Cherimoya

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- Let's look at prices to the grower

Is this fruit worth talking about?

Market Prices at LA Wholesale market

- March, 2015 LA Wholesale Market
  - 35 lb cartons
  - 8s: $40-44
  - 10s: $40-44
  - 12s: $40-44
  - 14s: $40-44
  - Avg 10s about $1.20/ lb
  - Avg 10s about 3.5 lb
- January, 2015 LA Wholesale Market
  - 40 lb cartons
  - 8s: $50
  - 10s: $50
  - 12s: $50
  - 14s: $50
  - Avg 10s about $1.25/ lb
  - Avg 10s about 4 lb

Fruit size

- In California fruit ranges from ½ lb to 6 lbs/fruit depending on the amount of pollination

Local Prices

- Local farmer has been selling cherimoyas to local stores for $4/lb to $4.50/lb

- He supplies fruit in small quantities weekly
- Good quality
- He watches the display and replaces fruit that needs replacing

Cherimoya compared to Avocado

- At 30 lb/tree:
- At $4
- The gross income per tree is $120

- At 109 trees/acre
- Gross income is $13,080/acre

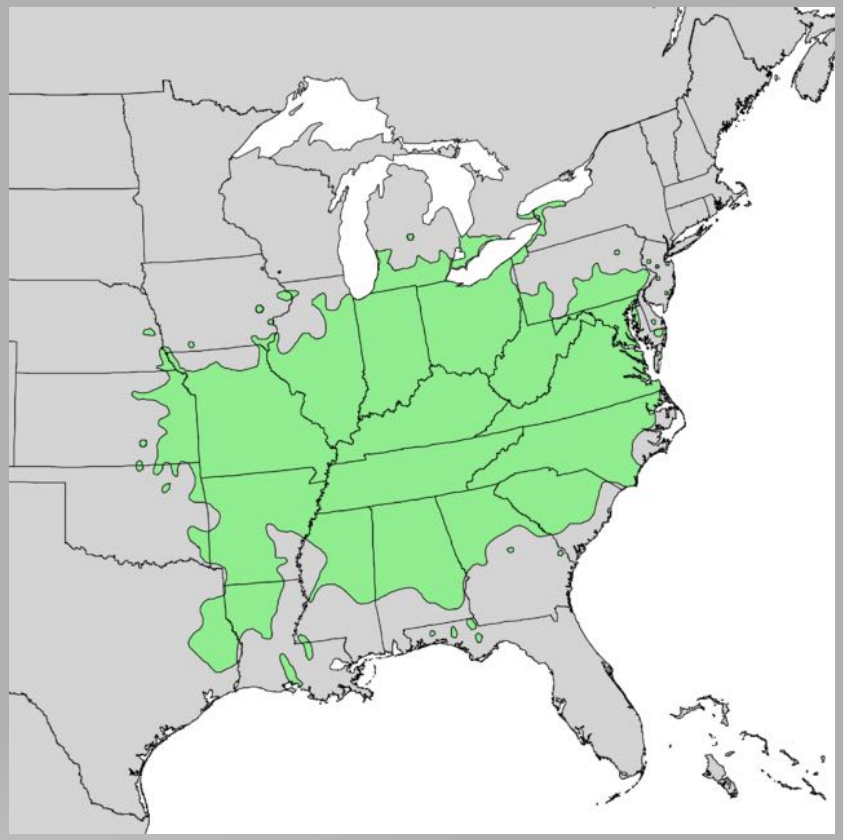
- **Avocado** at 70 lb/ tree
- At $1.00/lb

- At 109 trees/acre
- Gross income is $7600/acre

- Common names:
  - Cherimoya (U.S., Latin America)
  - Custard Apple (U.K. and Commonwealth)
  - Chirimoya
  - Chirimolla
- Related species:
  - Ilama (A. diversifolia)
  - Pond Apple (A. glabra)
  - Mountain Soursop (A. montana)
  - Bullock's Heart (A. reticulata)
  - Sugar Apple (A. squamosa)
  - Atemoya (A. cherimola x A squamosa)

Cherimoya: *Annona cherimola*
Family: Annonaceae

- Paw Paw (*Asimina trilobs*
- Largest fruit native to the U.S.



Also in the Annonaceae

Cherimoya

El Bumpo

- **Atemoya** created from cross made in 1908 at USDA lab in Miami
- Must be hand pollinated
- Female flowers open 2:00 to 4:00 pm
- Converts to male 3:00 -5:00 pm the next day

Atemoya (cross between Cherimoya and Sugar Apple)

Sugar Apple (*Annona squamose*)

- Mark Twain arrived in Hawaii in 1866 on assignment for the Sacramento Union newspaper

- He wrote “We had an abundance of fruit in Honolulu, of course. Oranges, pine-apples, bananas, strawberries, lemons, limes, mangoes, guavas, melons, and a rare and curious luxury called the cherimoya, which is deliciousness itself”.

What about Flavor?
Mark Twain liked it!

- “The cherimoya is regarded by many as being among the best of tropical fruits. The cherimoya has a texture of a soft, non-gritty pear and a delicate, highly appealing fruit flavor with little acidity. Cherimoyas usually are eaten fresh; however they are excellent in ice cream and sherbets”

From UCCE Ventura County

- “The seeds, leaves, and limbs contain poisonous alkaloids that have been used to kill lice.”
- Taken internally, these alkaloids act as an emetic and cathartic and should be regarded as poisonous.”

However, be careful!

History and origin

- **Origin:** The cherimoya is believed to be native to the inter-Andean valleys (4,600 ft to 8,500 ft elevation) of Ecuador, Colombia and Peru.
- Pottery is known from Peru from 1000 BC that are shaped like cherimoyas
- Spanish soldiers shipped seeds to Spain in 1757
- Seed were shipped to Hawaii in 1790

Adaptations

- **Temperature:** The cherimoya is subtropical or mild-temperate and will tolerate light frosts. Young growing tips are killed at 29° F and mature trees are killed or severely injured at 25° F.

- **Chilling:** If cherimoyas do not receive enough chilling, the trees will go dormant slowly and then experience delayed foliation. The amount of chilling needed is estimated to be between 50 and 100 hours.

- **Location:** The tree grows well in the coastal and foothill areas of southern California, doing best at a slight elevation, 3 to 15 miles from ocean.
- Most of the commercial industry is located in Santa Barbara, Ventura and San Diego counties

- It is worth attempting in sunny, south-facing, nearly frost-free locations from San Francisco Bay Area to Lompoc, and may survive to fruit in a very few protected Central Valley foothill locations from Chico to Arvin, although this is risky. Resentful of the excessive dry heat of the interior, it is not for the desert. Cherimoyas are not recommended for container culture.

Adaptations

- **Growth Habit:** The cherimoya is a fairly dense, fast-growing, evergreen tree, briefly deciduous in California from February through April. The tree can reach 30 feet or more, but is fairly easily restrained.

- Commercial growers keep them pruned low for ease of hand pollination

Description of growth habit

Cherimoya tree pruned vs un-pruned

Good Things about this Fruit

- It's the best tasting to fruit to come from South America
- And now it's the best tasting fruit grown in Southern California!
- We have a very large population that likes to buy it from farmer's markets

Potential Challenges for the Grower

- Hand Pollination
- Pruning
- Pests: mealybugs and ants
- Diseases: Armillaria (oak root fungus)
- Handling and storage

- Training the produce managers not to put this is a cold room at 34F

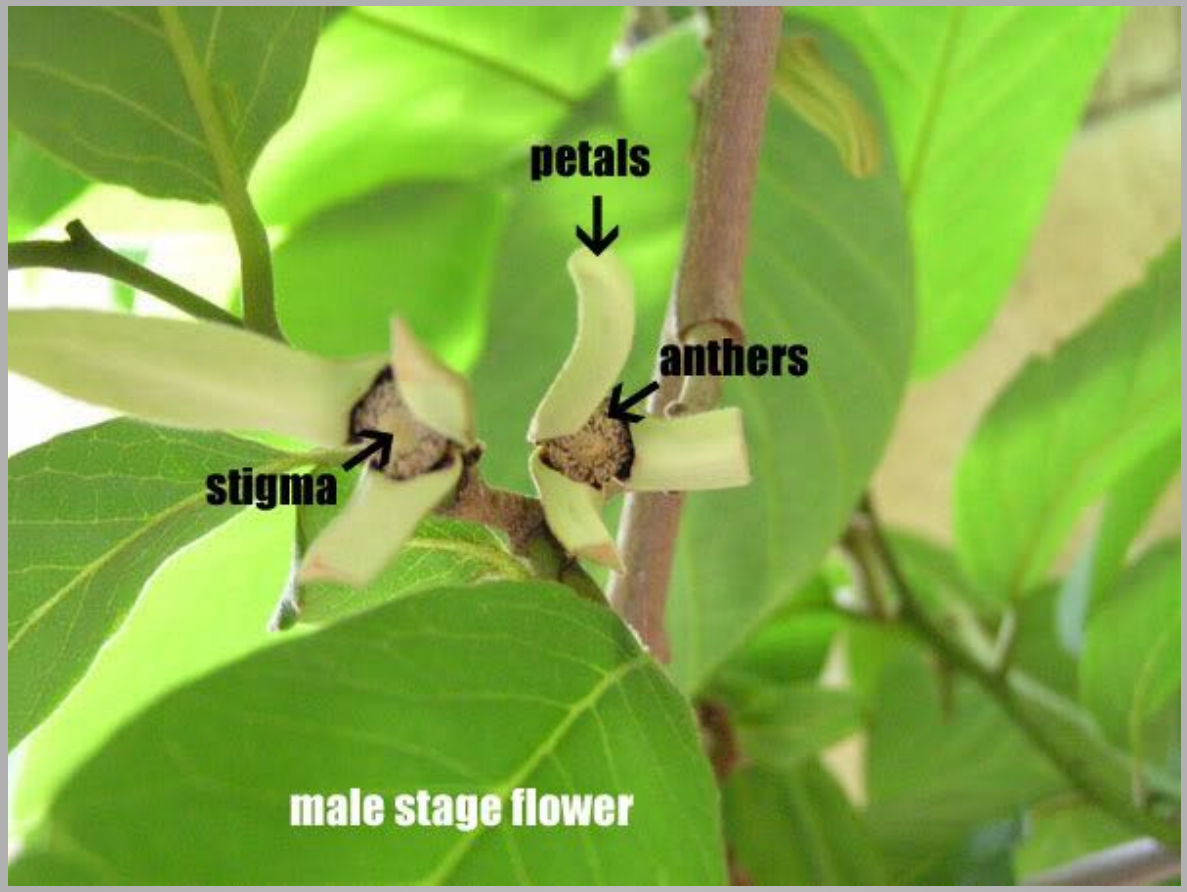
- **Flowers:** The fragrant flowers are borne solitary or in groups of 2 or 3 on short, hairy stalks along the branches. They appear with new growth flushes, continuing as new growth proceeds and on old wood until midsummer. The flowers are made up of three fleshy, greenish-brown, oblong, downy outer petals and three smaller, pinkish inner petals.

Description of flowers

- They are perfect but dichogamous, lasting approximately two days, and opening in two stages, first as female flowers for approximately 36 hours. and later as male flowers. The flower has a declining receptivity to pollen during the female stage and is unlikely to be pollinated by its own pollen in the male stage.

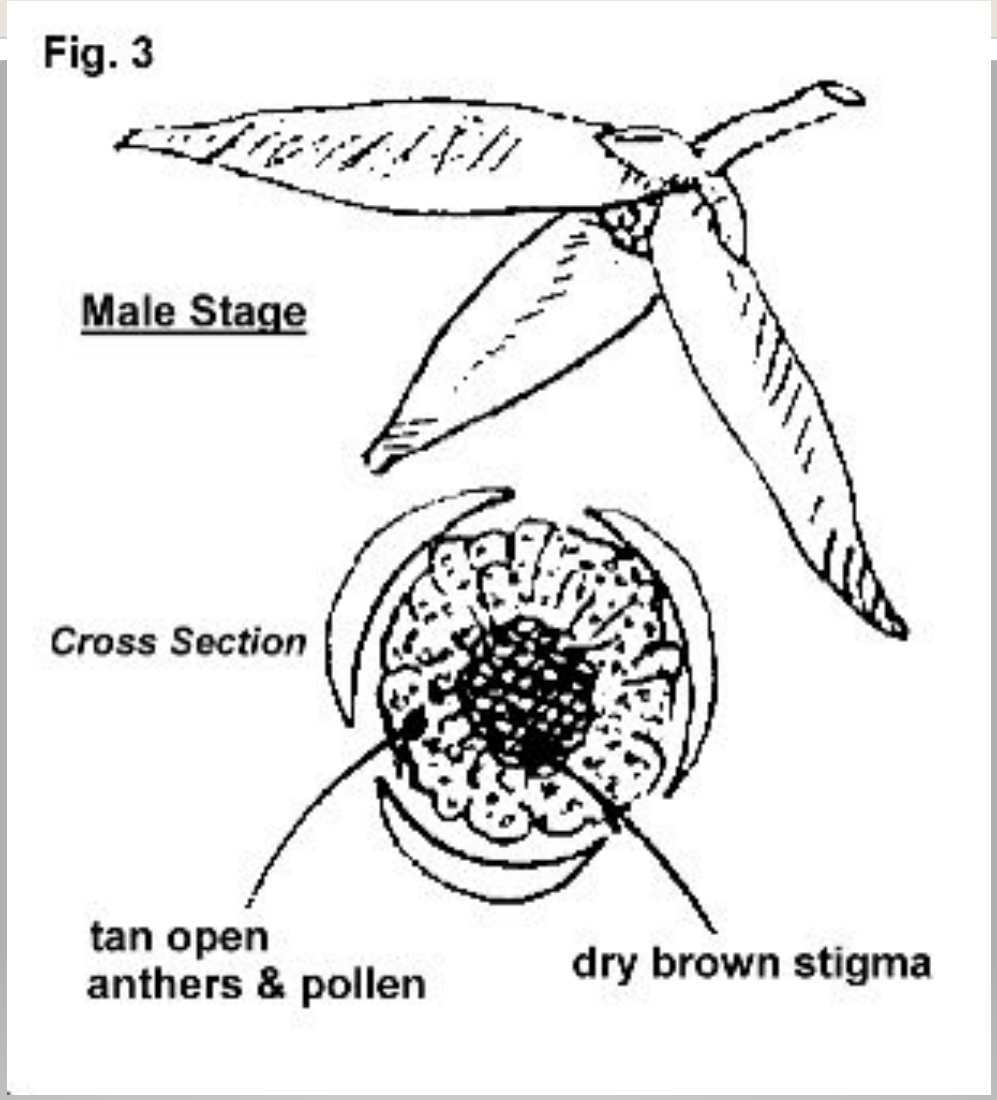
Flowers

Female Stage Flower



Male Stage Flower

Cherimoya pollen and anthers



Cherimoya male stage flower

Pollinating Gun

Pollinating into the female flower

Youtube videos

- http://www.youtube.com/watch?v=YTaBVR-YrQc
- http://www.youtube.com/watch?v=naW_jR7XpK8
- http://www.youtube.com/watch?v=zL3N5kf_Muc
- http://www.youtube.com/watch?v=1dLyJJxbEV8

- **Fruits:** The compound fruit is conical or somewhat heart-shaped, 4 to 8 inches long and up to 4 inches in width, weighing on the average **5-1/2 to 18 ounces**, but the largest fruits may reach **5 pounds in weight**. The skin, thin or thick, may be smooth with fingerprint-like markings or covered with conical or rounded protuberances.

- The sweet, juicy, white flesh is melting, subacid and very fragrant. The fruit is of a primitive form with spirally arranged carpels, resembling a raspberry. Each segment of flesh surrounds a single hard black bean-like seed. The fruit size is generally proportional to the number of seeds within. **They ripen October to May.**

Protrubences on peel

Smooth peel

Culture

- **Location:** Cherimoyas prefer a sunny exposure, buoyant marine air and cool nights. In southern California do not plant where heat collects on barren hillside or against a wall, since the leaves and fruit may sunburn badly. In the north, do the opposite: plant against a south facing wall to collect heat and encourage early bud-break and fruit ripening. The trees need protection from constant ocean or Santa Ana winds which may damage them and interfere with pollination and fruit set.

Culture

- **Soil:** The cherimoya performs well on a wide range of soil types from light to heavy, but seems to do best on a well-drained, medium soil of moderate fertility. The optimum pH ranges from 6.5 to 7.6

Culture - irrigation

- **Irrigation:** Cherimoyas need plenty of moisture while they are growing actively, but should not be watered when they are dormant. The trees are susceptible to root rot in soggy soils, especially in cool weather. Commence deep watering biweekly in April. Drip irrigation is also an excellent way to supply water. It is best to avoid poor water to prevent salt build-up. Drought-stressed trees will drop their leaves, exposing the fruit to sunburn

Culture - fertilization

- **Fertilization:** Cherimoyas should be fertilized on a regular basis. Apply a balanced fertilizer, such as 8-8-8 NPK, in midwinter, then every three months. Increase the amount of fertilizer each year until the trees begin to bear fruit. Mature trees require an annual application of 4 ounces of actual nitrogen per inch of trunk diameter. Cherimoyas also respond to organic amendments. It should be kept in mind that yellow leaves may mean that the soil too dry or the weather too cold, not always a need for fertilizer.

Culture - pruning

- **Pruning:** Cherimoyas have rather brittle wood. Prune during the dormant period to develop strong branches that can support the heavy fruit.
- Train the tree to two scaffold branches at 2 feet of trunk, pruning them to a 2 foot length. Save only the strongest single shoots, preferably those at 60 to 90 degree angle, and remove the others.
- In the following years, remove two-thirds of the previous year's growth, leaving six or seven good buds, at time of new growth. This will keep fruiting wood within reach of the ground. Thin out crossing branches.

Culture – frost protection

- **Frost Protection:** Young trees are very frost sensitive. Wrap the trunk and scaffold with sponge foam for protection, or cover the entire tree. In cooler areas plant next to a south-facing wall or under the eaves to trap house heat.

Culture - pollination

- **Pollination:** Since natural pollinators are not present in California, the flowers must be pollinated by hand. This is best done in mid-season of bloom, over a period of two to three months. In early evening, collect in a small bottle the anthers and pollen from the interior of fully open male flowers with a #2 or #3 artists brush. Anthers will be tan colored and the white pollen falling from them will be obvious. The pollen has its highest viability at the time it is shed and declines significantly with time. Immediately apply freshly collected pollen with a small brush to the flowers in partially open, female stage. If no female stage flowers are available, pollen may be saved in the sealed container under refrigeration overnight. Pollen may then be applied to female stage flowers in the morning.

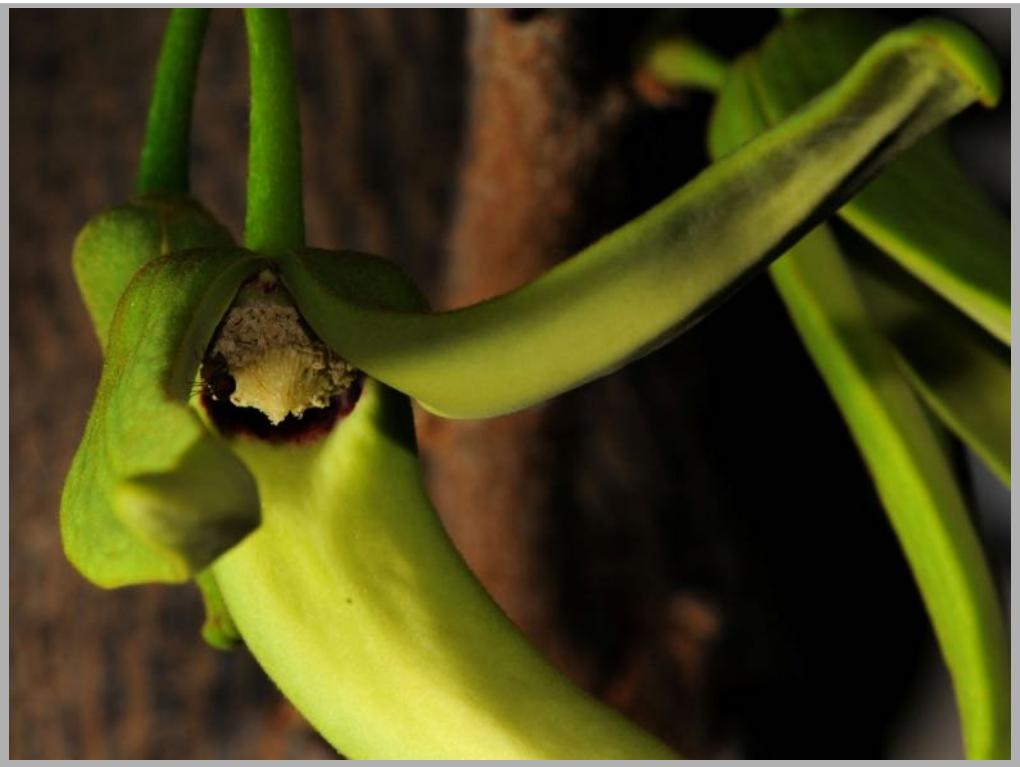
Culture - pollination

- **Pollination:** In large scale operations the pollen may be mixed with inert Lycopodium spores, PVC, starch or talc powder and applied with aspirator-type Japanese apple-pollinators, to save time and pollen. Pollinate every two or three days, and only flowers easily reached inside the tree, to avoid sunburned and wind-damaged fruit. If pollination efforts are quite successful, it may be necessary to thin the fruit. Too much fruit may result in small size and adversely effect future yields.

Culture - propagation

- **Propagation:** Since there are no recognized rootstocks for cherimoyas, seedlings are universally utilized. Seeds from the White cultivar (Dr. White) are thought by some to produce superior rootstocks, however there does not appear to be a great deal of objective data to support this position. Seeds remain viable for two to three years if kept dry and protected from weevil and fungi.

- With 70° F bottom heat, seed will germinate in about 21 days, but will require about 40 days under normal ambient growing conditions. Seedlings should be transplanted to deep containers (approximately 18") when they are 3" tall to promote development of the tap root. In frost-free areas, it is recommended that seedlings for spring grafting be planted in their ultimate location in the fall and grafted in the ground the following spring.



Natural Pollinators? Nitulid beetle or maybe trash beetles (*Staphilinidae*)

Culture - grafting

- Grafting is most successful in January through May provided previous years leaves have not been shed from the potential scionwood. During this period no scion preparation is required other than removal of leaves. All normal grafting techniques appear to be equally successful. However in topworking, nurse branches are desirable if not essential for success. To bud, collect budwood in July store refrigerated for 10 days in plastic. Petioles will drop exposing dormant buds. Bud at once using chip bud technique and wrap well against dehydration. Grafted plants will bear in two to three years

Pests and diseases

- **Pests and Diseases:** Mealybugs and snails are the main pests of cherimoyas. Keep ducks or apply copper strips to the trunks for control of snails. Mealybugs are brought by ants which can be controlled to some extent by maintaining fresh Tanglefoot on masking tape around the trunk. The masking tape is important to prevent damage to the tree. Skirt the tree to prevent ant access from the ground or weeds. No chemicals are registered for use on Cherimoyas.

Diseases

- Cherimoyas are susceptible to *Armillaria* (Oak Root Fungus) and *Verticillium*. Do not plant in old vegetable gardens, or near tomatoes, eggplant or asters. Crown rot can kill trees damaged by frost or growing in saturated soil, as well as from trunks hit by frequent, superficial lawn sprinkling

Harvest

- **Harvest:** The fruit turns a pale green or creamy yellow color as they reach maturity. Color change is not marked in cool weather. They should be picked when still firm and allowed to soften at room temperature.
- Ripe fruit will give to soft pressure. Overripe fruit will be dark brown. Fruit left on the tree too long will usually crack or split and begin to decay. The fruit should be clipped rather than pulled from the tree. Cut the stem close to the fruit so it won't puncture other fruit during storage.

Fruit storage

- Store mature fruit above 55° F to prevent chilling injury to the skin and flesh. Ripe fruit will deteriorate quickly but can be stored at temperatures lower than 55° F for short periods.
- Ripe cherimoyas can be frozen and eaten like ice cream. Cherimoyas are best served chilled, cut in half or quartered and eaten with a spoon. The fruit can also be juiced or used to make delicious sorbets or milkshakes.

- **Commercial Potential:** Though unusual in appearance, cherimoyas are readily accepted by western tastes and has become a favorite tropical fruit. Demand greatly exceeds supply in all U.S. markets as most fruit never leaves California, the only producing state.
- The fruit commands high wholesale and retail prices, but costs are high and major crop losses from frost and fruit splitting are an ever present possibility. The major labor costs are pruning, pollination, ant control and irrigation.

Potential

Cultivars

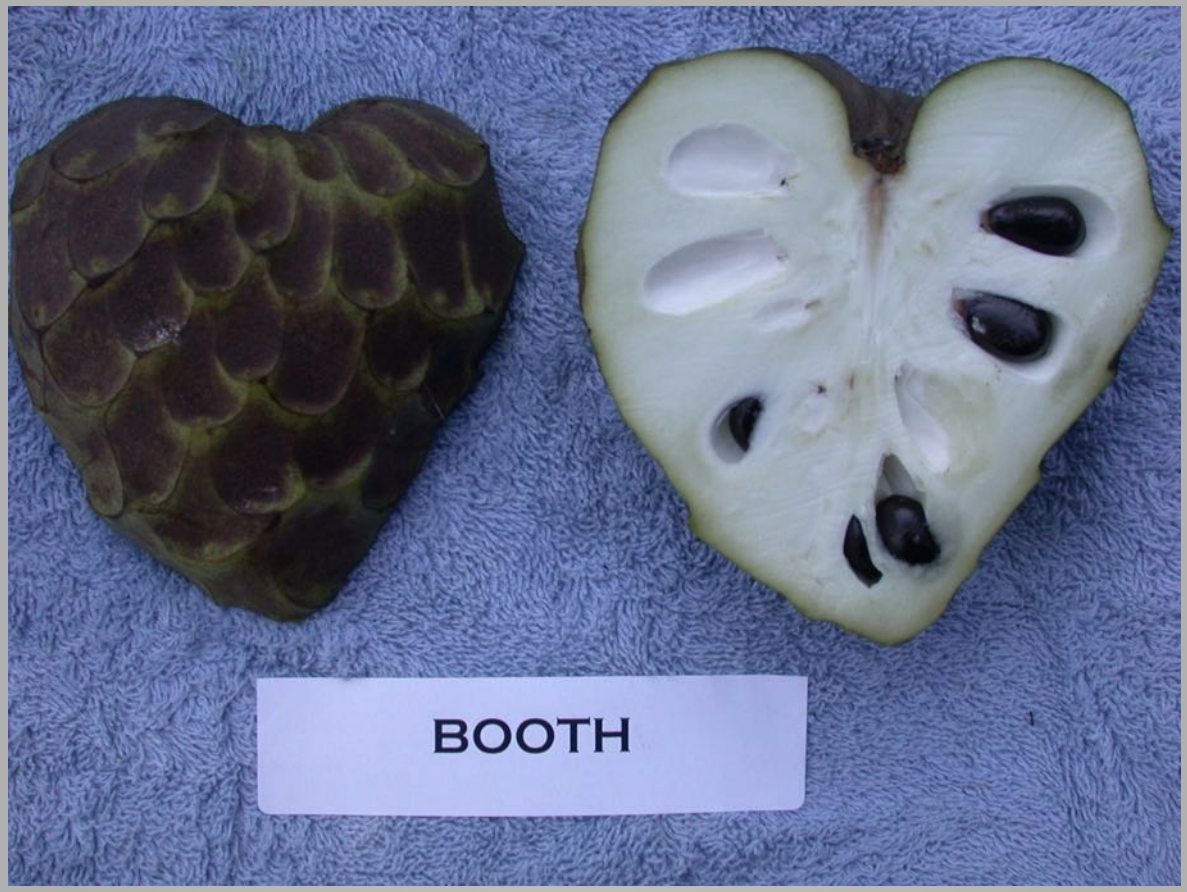
- **Bays**
- Origin James Bays, Ventura, Calif., 1920. Tree broad, to 20 ft. Best in Carpenteria area. Fruits round, medium size, light green, skin shows fingerprint like marks (impressa type). Flavor good, almost lemony.

Bays

- **Big Sister**
- Origin James Neitzel, San Diego, Calif., 1979. Sibling of Sabor. Fruit large, very smooth, good flavor; impressa type. Often self-fruitful.

Big Sister

- **Booth**
- Origin A. F. Booth, Hollywood, Calif., 1921. Among hardiest of cherimoya, does well in most present growing areas. Tree 20 to 30 feet high. Fruit is conical, impressa type, medium size, rather seedy, with flavor that suggests papaya.



Booth

- **Chaffey**
- Origin A.M. Chaffey, West Los Angeles, Calif., 1945. Seed from Salta, Argentina. Tree rather open, fast growing. For coastal areas. Fruit small to medium, round, impressa type, with high, lemony flavor.

Chaffey

- **Ecuador**
- Tree broad, branches limber, spreading. Selected for superior hardiness. Fruit medium, quite dark green, mammillated, flavor good.

Ecuador

- **El Bumpo**
- Origin Rudy Haluza, Villa Park, Calif., 1986. Fruit conical, medium size, mammillated, not suited for commerce. Skin soft, practically edible. Flavor among the finest.

El Bumpo

- **Pierce** (syns. Knight, Escondido White, Ryerson, Thomson-Spain, & Bayott)
- Believed to be from a group of scions imported from Mexico in the 1930's by a Mr. Knight of Orange. Dr. H. F. Pierce planted a grove in Goleta in that period made up largely of trees produced by Knight. This cultivar was Dr. Pierce's favorite and was named "Pierce" by him. Tree is vigorous with large dark green leaves. Fruit is medium sized elongated conically shaped with very smooth skin and a high sugar content.

- **White** (syn. Dr.White)
- Origin J. H. MacPherson, Lemon Grove, Calif., 1928. Tree open, unkempt; to 35 feet, needs forming. A commercial favorite at Carpinteria. Best near coast. Fruit large, to 4 pounds, conical, with superficial small lumps (umbonate). Flesh juicy, flavor weak, suggesting mango-papaya.

- **Whaley**
- Origin Hollywood, Calif., 1924. Tree moderately vigorous. Fruit medium to large elongated conical, tuberculate, light green, flavor good. Seed enclosed in an obtrusive sac of flesh.

A word on rootstocks

- The following discussion is from a talk by G. Bender to the California Cherimoya Growers Association on the need for rootstock research. Ideally, at S. Coast Research and Extension Center, rootstocks would have to be made from rooted cuttings since there is so much cross-pollination in the cherimoya variety collection.

Rootstocks?

- Rootstocks are chosen for many different reasons
  - Yield, fruit size, time of harvest
  - Long term graft compatibility
  - Root rot resistance
  - Nematode resistance
  - Salinity tolerance

- “Preliminary tests indicate the cultivars White and Deliciosa are moderately cold tolerant. White is widely used as a rootstock.” *Claude Sweet*

What Do We Know About Cherimoya Rootstocks?

- “Grower observations have indicated that yields can vary by as much as 100 % depending on genetic variations between rootstocks that influences tree vigor and tolerance of adverse soil and climatic factors. The genetic variation of seedlings produced from outcrossing is greater than self pollinated seed.” *Claude Sweet*

Cherimoya Rootstocks

Cherimoya Rootstocks

- “There are no recognized rootstocks for cherimoyas; therefore seedlings are universally utilized. Seeds from the White cultivar are thought by some to produce superior rootstocks, however there does not appear to be a great deal of objective data to support this position.” *Fruit Facts, CRFG*

- Seeds are soaked for 1-4 days, and floaters are discarded. When planted into peat/sand mix, seeds will germinate in about 21 days with 70 F bottom heat, seeds will germinate in 40 days at ambient temperature.

Seedlings

Rooted Cuttings

- According to Claude Sweet, cherimoyas won't root from cuttings. Other reports indicated that cuttings with leaves would root, but when another researcher tried it they desiccated through water loss.
- Siqueria et.al tried cutting leaves in half and spraying with an ultrasonic nebulizer (to create a dry fog). Cuttings were treated with 0, 200, or 2000 ppm IBA. At 63 days they noted 85 to 92% rooting, independent of IBA concentration.

- Create rooted cuttings from each cultivar
- Grow seedlings as a back-up plan
- Screen for tolerance to Armillaria root rot

Research Project

References

- “Fruit Facts” California Rare Fruit Growers website: http://www.crfg.org/pubs/ff/cherimoya.html
- “Cherimoya” University of California Cooperative Extension, Ventura County: http://ceventura.ucanr.edu/Com_Ag/Subtropical/Minor_Subtropicals/Cherimoya_/