

## The Crop of the Day

### Papaya (*Carica papaya*)



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## Sources

- Storey WB (1976) Papaya - *Carica papaya* (Caricaceae). In: Simmonds NW (ed) Evolution of crop plants. Longman, London: pp. 21-24.
- Fisher JB (1980) The vegetative and reproductive structure of papaya (*Carica papaya*). Lyonia 1(4). Lyon Arboretum, Honolulu, HI
- Chaves-Bedoya G, Nuñez V (2007) A SCAR marker for the sex types determination in Colombian genotypes of *Carica papaya*. Euphytica 153:215-220.
- Mark's Fruit Crops: Papaya: <http://www.uga.edu/fruit/papaya.htm>
- California Rare Fruit Growers: Papaya: <http://www.crfg.org/pubs/II/papaya.html>
- Purdue U.: Center for New Crops and Plant Products: [http://www.hort.purdue.edu/newcrop/duke\\_energy/Carica\\_papaya.html](http://www.hort.purdue.edu/newcrop/duke_energy/Carica_papaya.html)

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## Papaya, the plant and its origins (I)

- Small, nearly unbranched small tree in tropical America
- Family Caricaceae (related to Passifloraceae)
- Genus *Carica*:
  - 1 species: from Central America
  - Other related species, from South America, in:
    - genus *Vasconcella*: 21 species, all from tropical America
    - Genus *Jacaratia*: 7 species
- $2n = 2x = 18$



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## Papaya, the plant and its origins (II)

### Related species:

- *Vasconcella x heilbornii* (syn. *Carica pentagona*): **babaco**:
  - seedless fruit, higher elevations
- *Jacaratia spinosa*: wild papaya, premontane moist forests in Central America



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## Papaya, its uses

- Grown in tropics, Hawaii as food:
  - fresh fruit
  - vegetable: cooked fruit (in Peru, also leaves of *C. monoica*)
  - sweet (*dulce*): cooked in syrup
- Grown in East Africa, Sri Lanka, etc.
  - milky latex in green papaya: papain: proteolytic enzyme active over a broad range of pH
    - Meat tenderizer,
    - Clearing beer (chill-proof beer),
    - Exfoliative cytology (stomach & intestinal cancer);
  - in the Philippines, meat is wrapped in young leaves to tenderize it



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### Other uses

- wool & silk treatment before dyeing
- Face creams and face lift preparations
- Cleansers for contact lenses
- Surgery: remove dead or ruptured tissue

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## Papaya, the harvest

- Propagation mostly by seed, sometimes by cutting
  - After transplanting the trees will flower about 6 months later and the fruits will mature in about 4 months. Normally a yield of 100 fruits per tree can be expected.
- The trees can be harvested for about 1 1/2 to 2 years after which they can be topped to produce secondary branches for more fruits.
- Harvested fruits are packed for export in a single layer in corrugated fibreboard cartons lined with low density polyethylene film, storage period of mature fruits is 3 weeks at 10 C.




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## Papaya, its reproduction

- All species of Caricaceae, except 3 *Carica* species, are dioecious.
  - Exceptions are *C. monoica*, *C. pubescens*, and *C. papaya*.
- *C. papaya*:
  - Pistillate: ♀: stable sexual phenotype
  - Staminate: ♂: can change into andromonoecious (male + hermaphroditic on the same plant):

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## Reproduction of papaya



Female tree



Female flower

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## Reproduction of papaya



Male flower



Andromonoecious

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## Papaya, its history and production (I)

- Originated in lowlands of eastern Central America or northwestern South America. Probably was cultivated widely in Mexico and Central America prior to 1492.
- After the conquest of the Americas, distributed by Spanish and became widely grown in all tropics
- Selection for larger fruit, dioecy.
- Plant breeders have produced varieties to match local preferences for fruit size, shape, flesh color, and flavor.

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## Papaya, its history and production (II)

- Production in Hawaii:
  - based on cultivar Solo and derivatives, introduced from Barbados in 1911; since 1998, genetically engineered to resist papaya ringspot virus
  - pear-shaped fruits of 350-500g
  - produced by hermaphroditic trees of an inbred gynodioecious strain; seeds of hermaphroditic trees produce 2 hermaphrodites:1 female
- Production in South Africa:
  - based on cultivar 'Hortus Gold,' 'Honey Gold'; 2x size of 'Solo'
  - produced by female plants of dioecious strain; seeds produce 1 female:1 male; 10-16% of plants as male is sufficient for pollination



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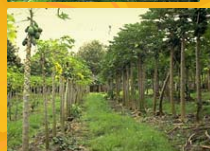
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## Genetic Engineering of Papaya

- Papaya: first genetically engineered fruit crop to be grown commercially
  - Resistance to papaya ringspot virus (PRSV):
    - Introduced gene coding for viral coat protein into papaya genome
    - Two varieties: 'SunUp' (yellow) and 'Rainbow' (orange)
- Potential concerns:
  - Gene flow (outcrossing) : contaminates organic production
  - Foreign exports affected
  - 50% of HI production is transgenic:
    - Cv. Kapoho Solo is non-transgenic: firm flesh & long shelf life, yellow flesh type
  - Ratio of 1:1 (hermaphrodite:female) in transgenic instead of 2:1 in conventional



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## Papaya nutritional qualities

- Fruit is ready to eat when 70-90% yellow and yields slightly when squeezed.
- One papaya (~ 300g): % DV
  - 313% for Vit. C
  - 30% for folate (vit. B9)
  - 25% potassium and dietary fiber
  - 18% vit. A and E
  - 118 calories
- Antioxidants (vit. A, C, E); heart disease, diabetes, colon cancer
- Dietary fibers: colon cancer
- Anti-oxidants + papain: Anti-inflammatory (arthritis)

<http://www.whfoods.com/genpage.php?tname=foodspice&dbid=47>  
<http://www.nutritiondata.com/facts-B00001-01e20W1.html>

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