO SPRING 2018 CAFNRM GRADUATES

Ale , Lemau Taisia
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Rhyno , Connor Royels
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Russell , Lars William
Solis-Kalani , Kodie Keolikaheamaikalani'iku'upu'uwai Maile

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Northwest FARM CREDIT SERVICES

CAFRNM Students Share Basic Ag Skills to Hilo High School Students

By Aaron Shipman

As the semester rapidly draws to a close, the students of the College of Agriculture Forestry and Natural Resource Management, UH Hilo showcased their skills through community outreach. This year, the Introduction to Horticulture (Hort 262) class instructed by Dr. Norman Arancon visited the students of Hilo High School supervised by their instructor Christian Atalig. On May 3rd the class demonstrated a few very important basic concepts and skills in plant production. They led these agricultural minds through a series of horticultural practice beginning with nutrient cycling and composting, through seed viability and storage, all the way to transplanting seedlings and clonal production through various layering techniques. This was a great learning experience for the both teacher and students, as we all brought something beneficial away at the end of the day whether it be our ability to impart knowledge or the possibility of motivating younger generations to place more interests in agriculture as an option for a major in college after high school.

The collaboration between CAFNRM and Hilo School dates back in April 6, 2014 when Dr. Arancon agreed to help out the Mr. Atalig's Hilo High School Ag program by regular consultation and holding seminars and workshops. Both parties agreed that there is so much potential to revitalize the Ag Program that has long been not given attention at Hilo High School and the same time involve the students in rebuilding the once lush vegetation of fruits trees and vegetables along the hillsides of the campus.

Hort 262 Students teach Hilo High School students some basic methods in plant production

SNAPSHOTS

This section is dedicated to photos of CAFNRM students involved in varied hands on activities on and off campus

Ag 205 students, Daniel Dunnom and Batina Grosset, showcasing value-added products on Ag Fair Day

Ag 205 student, Reid Hamsaki, showcasing value-added products on Ag Fair Day

Ag 230 students and their produce display on Ag Fair Day

Animal Science students taking care of farm animals on Ag Fair Day

Aquaculture students and their display on Ag Fair Day

Ag 230 students showcasing gardens at end of the semester


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Ag 230 students showcasing gardens at end of the semester

Hort 352 students planting fruit trees at an orchard in Naalehu

Ag 230 students showcasing gardens at end of the semester

Ag 294 student, Connor Rhyno, inspecting earthworms in vermicompost bins

Hort 262 students field trip at Mahealani farms