Growing Tropical Fruit & Nut Trees For The Homeowner

October 15, 2010

UH CTAHR Master Gardening Conference

KAUA'I • O'AHU • MAUI • LĀNA'I • MOLOKA'I • HAWAI'I

UNIVERSITY of HAWAI'I
MASTER GARDENER
College of Tropical Agriculture & Human Resources

Tropical Fruits and Nuts

- **Successful cultivation is strongly influenced by:**

  Variety (cultivar)

  - **Most trees are propagated vegetatively:**
    - **grafting, budding, airlayering, cuttings**
  - **Some trees propagated from seed:**
    - **papaya, coffee, mangosteen**

  Growing environment is important.

  Cultural practices can be important.

Propagation Methods

Rambutan bud grafting

Lychee airlayering

Macadamia grafting

Papaya seed germination

Importance of Pruning and Training Tropical Fruit Trees

- Manage tree size*
- Manage flowering and fruiting
- Facilitate Harvesting
- Manage disease and pests

Lychee: Australia


Jubilee

Macadamia

(*Macadamia integrifolia* = smooth shell macadamia)

- **All orchards consist of grafted trees on seedling rootstocks**
- **All cultivars (varieties) developed in Hawaii**
- **Trees begin bearing 4 years after planting**
- **Nuts drop to the ground when mature and are harvested by hand or mechanically**
- **Nuts are husked, dried and roasted for consumption & sale**




Farm and Forestry Production and Marketing Profile for Macadamia Nuts (Nagao, 2010)

http://www.agroforestry.net/scps/Macadamia_specialty_crop.pdf

Optimum Macadamia Growing Conditions in Hawaii

- **Deep, well-drained soil is best but orchards also found on rocky soil**

- **Rainfall: 60 inches (1524 mm)**
  drier in spring during flowering

- **Temperature: Average annual 69 F (20.6)**
  Average maximum 78 F (25.6 C)
  Vegetative flushing range 68-86 F (20-30 C)
  Average minimum 60 F (15.6C)
  Flowering range 59-64 F (15-18 C)

Propagation

- Grafting onto seedling rootstocks

Trees planted into field 8-12 months after grafting. (Varieties: 344, 508, 660, 294, 800, 741, 246)

Trees are pruned during first 3 years to produce a well-structured tree with good branching.

Relatively free of insect & disease problems.
Insect pests managed through biological control and frequent harvesting.

Harvested from the ground (4-5 week harvest intervals and husked within 24 hrs).

Home Processing of Macadamia Nuts

Husk and dry in-shell nuts on wire racks for 3-4 weeks.
Crack when kernels rattle in the shell.
Separate shells and dry kernels in food dehydrator.
2-3 days @100 F
4-5 days @ 125 F
2 days @ 140 F
*Roast @ 275 F for 20-30 min.

Cooperative Extension Service
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Fruits and Nuts
June 2002
F&N-6

Processing Macadamia Nuts at Home

Catherine G. Cavaletto, Department of Tropical Plant and Soil Sciences

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/F_N-6.pdf

Growing Lychee in Hawaii

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/F_N-2.pdf

Best Cultivar for HI: Kaimana

- Seedling of Hak Ip (1965)
- Matures June to July
- Spreading growth habit
- Flowers in about 4 years after planting
- High number of male flowers produced early in the season with higher proportion of female flowers later in the season

	Fruit Wt. (grams)	Fruit Diam. (mm)	Edible Pulp (%)	Abortive Seeds (%)	Soluble Solids (%)
	20 - 26	30 - 40	71 - 75	40	20 - 24

Additional Lychee Varieties for HI

Groff

Bosworth

Natural flowering of lychee, longan and rambutan in Hawaii can be inconsistent.

- **Environmental signals for induction of flowering are not consistent from one year to the next (growing environment is important for consistent production).**
- **Excessive vegetative growth restricts flowering and are affected by:**
  - **Growing location (soil, rainfall)**
  - **Fertilizer applications**
  - **Pruning**

Kaimana Lychee Yields (lbs/tree)

Location	*Tree Age*	*Mean*	*Range*
Panaewa 1	7	40	13 - 125
Panaewa 2	10	49	10 - 111
Kurtistown	5	33	6 - 73

25^{o} C = 77^{o} F

15^{o} C = 59^{o} F

Temp <15^{o}C
? Weeks (4-8)
Low Rainfall

Flowering

Vegetative Growth

Temp<25^{o}C
Low water
Low N

Floral Induction and Development

Temp 25-29^{o}C
High water

Harvest

Rest

Girdle

Temp >15^{o}C
High Rainfall

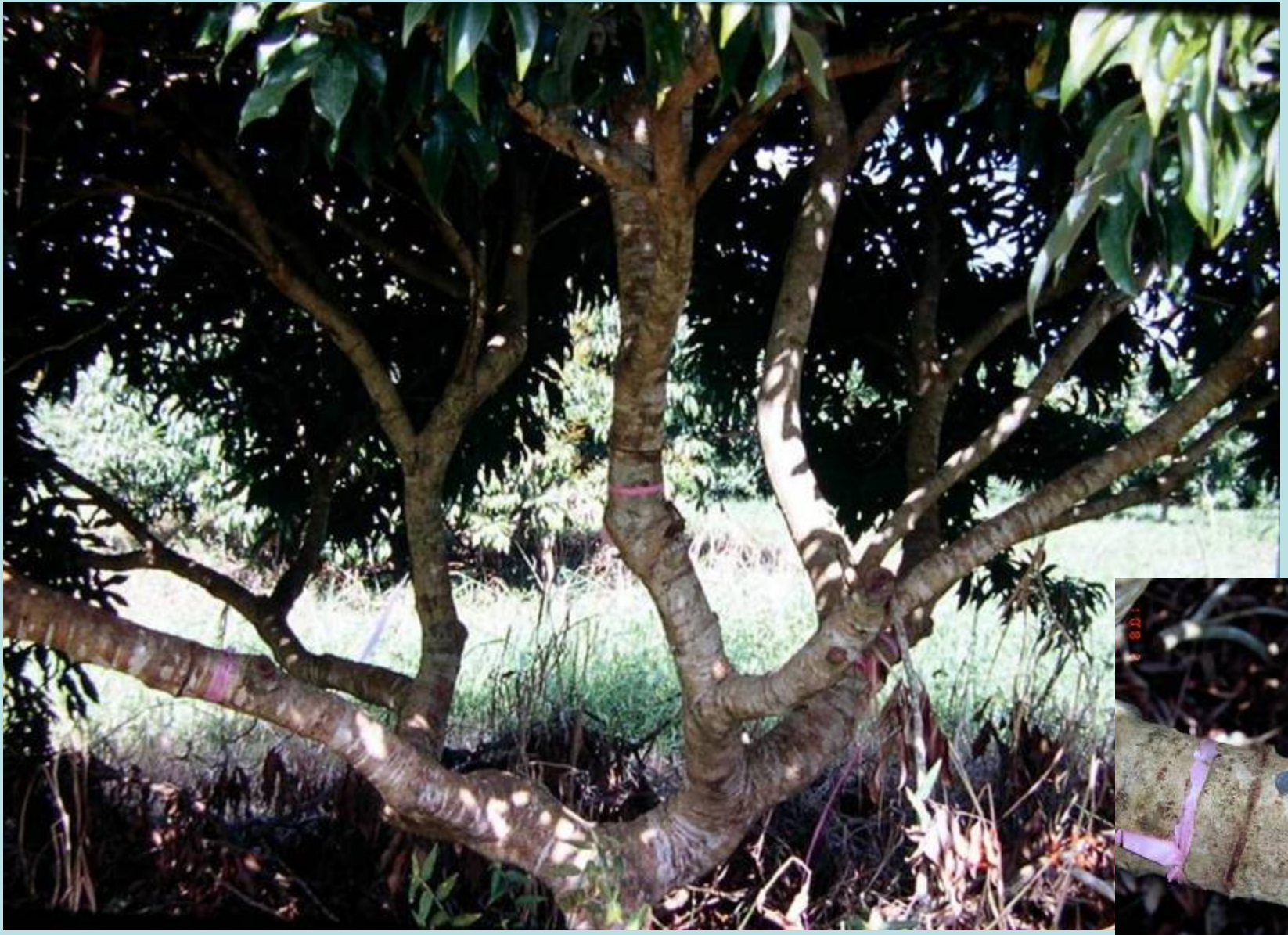
Prune, old
Panicle removal,
irrigate, fertilize

Weak Flowering
or
Vegetative growth

Crop Cycle
Kaimana Lychee in Hawaii

Pruning and (fertilization) after harvest are employed to stimulate uniform vegetative flushing

Do not over-fertilize at this time. (application of foliar fertilizer may be an option)



Girdling (cincturing) of branches

Effect of Winter Tip Pruning on Flowering of Kaimana Lychee

Panicles emerge from pruned shoot.

Problems Encountered

Erinose mites

Fruit fly

Birds

Lychee Growing Tips

'Kaimana' is the desired variety due to its consistent flowering under Hawaii growing conditions.

Concentrate fertilizer application during fruit development eg. 14-7-28+, 8-6-32+.

Prune soon after harvest.

Flowering occurs in response to low temperatures that coincide with maturation and regrowth of terminal shoots.

Dry weather enhances flowering but does not substitute for low temperatures.

Autumn girdling can enhance flowering.

Avoid applying high amount of nitrogen.

Avoid fertilizer application after September.

Keep historical information on yield (flowering) and fertilizer applications to estimate future fertilizer applications.

Longan Production in Hawaii

Cultivars Grown: Biew Kiew (commercial)
Chompoo, Egami (home garden)

Longan Flowering

- Factors involved in natural flowering similar to lychee, therefore, trees should be managed similarly.
- Egami tends to flower and produce more consistently for the homeowner.
- Flowering induced with soil application of potassium chlorate.
- Rates: 250 to 500 g/tree.
- Fruit thinning maybe necessary particularly with some varieties.
- Trees tend to be less responsive to subsequent applications.
- Sodium hypochlorite and calcium hypochlorite can induce some flowering.

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/NPH-5.pdf

Cooperative Extension Service
C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

New Plants for Hawaii
Sept. 2000
NPH-5

'Egami', a New Longan Cultivar from Hawaii

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'Egami' is a very productive cultivar of longan (*Dimocarpus longan* (Lour.) Steud.). It was selected at and can be pruned to maintain a low stature. Initially during flowering more male flowers are produced on the

Figure 1. The original 'Egami' longan tree at the Kona Research Station.

Figure 2. Fruits of 'Egami' longan.


Flowering Biew Kiew Trees


Fruit Thinning of Panicle

Control
Egami

Sodium Hypochlorite
Egami **Treated: 1/28/03**

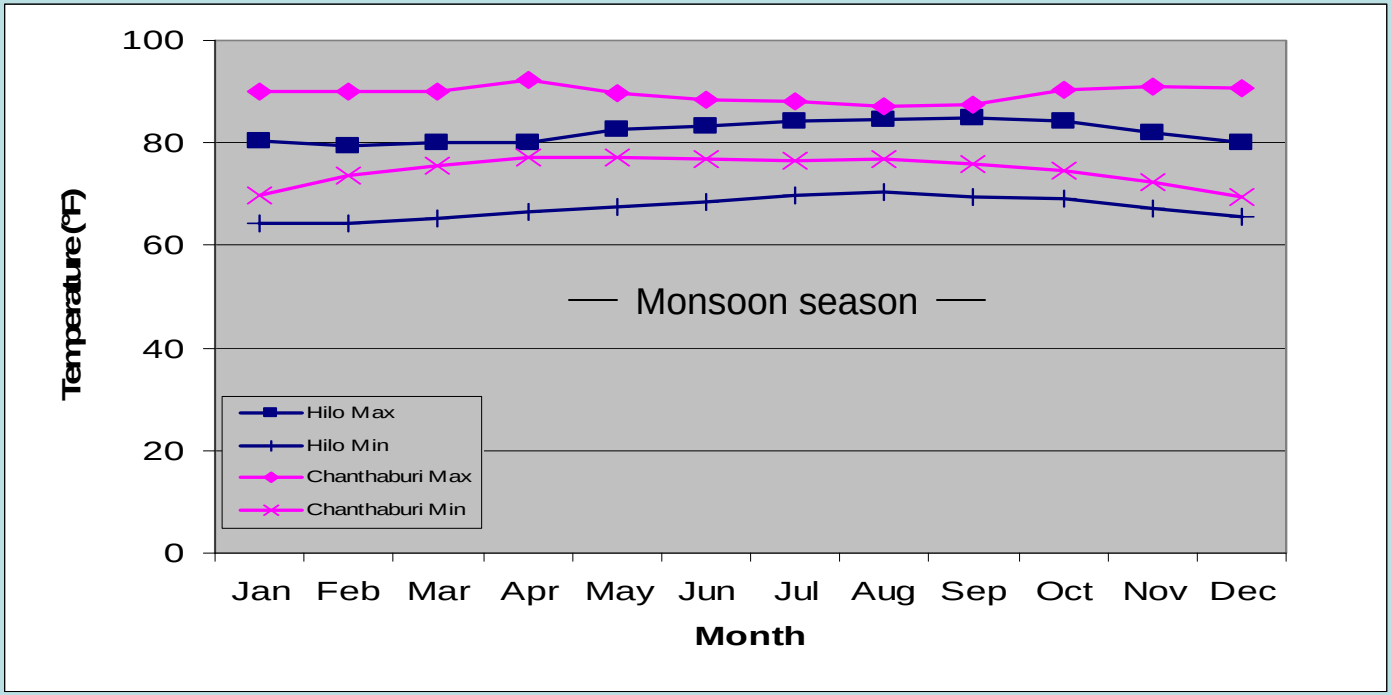
Rambutan Production in Hawaii

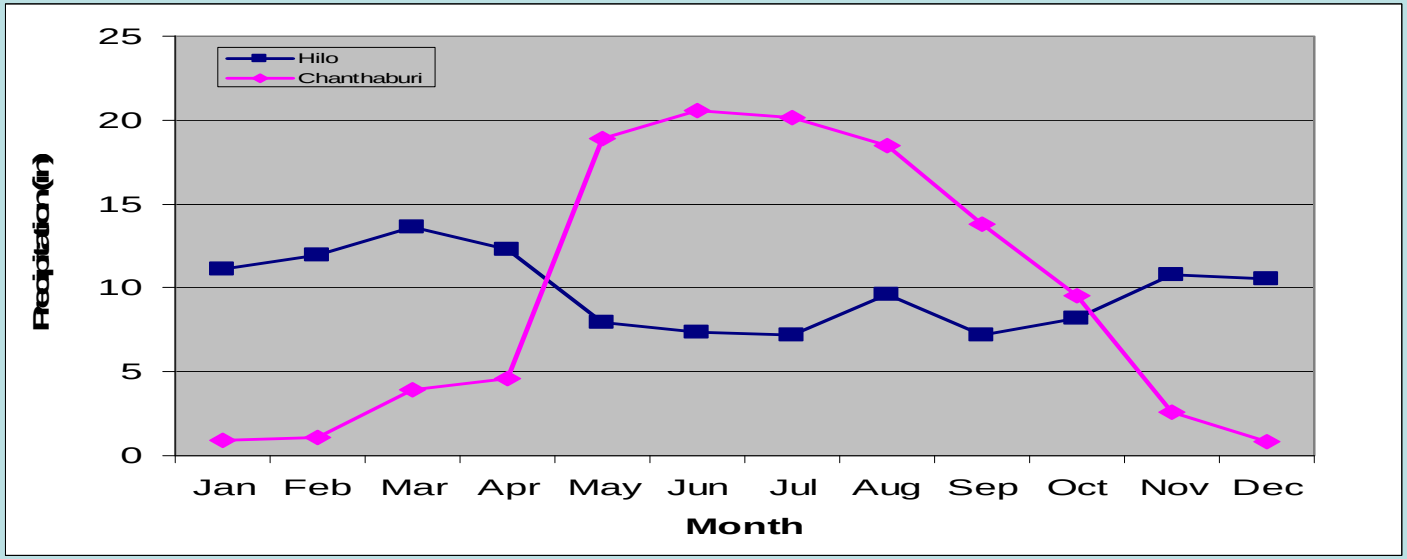
Cultivars Grown : Jitlee, Binjai, R9, R167, Silengkeng, R156, R134, R162

Rambutan Flowering in Hawai'i

- **Occurs in response to water stress**
- **Symptom = Leaf curling**
- **Main season (July to August)**
- **Minor season (April to May)**

Chanthaburi (Thailand) vs Hilo, HI





Flowering and Fruit Set of Rambutan In Hawaii

- **Lack of pollination results in development of deformed fruits.**
- **Cultivars planted in HI produce few male flowers for pollination.**
- **Strategies to enhance development of male flowers important for production.**

Deformed Fruit

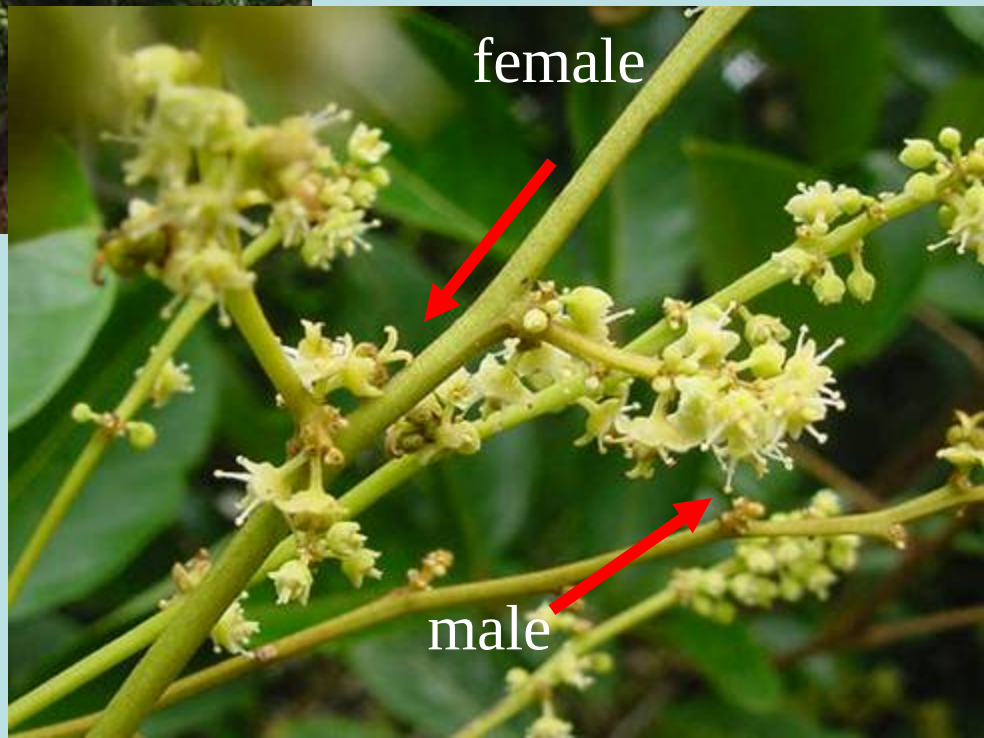
Flowering rambutan tree

Male (male tree)

Hermaphroditic female (majority of flowers)

Hermaphroditic male (very few present < 0.1%)

Silengkeng cultivar
(pollinator)
(Produces male & female flowers)



Citrus

- **How can I make my citrus fruits sweeter? Fertilizer???**
  - **Variety**
  - **Cultural practices**
  - **Environment**

Combined Effects of Ecological Factors on Citrus Fruit Qualities.

HUMID TROPICS Warm Nights, High Rainfall	High Sugar, High Juice Thin Peel, Poor Color, Fungal Blemishes ←	**ARID DESERT** Cool Nights Low Rainfall
	→ Brilliant Color, Minimal Surface Blemishes, Low Sugar, High acid, Thick Peel	

Soule, J and W. Grierson (1978). Citrus Maturity and Packinghouse Procedures. IFAS, University of Florida.

Propagation: Bud Grafting

Tangerine Orange	Cleopatra mandarin, Heen Naran, Rangpur lime, Citrus sunki
Grapefruit	Cleopatra mandarin, Heen Naran, Rangpur lime
Lime	Heen Naran
Pummelo	Heen Naran, airlayers

Additional Fruit Crops of Interest

Avocado

Propagation: Grafting; Plant grafted trees!

- Sharwil (B): winter – spring (green), 8-20 oz
- Greengold (A): winter – spring (green), 8-20 oz
- Kahaluu (B): fall – winter (green) 12-20 oz
- Malama (B): fall-winter (purple), 14-24 oz

(A) Day 1 am female, Day 2 pm male

(B) Day 1 pm female, Day 2 am male

Kahaluu

Greengold

Malama

Sharwil

Grafted avocado: multiple cultivars to extend harvesting season.

Cleft graft

Canopy Management

Develop strong framework

Manage tree size to facilitate easy harvesting

Pitaya (Pitahaya, Dragon Fruit) Crop Cycle in Hawaii

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Flowering
(Jul →mid Aug)

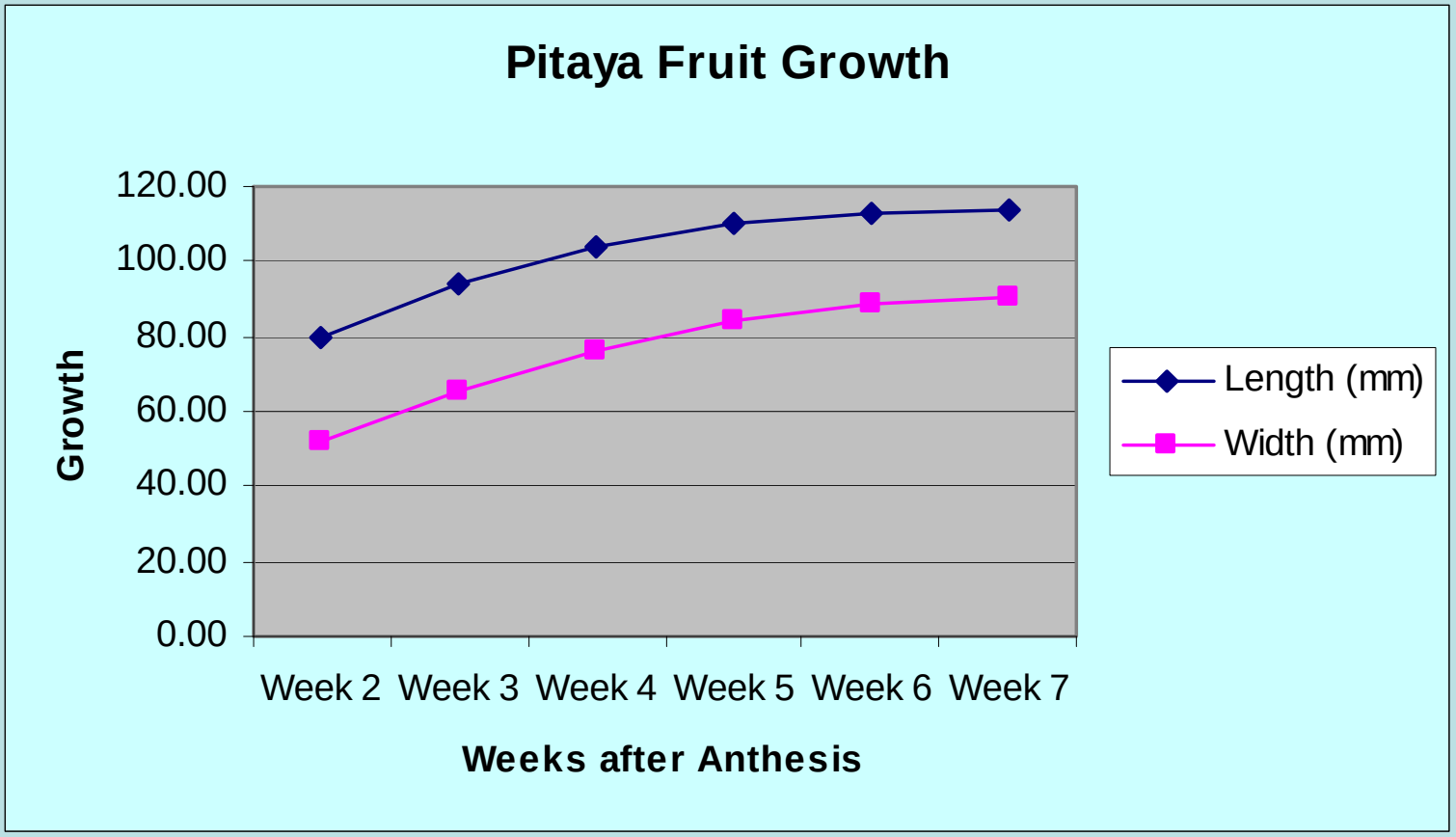
Fruit Development
(end July → mid Oct)

Pitaya: long-day-plant

Harvest
(end Aug→end Oct)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/F_N-9.pdf



16-30 fruits/tree
Avg. wt. 550 g

Production Constraints

Disease

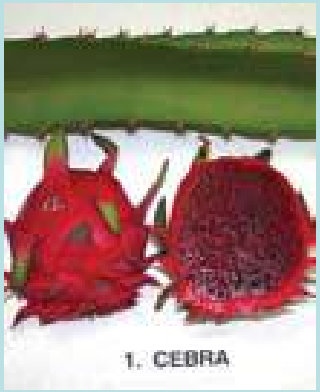
Strong Seasonality

Information on the performance of various clones under HI growing conditions.

Plant self-fertile clones.

Self-Fertile Clones

CEBRA



Nic

SEOUL KITCHEN

FL

VALDIVIA ROJA

Mex

SIN ESPINAS

Nic

PHYSICAL GRAFFITY

FL

Mango in Hawaii

Constraints to Mango Production

Insect and Disease Management

Consistent Flowering

Canopy Management

Mango anthracnose
(*Colletotrichum gloeosporiodes*)

Publications and Photos by
Scot C. Nelson, CTAHR Plant Pathologist

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-48.pdf

Mango Powdery Mildew

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-46.pdf

Insect & Disease Management

HAW-FLYPM
Hawaii Areawide Fruit Fly Pest Management Program
A Collaborative Project Between the UH CES, USDA ARS, and HDOA

http://www.extento.hawaii.edu/fruitfly

Flowering

Vegetative Flushing

Branch Age

Cool temp <59 F

(florigenic promoter)

2. Induction

Warm temp

(vegetative promoter)

1. Shoot Initiation

pruning, nitrate sprays, cool temp

Mango Cultivars Responding to Potassium Nitrate (4%)

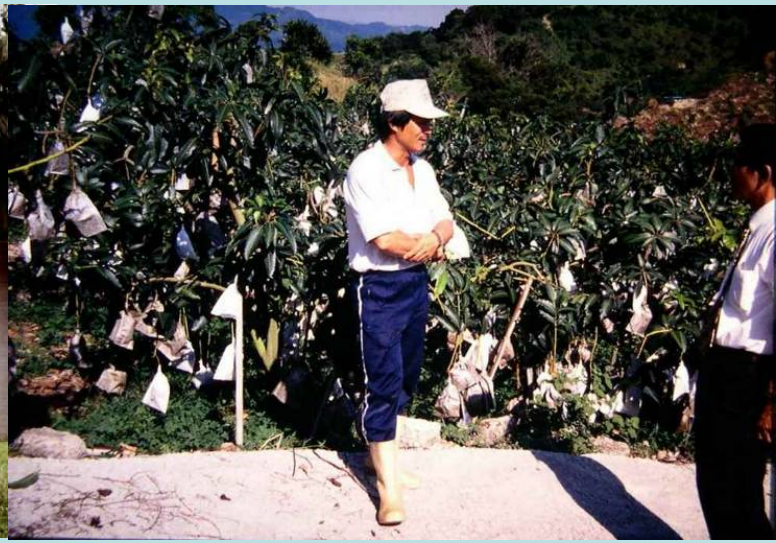
- Haden
- Momi K
- Ruby
- Joe Welch
- Keitt
- Excel
- Pope
- Manzanillo

Canopy Management

Rockhampton, Australia

South Florida

Taiwan



“Condo” Mangos

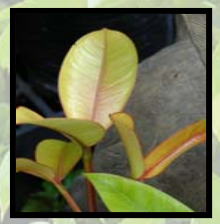
Cogshall
Fairchild
Neelum
Lancetilla
Mallika
Rosigold
Angie

Mangosteen In Hawaii

“Queen of Fruits”

Mangosteen Crop cycle
East Hawaii (2008-2010)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

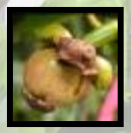


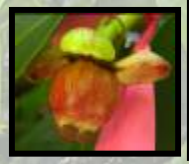
Flushing period #1
(mid June →mid Aug)

Flushing period #2
(mid Nov →late Dec)

Flowering period #1
(early Apr →late June)

Flowering period #2
(mid Aug →mid Sep)





Harvest period #2
(early Jan →mid Mar)

Harvest period #1
(early August →early Sep)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Production Constraints

Long juvenile period

Inconsistent flowering

Insect pest damage (mangosteen caterpillar)

Canopy area has a greater contribution to first flowering (precocity) than age.

First bearing = 50.3 m² (541.4 ft²) canopy surface area

Canopy--- Height = 14.5 – 15 ft
Diameter = 8.5 – 9 ft

Durian Crop Cycle in Hawaii

"King of Fruits"

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Fushing
(Jan)

Flushing
(Mar→May)

Flushing
(Aug → Sep)

Bud development
(beg Feb→April)

Bud Development #2
(June →Aug)

Flowering
(end Mar→April)

Flowering #2
(June →Sep)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Fruit Maturation

D 24: ~ 20 weeks

Ave. wt.: 4.9 lbs

Mon Thong: ~ 26 weeks

Ave. wt.: 14.7 lbs.

Production Constraints

- Inconsistent flowering

- Inconsistent fruit set; pollination problems.

- Varieties best for HI

Papaya

Propagation from Seeds

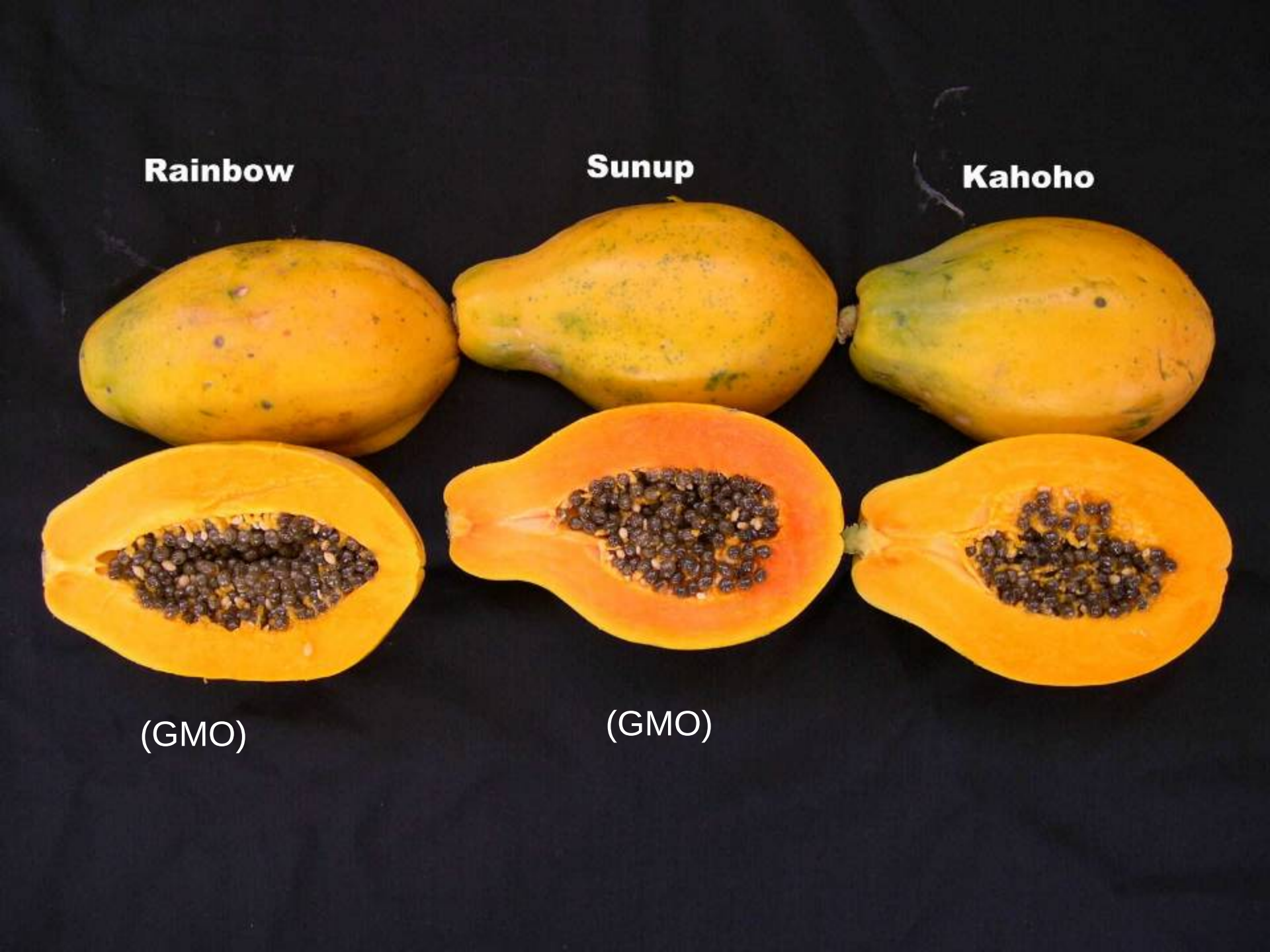
Female flowers

Hermaphroditic flowers

Fruits from female flowers

Male tree

Papaya ringspot virus disease


Rainbow
Sunup
Kahoho
(GMO)
(GMO)

Other Tropical Fruits

- Coffee
- Annonas

Banana

- Spice Crops
- Cacao

End