### History of Seed Production and Breeding in Hawaii

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### **History of Breeding and Seed Program at UH**

- 1918, sweetpotato, head lettuce, Cheung
- WWII Victory Gardens
- 1940s- formal breeding work WA Frazier
  - **'Pearl Harbor' tomato 1945**
- 1940s- tomato, Hawaiian Wonder pole bean,
   'Line-5' Solo papaya, Tomatoes, 'Niihau',
   'Kauai', 'Oahu', 'Maui', 'Lanai', 'Molokai',
   'Hawaii'



### **History of Breeding and Seed Program at UH**

- 1950s, Anuenue lettuce, Onolena sweetpotato Anahu tomato, Puakea cauliflower, Manoa sugar pea (powdery mildew), N-tomato hybrids, Kulanui head lettuce,
  1960s- Awahia onion (pungent),
  - Healani tomato, sweet corn, soybean, Hawaii Long eggplant, Manoa Wonder pole beans,



### **History of Breeding and Seed Program at UH**

- 1961- tomato varieties with resistance to 8 diseases, Nematodes
- 1962- multiple disease resistance in sweet corn
- 1970s- Hawaiian Supersweet No. 9, sweet corn, Waimanalo Long eggplant, Poamoho pole bean
- Pele and Waimea potatoes (late blight)



### **UH Tomato: some Disease resistance traits**

- Root-knot nematode
- Tomato Spotted Wilt Virus
- Fusarium Wilt
- Stemphylium leaf spot
- Cladosporium, leaf mold
- Spider Mites
- Short internodes



### **People in the UH Breeding Program**

- Tex Frazier, corn, tomato, Oregon
- Jim Gilbert, tomato, cauliflower, cucumber soybeans, onions, pyramid disease resistance
- Jim Brewbaker, sweet corn, field corn
- Jack Tanaka, sweet potatoes
- Frederick Krauss, cover crops, Production
- Yukio Nakagawa, Veg Specialist
- Dick Hamilton, Fruits, explorer



### **Growers and Extension Agents: backbone of UH breeding programs**

- Eggplant- Nitta Eggplant, Mr. Nitta
- Green Onion- Koba (selection from Japan)
- Kay Choy, Hirayama, white rust resistant (from Molokai, selection)
- Basil Fusarium resistant (Hamasaki)
- Maui Sweet onions (Ted Hori, Shimabuku, variety selection, crop management)



### Seed Program at UH

- Initiated 1960 (Gilbert), Seed Distribution
   Program
- Funded by legislature 1969
- 7 hybrids, 16 vegetable varieties and Papaya
- Seed production on all islands; papaya on Kauai
- Need a Vegetable Breeder at UH
- Need a Seed Specialist



# **Seed Programs**

- Public, Government
- Private (narrow germplasm)

# Artisanal or Informal (*diverse germplasm*) Home-gardening Indigenous Community



# Decline of Public Breeding Programs

- decline over past 40-50 years
- Nationally and in Hawaii
- Land-grant universities shifted to produce 'products' that were more profitable, royalties, patents
- less classical breeders, more molecular biologists



# Alternative Breeding Programs

- Public breeding initiatives, participatory models
   eg Organic Seed Alliance & Cornell
- Plant breeding clubs
- Seed Saving Networks



### Hawaii Statewide Seed Assessment

### SurveyMonkey.com

### N= 128 responses



### Farm Size in Survey

Range= 0-250 Acres
Most farms= 1 Acre
Average size= 10 Acres
Larger farms= 250, 195, 75, 10-20



### **Environmental Conditions in Farm**

### **Frequency mentioned**

• Rainfall- 9,15, 30.. 100s, 125, up to 180"

- Elevation- sea level, range 200 to 1000s, and 1000-3000 ft
- Temperature minimums- 30s to low 80s
  - Temp. maximums- low 80s to mid 90s



#### **Breeding in Hawaii important for Food Security?**





#### **Experience Producing or Saving Seed?**



#### Years of Experience Saving Seed

- Range 1-50 yrs
- Average= 10 years
- median= 5 years
- Less than 3 years= 43%



#### Have You conducted crop improvement, breeding?









#### Seed Saving Skills?



### **Information Needs on Seed Saving?**

- Isolation distance (65%)
- Population size (77%)
- Seed maturity, harvest time (76%)
- Harvest guidelines (51%)
- Processing and storing (58%)
- Roguing guidelines (63%)



Interest on Public Seed Initiative? List of Top Activities

- Saving Seed, personal use
- Restoring seed of Heritage or traditional Hawaiian Crops
- Seed exchange programs
- Attending advanced Seed Saving Class
- Participating in Variety Trials
- Attending class on crop Improvement



## **Crops, success in Seed Production**

### **Frequency mentioned**

- No. 1. N= 46, beans, brassicas (kale), lettuce, Native, papaya, pumpkin, sweet corn, tomato
- No. 2. N= 45, arugula, basil, beans, cilantro, corn, ginger, herbs, cucurbits, papaya, tomato,
- No. 3. N= 54, basil, beans, dill, edible hibiscus, green onions, lilikoi, maile, potato, sesame, tobacco, flowers



### Crops, most difficult for Seed Production Frequency mentioned

- No. 1. N= 35, awa, basil beans, pepper, broccoli, onion, carrots, native, corn, cucurbits, lettuce, papaya, lettuce, ornamentals
  - Most mentioned overall: arugula, beets, broccoli, cabbage, carrot, chard, corn, kale, lettuce, onions, pepper, cucurbits









### **Goal of Variety Trials**

### •Expression of the plant due to genetics or to the environment

### ID varieties adapted to the land (replace inputs with well adapted varieties)



### **Experimental Design**

 Observational (non-replicated) trials: screen varieties, evaluate sources, check trueness to type

VS

- Replicated trials
  - (results are not due to environment alone)



### **Population Numbers** to assess genetic variability

- Corn 30
- Brassicas 30
- Carrots 50
- Radishes 50
- Tomatoes/pepper 10
- Squash, cucumbers 10
- Beans 30

(source: OSA Farm Variety manual)



### **Consistent Treatments**

- Growing seedlings
- Transplanting/planting
- Irrigation
- Cultivation
- Fertilization
- Pest management
- Harvesting



### **Trial Evaluation**

- Log sheet
- scoring (index) vs measuring
   Scoring may be more valuable
   and quicker-
- All on same date, scoring system
   Scale of 1-9

(1= least, 9= most desirable),



### **Collaborative Research Trials**

Hawaii Trial Network, on different islands to compare several microclimates and production niches; trial database with trial network to follow performance on different microclimates.

(Micaela Colley, HI Public Seed Conf. 2010)

- Lettuce
- Tomato



### **Tomato response to Nitrogen**

#### Heirloom vs New Hybrid varieties, response







### Leafies response to Phosphorus



#### **Import Replacement: Romaine Lettuce Variety Trials**

Seasons: Winter, Spring, Summer



Locations: Oahu, Molokai, Lanai

#### **Seed Source:**

Hazera, Johnny's, Nunhems, Orsetti, Rijk Zwaan, Seminis, Siegers, Syngenta, Western Pacific Seed



#### cv Lital (Hazera) (Spring, cooler months, light green foliage)



cv Concept (Johnny's) (Summer Poamoho)

#### cv Brave Heart (Seminis) (Molokai, Spring, cooler months)



Bamby (Johnny's) (baby, specialty, cooler?, Waimea)













