U.S. Pacific Basin Agricultural Research Center

Report from the Stakeholder Workshop and Program Visioning Conference
Hilo, Hawaii – May 28-29, 2008
v061408

Executive Summary

The PBARC Stakeholder Workshop and Program Visioning Conference brought together nearly seventy participants representing industry, state and federal partners as well as customer and stakeholder groups with a wide range of interests for a two-day workshop in Hilo, Hawaii. A unifying theme from the two day meeting was the importance of Hawaii as a global model for sustainable tropical/subtropical agricultural systems. The Writing Team aggregated the researchable problems from the workshop and identified three overarching research themes: 1) research to underpin Hawaii as a global model for sustainable tropical/subtropical agricultural systems, 2) research to address constraints to U.S. and Pacific Basin agriculture and threats to the environment, and 3) research to support regulatory actions. Researchable problems under each of these overarching themes were then assigned by the Writing Team to one of four priority categories based upon their relevance to the proposed PBARC mission and their suitability taking into account the Center's research capacity and resources. Most crop systems, aquaculture, and fruit fly/invasive insects research under the first and third overarching themes were categorized as high priority (exceptions were agricultural inputs and food safety research) whereas most researchable problems under the second overarching theme addressing constraints to agriculture were deemed of lower priority for PBARC's mission. Vision and mission statements were developed to reflect these priorities. Stakeholders expressed appreciation for the historical contributions of ARS research in Hawaii and there were expectations that PBARC would continue to play a key role in support of Hawaiian and Pacific Basin agriculture in the foreseeable future. The importance of the integration of PBARC's research program into the ARS National Programs was also recognized. The USDA, Agricultural Research Service's (ARS) programs on fruit fly, post harvest commodity treatment, and germplasm research were consolidated last year into a new U.S. Pacific Basin Agricultural Research Center (PBARC) on the Island of Hawaii. Research facility consolidation together with the retirement/departure of three research scientists (including two research leaders) provided the opportunity to involve customers, stakeholders, and partners in a workshop to develop a future research vision for the laboratory taking into consideration the unique setting as well as the center's capabilities and resources. The ARS Pacific West Area (PWA) and PBARC jointly convened a Stakeholder Workshop and Program Visioning Conference for PBARC on May 28 and 29, 2008 in Hilo, Hawaii. The nearly seventy participants represented industry, state and federal partners as well as customer and stakeholder groups with a wide range of interests applicable to the PBARC research program.

Background

Hawaii is isolated and strategically located in the middle of the Pacific Ocean. It has a favorable year around climate for agricultural production with a native flora and fauna at high risk of competition from non-native species. Hawaii's year around favorable climate has attracted seed companies for production of new varieties with nearly all corn in commercial production world-wide today having some period of time in Hawaii during the production cycle. This aside, Hawaii's isolation and dependence on imports for fresh fruits and vegetables and energy resources and a high risk of new pest introduction and establishment has resulted in quarantine restrictions that have constrained agricultural production in the islands. At this time, Hawaii is the only state under full federal fruit fly quarantine. As a result of the presence of the tephritid species in Hawaii, USDA fruit fly research has been present in Hawaii for nearly 100 years and much of the basic biology and control technologies for fruit fly species have been developed by USDA and related agency laboratories in Hawaii.

Agriculture in Hawaii is in transition from a largely export plantation economy to a diversified agricultural economy on prime lands formerly in sugar and pineapple production. The Hawaii Area-Wide Pest Management Program, initiated by USDA, ARS in Hawaii in 2000 and now in its final year of funding, demonstrated for the first time control methods and strategies for the suppression fruit flies in Hawaii below economic threshold levels in most growing areas in the state. In addition, post-harvest commodity treatment protocols developed by the laboratory over the past 30 years have opened up new opportunities for export of fresh fruits and vegetables to U.S. mainland markets from Hawaii. These accomplishments directly benefit Hawaii as well as U.S. mainland agriculture, much of which is also at risk of fruit fly infestation.

The core strengths of ARS in Hawaii have been in fruit fly control programs, post-harvest commodity treatment and germplasm preservation. The Agricultural Research Service in Hawaii was a partner in the development of the first genetically engineered tropical fruit, the rainbow papaya, and has played a key role in securing all necessary federal permits for the commercialization of the fruit for production in Hawaii. Hawaii is at great risk of new pest infestation, therein, plant breeding programs remain a critically important need for long term sustainable production of crops in Hawaii. Most notable of the pest problems in recent years include anthurium blight (*Xanthomonas*), banana bunchy top disease, papaya ring spot virus, bacterial heart root of pineapple, papaya mealy bug, the Asian citrus psyllid, nettle caterpillar, and others. The varroa mite was detected for the first time in Hawaii in April 2007 and is believed to be solely on Island of Oahu at this time. State quarantine measures have been implemented to contain the mite on Oahu and to reduce infestation levels in honey bees on Oahu. Because Hawaii supplies about one-third of the U.S. mainland honey bee queens, the detection of the varroa mite for the first time in Hawaii has serious implications for U.S. agriculture. Containing the mite on Oahu is a top priority of the Hawaii Department of Agriculture to assure the availability of bees statewide for pollination services and a health queen bee industry for Hawaii for U.S. and worldwide agriculture.

Workshop Plenary and Breakout Sessions

The workshop began with a plenary session to set the stage for the subsequent stakeholder breakout sessions (Appendix 1 – workshop agenda). The meeting was opened by Dr. Andrew Hammond, PWA Director, who welcomed the participants, established the workshop objectives, and presented an overview of the current PBARC program status and outlook. Lyle Wong, Administrator of the Plant Industry Division of the Hawaii Department of Agriculture, followed with an overview of the historical trends and the future outlook for agriculture in Hawaii and the Pacific Basin. Next, Drs. Peter Bretting, Daniel Strickman, and Sally Schneider, ARS National Program Leaders, described PBARC's role in support of the ARS mission, national programs, and action agency research needs. The plenary session was concluded by Dr. Dennis Gonsalves, PBARC Director, who provided an overview of the current PBARC facilities, staff, and research program. With the stage set, Dr. Molly Kretsch, PWA Acting Associate Director, described the charge and process for the facilitated stakeholder/customer breakout sessions. Participants (Appendix 2 – listing of workshop participants) convened into their assigned groups (Red, Green, Blue, and Purple) and provided input on the following questions during the workshop:

Breakout Session #1:

- What crop and cropping systems are the future of agriculture in Hawaii and the Pacific Basin?
- What are the key constraints to future agricultural sustainability, productivity and profitability from a National perspective?
- What are the current and future regulatory research needs for the Animal Plant Health Inspection Service (APHIS) and other action agencies that PBARC could address?
- Taking these factors into account, along with the ARS National Programs as a backdrop, what are the future research needs that PBARC is uniquely positioned to address?

Breakout Session #2:

- Are there additional research needs that should be added to the questions addressed in Session #1?
- Prioritize the identified research needs into utmost importance, very important, and important taking into consideration PBARC's unique strengths. [Group consensus sought]
- Develop a proposed vision statement for PBARC capturing these priorities.

From the breakout sessions, thoughts on the future of agriculture in the Pacific Basin and researchable problems that could be uniquely addressed by PBARC were captured (Appendix 3 - "raw" Breakout Groups reports). Building upon the stakeholder/customer input, a writing team comprised of the Acting PWA Associate Area Director (Molly Kretsch, Chair of the Writing Team), three ARS National Program Leaders (Peter Bretting, Sally Schneider and Dan Strickman), two ARS scientists not from the PBARC location (Robert Mangan, Weslaco, TX and Ray Schnell, Miami, FL), and one broad-based stakeholder (Lyle Wong, Administrator of the Plant Industry Division of the Hawaii Department of Agriculture, Honolulu, Hawaii) were charged with identifying common research themes from the workshop, recommending vision and mission statements for PBARC, and providing a programmatic analysis of proposed researchable problems. The recommendations were to be in the context of the ARS National Programs taking into account appropriate research relationships between PBARC research and that of other ARS

laboratories. In addition, the team was instructed that the recommendations should consider the unique capabilities and resources at PBARC and maximize the synergy obtained by collaborating with research partners. This document contains the recommendations of the seven members of the writing team.

Writing Team Recommendations:
A unifying theme of the two day stakeholder's meeting was the importance of Hawaii as a global model for sustainable tropical/subtropical agricultural systems. The new PBARC laboratory will continue to contribute to this vision through its ongoing research programs in partnership with stakeholders, growers, state agencies, and other research entities in Hawaii. This was considered a worthy goal for the state as a gateway to the Pacific Basin for the United States and as the most isolated chain of islands on earth.

Recommended Vision: "Growing Hawaii's Unique Agriculture into America's Future."

Recommended mission:
The mission of the U.S. Pacific Basin Agricultural Research Center (PBARC) is to conduct research for development of sustainable agricultural systems and pest management programs in support of Hawaii, the Pacific Basin, and U.S. agriculture. To achieve this mission, PBARC collaborates with producers, action agencies, universities, ARS locations, and other agricultural research institutions.

Common Research Themes: The Writing Team aggregated the researchable problems prioritized by the workshop participants as "utmost important" or "very important" into three overarching themes:

- Research to underpin Hawaii as a global model for sustainable tropical/subtropical agricultural systems
- Research to address constraints to U.S. and Pacific Basin agriculture and threats to the environment
- Research to support regulatory actions

Researchable Problem Prioritization: Under the overarching themes, researchable problems identified by workshop stakeholders, customers, and partners were assigned by the writing team to one of four priority categories based upon the relevance to the proposed PBARC mission and the suitability, taking into account the Center's capacity and resources to conduct the research. The four categories are:

Category 1: The research problem falls within the proposed PBARC mission and the Center has existing capacity and resources to conduct the research.

Category 2: The research problem falls within the proposed PBARC mission but some additional capacity and resources are required to conduct the research.

Category 3: The research problem falls within the proposed PBARC mission but major increases in capacity and resources are required to implement the research, such as completion of the new PBARC building (phase 2) and substantial expansion of the research staff.

Category 4: The research problem falls outside of the proposed PBARC mission. In these instances, the writing team provided suggestions for alternate research locations or other ARS National Programs to address the research, when known.

Researchable Problem Areas

Overarching Theme #1: Research to address Hawaii as a global model for sustainable tropical/subtropical agricultural systems

Hawaii, with its blend of annual and perennial, fruit, nut tree, vegetable, ornamental, and seafood production systems grown on large and small farms over 10 climatic zones – some allowing multiple production cycles/year – and on differing soil types all within a reasonably compact and isolated location, offers the potential of a global model for sustainable production systems for tropical/subtropical agricultural products. Sustainability attempts to balance the demands of the consumer for high quality affordable products, the need of the grower/producer to make a living, and the desires of the general public for a healthy environment. A wise man once said "sustainability is farming in such a way that my grandchildren will be able to farm."

In developing strategies for the management of pests, pathogens, fertilizer, water, soil, and energy consumptions, the demands of the consumer, the needs of the producer, and the desires of the public must all be considered. As labor constraints increase, synchronous flowering and maturation are important for automation of harvest and other crop management tasks. For example, control of flowering to enable producers to hit key production windows, such as Valentines Day for cut flowers, would increase profitability. Sustainable solutions require a combination of new technologies and chemical, cultural, biological, and genetic management strategies that have been carefully tailored to the specific set of circumstances for each crop/field combination. Because of the level of complexity, these combination strategies require greater expertise and more experience on the part of growers in order to reduce the risk of crop losses to an acceptable level.

A key component of sustainable production systems is superior genetic resources. Detailed knowledge of the genomics/genetics of tropical and subtropical crops is needed to elucidate the genetic basis underlying key crop agricultural/horticultural traits. Additional knowledge of the regulation of transgene expression is required to increase efficiency in engineering disease resistance and other traits. Evaluation of the potential risks associated with the release of transgenic crops to the environment is also important to ensure acceptance of genetically modified (GM) crops and environmental safety. These studies could be used as model systems for the release of other GM crops. Also, application of modern molecular genetic/genomics techniques to enhance traditional breeding programs was recognized as a high-priority research area for PBARC

(categories 1 or 2). This includes developing transgenic plants, genetic linkage maps, and identifying quantitative trait loci. Adoption of marker assisted selection (MAS) would help accelerate selection in long generation tropical/subtropical perennial species. In addition, the capacity to develop new tissue culture systems for many of the minor tropical fruit and ornamental species was deemed high priority research.

Other high priority researchable problems (falling within categories 1 and 2) included research on pollinators (primarily bees), plant physiology and flowering control, integrated pest management, and aquaculture (nutritional requirements of fish and seafood). A lower programmatic priority was assigned to agricultural inputs research (Category 3) related to best management practices because substantial increases in PBARC capacity and resources would be required to implement the research.

Crop Systems: Tropical/subtropical genetics, genetic improvement, and genetic resources

- Genetic improvement for ornamentals, tropical fruits and other tropical and subtropical crops, including both traditional breeding and genetically engineered approaches
    - Disease resistance/stress tolerance, especially host-plant resistance to the fruit fly complex, viruses, nematodes and other pests [Category 1 or 2]
    - New plant varieties:
        - Crops – papaya, coffee, anthurium, pineapple, sugarcane, tropical fruits [Category 1 or 2]
        - New pineapple gold varieties w/resistance to natural flowering, internal browning, nematodes [Category 2]
        - Increase collaboration on production of seed and variety development between the ARS sugarcane breeding stations, university breeding programs and Hawaii Agricultural Research Center (HARC). [Category 1 or 2]

- Tropical/subtropical genetic resources for:
    - Ornamentals [Category 2]
    - Traditional island crops (seaweed [Category 4] , taro [Category 2 or 3], noni [Category 2]), including medicinal plants [Category 2])
    - Sugarcane collection backup to PBARC including enhanced collaboration between ARS sugarcane genetic resources located at the ARS Miami location. [Category 2]
    - Biofuels - oil seed crops (e.g., oil palm, jatropha). [Category 2 or 3]

Crop Systems: Enhanced knowledge of plant physiology and flowering control

- Coffee, papaya, orchids, protea, and pineapple [Category 1 or 2]

Crop Systems: Best management practices for tropical/subtropical ornamentals, fruits and other crops. The workshop participants stated that in developing best management practices, for the research areas listed below, that consideration should be given to the following: 1) economic and environmental analysis for all crops, especially papaya, coffee, anthurium, pineapple, sugarcane, tropical fruits; 2) traditional Hawaiian agricultural practices; and 3) diversification. It was recognized that these considerations would require partnerships with universities or other outside organizations.

- Agricultural Inputs
    - Energy (renewable energy production from agricultural products) [Category 3]
    - Fertilizer
        - utilization and feedstock (local livestock, molasses, aquaculture) [Category 3]
        - development of improved application techniques to conserve use [Category 3]
    - Soil quality [Category 3]
    - Water: development of improved application techniques to conserve use [Category 3]

- Pollinators (especially bees and queen bee production) [Category 2]

- Integrated Pest and Pathogen Management
    - Biology, risk assessment, detection, and control [Category 1]
    - Invasive species [Category 1]
    - Emerging pests [Category 1]
    - Fruit flies [Category 1]
    - Nematodes: research related to enable exporting potted plants and growing bedding plants (i.e. detection, inspection, control), for ornamentals, pineapple, coffee, ginger [Category 2]
    - Pathogens [Category 2]
    - Biocontrol [Category 2]
    - Area-wide approaches to pest management [Category 2]

Animal Systems: Development and delivery of aquaculture feeds

- Determine nutritional requirements of target species [Category 2]
- Aquaculture feedstocks and feed milling [Category 2]

Overarching Theme #2: Research to address constraints to US and Pacific Basin agriculture and threats to the environment

Hawaiian agriculture has unique advantages including minimal temperature stress, regionally abundant rainfall, and a skilled work force. Hawaiian agriculture also has unique challenges due to geographic isolation, limited local markets, and poor soils. Key constraints include the availability and cost of energy, water, and fertilizer. Some of these challenges are because the Hawaiian agricultural system does not grow a full set of

food products. One example is the severe limitation on animal agriculture. Cropping systems are not suited to feed production and therefore the only economical feed for cattle is forage grass. Shipment of grain for finishing cattle is much more expensive than shipment of meat and therefore Hawaii ships grass fed cattle to the U.S. mainland for finishing. Not only does this make Hawaiian beef more expensive than mainland beef, it also limits the market for local by-products that might be used in limited quantity for feed and the availability of manure as fertilizer. Although some constraints are unavoidable, research can reduce the negative impact of some of them. One example is increasing the shelf-life of agricultural export products that would allow the use of more cost efficient shipping methods than air cargo.

The workshop customers and stakeholders identified the following researchable problems to address identified constraints to agriculture and threats to the environment. With the exception of research on local sources of aquaculture feeds and extending the shelf-life of tropical fruits, all other research in this overarching theme was assigned a lower priority category by the writing team because the research did not fall within the proposed PBARC mission or considerable expansion of capacity and resources would be required to initiate the research.

- Lack of local energy sources [Category 4, coordinate with NP307]. Other ARS locations may be able to conduct this research but the specific sites were not known by the writing team.]
    - Develop on-farm production of biodiesel for operation of farm equipment
    - Research on GMO algae for oil production
    - Research on renewable energy and other biofuels from agricultural products

- Lack of local fertilizer sources [Category 3]
    - Develop local sources from agricultural production

- Lack of local sources for aquaculture feeds [Category 2]
    - Develop local sources of feeds that provide optimum nutrition

- Long distance shipping and high labor costs necessitate special marketing practices to achieve global competitiveness
    - Improve packaging of exotic tropical fruits [Category 4; coordinate with NP306]
    - Develop longer shelf life of exotic tropical fruits [Category 2 for NP301 efforts, Category 3 for NP306 efforts]
    - Conduct research to document safety of vegetable crops in order to certify products for the global markets [Category 4; coordinate with NP108]

- Lack of agricultural water in arid island areas or areas where fresh water is constrained by saltwater intrusion
    - Identify new sources[Category 4; coordinate with NP211 in the ARS National Resources and Sustainable Agricultural Systems research programs]

Overarching Theme #3: Research to support regulatory actions

Crop Protection and Pest Prevention - Fruit flies and other invasive insects: Regulatory actions designed to stop the geographic expansion of damaging pests must be based on good science that assesses risk in comparison to benefit and uses effective methods. The foundation of science-based regulations is research so that worthwhile problems are addressed effectively. Regulations generally include specific language on the importance of pests and the techniques used to detect and treat them in commodities. More generally, development of good integrated pest management programs can reduce the need for regulation in the first place. Programs that protect commodities before harvest may eliminate the need for regulation, be a part of a Systems Approach Treatment, facilitate inspection, or reduce the number of shipments requiring post-harvest treatment. The need to continue research programs addressing fruit flies and to initiate more extensive projects for other invasive species was raised by workshop participants. The fruit fly research approaches were in close accordance with the National Fruit Fly Action Plan that emphasizes detection, management and regional eradication, and quarantine treatments. The need for continued programs to protect horticultural production from fruit flies and other pests currently attacking fruit production in Hawaii, such as the Area Wide Fruit Fly Project were also mentioned. Management of quarantine systems and development of quarantine treatments were recognized as key factors in combating threats to both imported and exported agricultural products. Stakeholders recognized that the historical approaches focusing on tropical fruit flies are being broadened to include other problematic invasive insects, such as light brown apple moth, nettle moth and Asian citrus psyllid. This reflects a national approach in ARS to apply the lessons learned from fruit fly programs to control of other invasive insects.

The workshop customers and stakeholders identified the following researchable problems to address research to support regulatory actions. Most research areas were considered of high priority for PBARC (Category 1 or 2).

- Develop knowledge, information, and protocols needed by regulatory agencies for emerging, invasive, and quarantine pests, especially fruit flies.
    - Inspection methods, detection tools, and eradication and/or control treatments of invasive pests [Category 1] and invasive pathogens [Category 2]
    - Biology of invasive pests and plant pathogens to produce evidence-based regulations [Category 1]
    - Commodity treatments/protocols [Category 1]
    - Technology (detection, inspection, control) to address quarantine requirements for nematodes including restrictions for exporting potted and growing bedding plants (ornamentals, pineapple, coffee, ginger) [Category 2]
    - Pest and pathogen island-wide surveys to support quarantine restrictions considering Hawaii's position as a sentinel for emerging pests and pathogens [Category 2]

    - Food safety research to support development of methods for post-harvest treatment and to document the safety of pest/pathogen-resistant varieties. [Category 4; coordinate with NP108]

- Develop techniques and procedures, such as sterile insect techniques, in support of regional eradication efforts
    - Sterile insect techniques and supporting technologies: production of sterile fruit flies and other elements of sterile insect release programs. [Category 1]
    - Technology to support *Varroa*-free areas for bees [Category 2; coordinate with NP305]

- Permits and outreach
    - Develop evidence that documents public and environmental safety of GMO varieties [Category 1 or 2]
    - Develop evidence needed to obtain permits for importation and dissemination of exotic beneficial insects and other biological control agents, particularly in the area of environmental security. [Category 1]
    - Acquire national registrations for the insecticide mixtures that contain parapheromones for the *Bactrocera spp.* [Category 1]

Appendix 1: PBARC Workshop Agenda

U.S. Pacific Basin Agricultural Research Center
Stakeholder Workshop and Program Visioning Conference
Hilo, Hawaii
May 28-29, 2008

Wednesday – May 28

7:30 Coffee and registration

Moderator: Dennis Gonsalves

8:30 Welcome, Meeting Objectives, Current Program Status and Outlook – Andy Hammond

9:15 Historical Trends and Future Outlook for Agriculture in Hawaii and the Pacific Basin – Lyle Wong

10:00 Break

Moderator: Andy Hammond

10:30 PBARC's Role in Support of ARS Mission, National Programs and Meeting Research Needs of Action Agencies – Peter Bretting, Dan Strickman, Sally Schneider

11:15 Facilities, Staff, and Current Research at PBARC – Dennis Gonsalves

12:00 Working Lunch – Charge to Breakout Groups (Molly Kretsch)

1:30 Convene into Breakout Groups – Session #1

3:30 Break

Moderator: Peter Bretting

4:00 Reconvene in Plenary Session - Reports from Breakout Groups and General Discussion

5:00 Adjourn for the Day

(Day 2 – below)

Thursday – May 29

7:30 Coffee

8:00 Announcements and Charge to Breakout Groups (Molly Kretsch)

8:30 Convene into Breakout Groups – Session #2

10:30 Break

Moderator: Dan Strickman

11:00 Reconvene in Plenary Session - Reports from Breakout Groups

12:00 Working Lunch – General Discussion (Sally Schneider)

1:30 Conference Wrap-up

Comments from Dennis Gonsalves

Comments from Bretting, Strickman, Schneider, and Kretsch

Comments from Andy Hammond

2:30 Adjourn Formal Conference; Optional Tour of PBARC Facilities

Appendix 2: PBARC Workshop Participants

Name	Affiliation	Break-out Group
Alvarez, Anne	UH Manoa	
Arcinas, Albert C.	HARC Maui Substation	
Bretting, Peter	ARS, NPS	
Chang, Chiou Ling (Stella)	ARS, PBARC	
Criley, Richard	UH Manoa	
Dowdy, Alan K.	APHIS, CPHST	
Dowell, Robert	CDFA	
Follett, Peter	ARS, PBARC	
Fukuyama, Clyde	Papaya (Kahuku Farms)	
Fulks, Ole	Honeybees (Big Island Beekeepers Assn)	
Gines, Leonard	Orchid (Gines' Orchids)	
Gonsalves, Dennis	ARS, PBARC	
Greenwell, Tom	Coffee (Greenwell Farms)	
Ha, Richard	Banana (Hamakua Springs Country Farms)	
Hammond, Andrew	ARS, PWA	
Hara, Arnold	UH Manoa	
Harrington, Vernon	APHIS, PPQ	
Hashimoto, Andrew	UH Manoa	
Hayashi, Calvin	Anthurium	
Hollingsworth, Robert	ARS, PBARC	
Hopkins, Kevin	UH Hilo	
Hu, C. Y.	UH Manoa	
Inouye, Grayson	Anthurium	

Jang, Eric	ARS, PBARC
Johnson, Richard	Tropical Fruit (HI Tropical Fruit Growers)
Johnson, Tracy	Forest Service
Kamiya, Kenneth	Papaya (HI Papaya Assn)
Keith, Lisa	ARS, PBARC
Kliks, Michael	Honeybees (Bee Keepers Assn)
Kretsch, Molly	ARS, PWA
Kuhn, Dan	Coffee (HI Coffee Growers Assn)
Leonard, David	Imperium Renewables
Maluafiti, Alicia	Crop Improvement Assn, Hawaii (HCIA)
Mangan, Robert	ARS, SPA
Matsuda, Melvin	Papaya (Kahuku Farms)
Matsumoto Brower, Tracie	ARS, PBARC
McCombs, Sue	APHIS, PPQ,
McInnis, Donald	ARS, PBARC
McQuate, Grant	ARS, PBARC
Miranda, Pepe	Kona Coffee Council
Miyasaka, Susan	UH Manoa
Nakahata, Mae	Sugarcane
Nellis, Daniel X.	Pineapple (Dole)
Nishijima, Wayne	UH Manoa
Numbers, Bob	Hawaii Biodiesel Consortium
Oda, Calvin	Pineapple growers Assn
Ostrowski, Anthony. C.	Aquaculture (Oceanic Institute)
Robinson, Robin (Mr.)	Sugarcane
Rouse, Gus	Honeybees (Kona

	Queen Hawaii)	
Schneider, Sally	ARS, NPS	
Schnell, Ray	ARS, SHRS	
Simmons, Peter	Kamehameha Schools Bishop Estate	
Steiner, William	UH Hilo	
Strickman, Daniel	ARS, NPS	
Takemoto, Alan	Hawaii Farm Bureau Federation	
Tanouye, Eric	Florists & Shippers Assn (Hawaii Growers and Shippers)	
Tanouye, Harold	Nursery (Tropical Floral Products)	
Vargas, Roger	ARS, PBARC	
Wall, Marisa	ARS, PBARC	
Weinert, Eric	Tropical Fruit (Plant It Hawaii)/Hula Brothers	
Wong, Lyle	Hawaii Dept. of Agriculture	
Zee, Francis	ARS, PBARC	

Appendix 3: Breakout Sessions 1 & 2

Breakout Session #1 – "Raw" Reports from the Breakout Groups

Q1: What crop and cropping systems are the future of agriculture in Hawaii and the Pacific Basin?

Red Group:
Anthuriums (cut flowers, potted plants), foliage plants and tissue culture
Other floricultural crops to support tourist industry
Niche market specialty crops and Hawaii branding

- Cacao
- Vanilla
- Tea

Sugarcane – traditional and ethanol (biofuels)
Seed crops – genetically engineered
Pineapple
Coffee
Tropical fruits and nuts
Vegetables –import replacement
Taro
Land and marine based bioenergy feedstocks
Livestock feed crops
Agroforestry
Mechanizing crops from developing countries
Waste re-utilization for fertilizer

Green group:
Look at the economic stats. Diversified agriculture. Feedstock crops for biofuels (oil seed, sugar cellulosic); floriculture/ornamentals; coffee; diversified food crops (fruits, vegetables, nuts); seed crops; livestock/animal feeds; aquaculture; livestock (dairy, poultry, meat) adopted to tropics; forestry products.

Cropping systems; Integrated, mono-biofuels; diversified-food; greenhouse, hydroponics, intercropping; controlled environment, permaculture

Blue group:
Koa
Agri-Forestry
sugar
Silviculture (slow growing, high value trees)
Pineapple
Native trees for reforestration
Seed crops

Vanilla
Diversified agriculture
Papaya
Landscape ornamentals
Food crops, self-sufficiency, food security
Consumer/restaurant fruits and veggies
Exotic table fruit
Orchids/nursery plants
New high value crops/leading edge
Seafood
Nutraceuticals
Biofuel and co-products (feed for fish, algae, grasses)
Coffee
Animal feed (locally avail ingredients)
Brood animals
Grass-fed terrestrial animals
High value-niche market for local and export
Bees and honey (Queens & Pollinators)
Hawaii-branded products – Seal of Quality

Broad Categories for the above list would be

- Import replacement
- Local use and local self-sufficiency
- Export
- Tourist-oriented Hawaii-branded
- Preserve open spaces and restore forests
- Create Ag jobs

Purple Group:
This information was included in their Breakout Session Q2 report below.

Q2: What are the key constraints to future agricultural sustainability, productivity and profitability from a National perspective?

Red group:
Energy and transportation (shipping materials to and from the market)
Workforce shortages
Varietal development (i.e. breeding, propagation, marketing)
Low cost imports
Pests and diseases
Cost of inputs (i.e. fertilizer)
Climate changes (i.e. salinity, temperature fluctuations)
Cost/availability of irrigation
Hidden cost of regulations
Unfair competition on the global market

Non Governmental Organization (NGO) scrutiny of environmental practices (i.e. GMO)
Loss of agricultural land (i.e. urban sprawl)
Competing uses for prime agricultural land (i.e. between crops)
Political environment: Farm Bill continues to provide subsidies to large corporate farms
Training for the future: reduced interest in agricultural education (i.e. Fewer students attracted to agriculture)
Added costs of food safety requirements

Green group:
New diseases and pests (increasing exposure to invasive species); water availability; pollinators (bees) – varroa mites; input costs of production; rate of innovation (new products, varieties); new sources of finance; capacity of PBARC to address critical needs (proactive) (scientists and facilities); tools to export local products (postharvest quarantine treatments); political will

Blue group:
Volcanic soils
Water
Isolation
Invasive pests, diseases and weeds
Climate-microclimate
Land availability for agriculture
IAL - Important Ag Land (preservation)
Lack of leadership (all levels)
Labor
Lack of Entrepreneurs (esp. w/cash)
Rising costs of inputs
Foreign Competition
Economies of scale not available
Transportation costs
Urban encroachment
Aging of agriculture workforce
Activism against technology
Lack of educ. & training for mid- to high-level agriculture positions
Not enough R&D (knowledge base) – basic and applied
Regulatory issues –small crops
Climate change – sea level rise

Purple Group:
No input provided.

Q3: What are the current and future regulatory research needs for APHIS and other action agencies that PBARC could address?

Red group:
Pollination studies to ensure no GMO contamination of non-GMO plants
Commodity treatments
Fruit flies and others (i.e. LBAM, pathogens and weeds) -survey tools and alternative control strategies
SIT (sterile insect technique) development (i.e. diets, strain development, QC)
Development of diagnostics and systematics
Ecology of fruit flies and other invasives (insects, pathogens and weeds)
Varroa mite studies
Palm pest complex – (detection and controls including biocontrol)
Invasive snails and slugs – control
Data for pathway analysis (i.e. airlines)
Food safety issues (i.e. develop diagnostic techniques)
Data development to prioritize or list invasive plants
Improve inspection technologies

Green group:
Quarantine data requirements for import and export; supplemental data for pest risk assessment; database of potential pests for crops currently grown in Hawaii

Detection technology (insect and plant pathogens); population control technology (insects and plant pathogens); risk litigation (high risk pathways); quality assurance (i.e. mass rearing for sterile release of fruit flies); functional genomics; availability of commodity treatments; survey and control technology; pests of palms; varroa mites; invasive snails

Food safety; tracking systems; compliance research; cost-effective regulation; improvement in quarantine inspection efficiency

Blue group:
Biology, detection, control, and eradication of exotic pests, weeds, disease, nemas (PBARC a leader in this per APHIS and CDFA)
Approval of drugs for animal diseases (FDA) (aquaculture)
Diversified sustainable Ag in Hawaii to reduce probability of import/export of exotic pests
Unique location for research of some exotic pests
Study native to better understand exotics
Determine basic biology and ecology of native, threatened, endangered organisms
Forestry & agriculture – common interests
Ag & conservation groups work together
Risk assessment for prevention of arrival of exotic pests
Continued development of new quarantine treatments
Permits to collect seeds of native plants for reforestation & development of new commercial landscape products

Pool of scientific expertise – don't let it shrink – imp for mainland
Economic impact of regulatory decisions
Rapid response team for incipient population before exotics become established
Enhance collaborative arrangements in socio-economic research that affects agriculture sustainability (i.e. banning of GMOs is a sociological issue)
Economic analysis – rapid assessment capability

Purple Group:
This group included their response to this question in Q4.

Q4: Taking these factors into account, along with the ARS National Programs as a backdrop, what are the future research needs that PBARC is uniquely positioned to address?

Red group:
Development of commodity treatments
Research land and marine bioenergy crops and value added products for Hawaii
Crop improvement and cropping systems for ornamentals, tropical fruits and other tropical and subtropical crops
Economic and environmental analysis for all crops
Survey, detection and management of invasive species (insects, pathogens and weeds)
Add sugarcane germplasm to PBARC, increase sugarcane collaboration within ARS, commercial and world collections
Nematology – i.e. restrictions for exporting potted plants and bedding plants (i.e. detection, inspection, control)
Fruit fly research – production, export and eradication
Development of disease resistant non-native Hawaiian taro
Development and research in GE crops
Develop tissue culture techniques for specialty crops
Evaluation of new crops and value added products (production, quality, economics etc.)

Green group:
Conduct pioneering research to reduce the cost of production; model for self-sufficient, sustainable agricultural system (cropping systems research, i.e. permaculture); powdery mildew control of papaya – add resistance to Rainbow; flower manipulation in coffee affecting ease of harvesting, coffee breeding program; develop and apply advanced genetic technology to tropical/subtropical crops unique to Hawaii (i.e. disease resistance, color, fragrance); alternative crops for the future; cultivar breeding; alternative pollination systems; sugarcane and coffee germplasm preservation and maintenance; detection and validation of detection systems for plant pathogens unique to the Pacific Basin; soil quality; research to treat coffee processing waste water; waste streams; develop control strategies for insect pests found in Hawaii and not on the mainland (fruit flies, LBAM)

Blue group:
Research for biology, detection, eradication, and control of invasive pests – vertical integration at PBARC and Weslaco
Genetics and genomics for plants, feedstocks and animals
GMOs - animals, feedstocks, plants, algae & all other organisms
Eradication of pests, diseases
Induce flowering for key time slots - coffee, papaya, ornamentals (esp. orchids, protea)
Development of disease-resistant plants
Control color of flowering plants
Leadership and collaboration in development and upkeep of decision-support systems that focus on multiple bottom-line goals to be used to assess response to possible crises & apparent ag opportunities
Quarantine treatments and procedures for import and export--inter-island, interstate and international
Landscape-scale understanding of impacts and interactions of ag on the ecosystems
ARS at national level is a leader in biocontrol, but PBARC is not a leader in HI in biocontrol so PBARC could draw on nat'l infrastructure & become a major player

PBARC is big part of the foundation of agriculture research in Hawaii and other Pacific Basin countries – other research programs (commodity, university, etc) build on PBARC
Can do research year-round in aquaculture to serve as basis for other work (nutrition requirements, feedstocks, feed milling, biofuels) in part due to unique climate & species
Cultivation and distribution of endemic plants for reforestration & for landscape – carbon sequestration as an income source
International cooperation with other Pacific Rim countries for pest control and new crop development

History and culture of a native agrarian culture: -PBARC can be positioned to be relevant to Hawaiian culture
What would it take for HI to be self-sustainable?
Tropical/sub-tropical germplasm suitable for HI
Demonstration trials to increase awareness of PBARC – collaborate with farm community
Farming & Production systems that use less water – water re-use
Global warming – changes in farming practices

Purple Group:
PBARC needs to focus more on getting technology transferred through partnerships (note that AWP did an excellent job of transferring technology).

Continue to develop papaya in response to new threats;
Need to focus on opportunity-based agricultural systems;

Research on perishability and shelf life is essential (allows produce to look better longer). This applies to anything coming from HI going to the Mainland (includes packaging).

Emphasis on quality for marketing;

Help with pesticide registrations for coffee. Coffee has practically no registrations.

Nematacide for coffee rootstock

Maintain and expand germplasm collection in collaboration with HARC.

Research on flower synchronization in coffee. Critical for mechanical harvesting,

Use of fermentation water from coffee,

Nematode management for flowers;

Protection of the last varroa-free area in US; *area wide suppression of varroa mite*.

Need research on farm-scale biofuel production (preferably biodiesel) – usable by small groups of farmers (economical)

GMO energy-producing algae;

Introducing farm waste into aquaculture, with output being fertilizer production for on-farm use (economical sources of fertilizer).

Economical sources of fertilizer;

Survey of pests and pathogens to provide better control of potential adverse introductions (to support quarantine into Hawaii); stricter guidelines.

Breakout Session #2 – "Raw" Reports from Breakout Groups

Q1: Are there additional research needs that should be added to the questions addressed in Session #1? Additions were incorporated into the Question #2 prioritizations below.

Q2: Prioritize the identified research needs into utmost importance, very important, and important taking into consideration PBARC's unique strengths. [Group consensus sought.]

Priority: Utmost importance

Red group:
Develop commodity treatments/protocols (Zero tolerance for regulated pests and diseases)

Crop improvement (i.e. traditional breeding and GE) and develop best management practices for ornamentals, tropical fruits and other tropical and subtropical crops

- Taking into account economic and environmental analysis for all crops
- Crops – papaya, coffee, anthurium, pineapple, sugarcane, tropical fruits

Fruit fly research – production of fruit flies, exporting commodities and fruit fly eradication

Green group:
Hawaii as a global model for sustainable tropical cropping systems

- Develop and apply advanced genetic technology to tropical/subtropical crops unique to Hawaii
- Establish framework for collaborative research and technology transfer
- Decrease cost of production
- Diversification, alternative crops, pollinators, soil quality
- HI traditional agricultural practices

Develop tools to address anticipated threats to HI and Pacific Basin agriculture and environment

- Biofuel
- Germplasm
- Genetic resources

Blue group:
Pest prevention
- Biology, detection, eradication, and control of invasive pests
- Quarantine treatments and procedures
- Eradication of pests & diseases
- Biocontrol

Gene bank
- Ornamentals
- Tropical & native traditional crops (seaweed, taro, noni)
- Native medicinal plants

New plant varieties
- genetics and genomics for plants, feedstocks, animals
- Science for GMO permits and outreach
- GMOs for plants, animals, feedstocks, algae & all organisms
- Disease resistant plants
- New pineapple gold varieties w/resistance to natural flowering, internal browning, nematodes

Development and delivery of animal feeds
- Aquaculture feed milling
- Nutritional requirements
- Feedstocks
- biofuels

Purple group:
Biodiesel on-farm production; GMO algae for oil
Renewable energy production from agricultural products
Fertilizer: utilization, local sources

Priority: Very important

Red group:
Develop or improve survey, detection and inspection methods of invasive species.
- Fruit fly complex, viruses, nematodes and other pests associated with crop improvement and management practices (listed in utmost importance)

Add sugarcane germplasm to PBARC, increase sugarcane collaboration within ARS, commercial and world collections

Nematology – restrictions for exporting potted plants and growing bedding plants (i.e. detection, inspection, control)
- Ornamentals, pineapple, coffee, ginger

---------- Issues below this line were considered of lower importance by the Red Group within the "Very Important" category.

Research land and marine bioenergy crop, biomass and value added products for Hawaii

Identify and evaluate new crop germplasm and value added products

Volcanic effects on crops

Green group:
Rapid response ability/capacity
Proactive approach to biology, detection, eradication and control of invasive pests
Research to develop tools to address threats (anticipated)
Detection, control of pests and pathogen
Disease resistance/stress tolerance (genetics)
Biofuel; germplasm; genetic resources
Research to support regulatory actions
    Biotech risk assessment
    Commodity treatment
    Food safety

Blue group:
Propagation and cultivation of endemic plants
    - Re-forestation
    - Carbon sequestration
Genetics, physiology and control of flowering
    - Coffee, papaya, orchids, protea

Purple group:
Island-wide surveys of pests and pathogens to support quarantine restrictions and as a sentinel

Coffee
#1 – coffee flower synchronization
#2 – continue ongoing breeding program
#3 – expanding and maintenance of germplasm (currently 4 acres at HARC)
#4 – evaluation of nematode resistance (collaborate with HARC)
#5 – new pesticide resistance assistance
#6 – process of reuse of wastewater

Ornamentals
#1 - Crop improvement through research, including GMO, addition of value to diversified agriculture
#2- Research on nematode management (applies broadly to all crops); Need nematologist

Bees
#1 – Protection of varroa-free areas
#2 – Areawide varroa control on Oahu
#3 – Expansion of queen breeding industry (a national interest)

Sugarcane
#1 - Breeding for pest resistance in collaboration with HARC
#2 – Develop one year canes for mechanical harvest and high fiber for biofuels in collaboration with HARC

Exotic Tropical Fruits
#1 – Improve packaging and product quality to extend shelf life, improve quality, enhance shipping characteristics
#2 - Develop optimal field strategies for maximum yield of quality product (e.g., top four = rambutan, longan, starfruit, & lychee)

Papaya
#1 – Development of new breeds to keep up with new needs, threats (virus, fungus, insects)
#2 – Pursue solutions to regulatory obstacles to export (GMO, pre-harvest pest control)

Aquaculture
#1 – Develop system to generate fertilizer from aquaculture system
#2 – Develop plant-based byproduct as feed

Local Sources of Food
#1 – Improvement of tropical food crops for disease and pest resistance

Priority: Important

Red group:
Development of disease and pest resistance for non-native Hawaiian taro

Blue group:
Interaction of agriculture on the ecosystem – especially water

- Landscape scale
- Farming & production systems that use less water
- Water re-use
- Global warming

Traditional agricultural and aquaculture systems and methods

Note: There were no "Important" priority issues submitted by the Purple and Green groups.

Q3: Develop a proposed vision statement for PBARC capturing the above research priorities.

Red Group: Scientific research leading to advances in food, agriculture and natural resource sustainability in the Pacific Basin"

Green Group: Sustaining a dynamic, tropical/subtropical agriculture in the Pacific Basin island ecosystems

Blue Group: PBARC shall be a leader in tropical/subtropical protection, conservation, development and delivery of tropical/sub-tropical agricultural research and products to achieve self-sufficiency, security, and sustainability with sensitivity to local cultures.

Purple Group: Growing Hawaii's Unique Agriculture into America's Future