**Pineapples**

- **Family**: Bromeliaceae
- **Genus**: Ananas
- **Species**: comosus

**Reading**

- Pineapple Cultivation in Hawaii
  - Bartholomew, Rohrbach, and Evans
  - University of Hawaii
  - Cooperative Extension Service
  - F&N-7
  - October, 2002
  - pdf file on web page

**Herbaceous Perennial**

**Flower description**

- Inflorescence
  - 100-200 flowers
- Flower
  - Perfect with floral bract
  - Three fleshy sepals and petals
  - Six stamens
  - Inferior ovary with 3 locules

**Flower description**

- Commercial clones are self incompatible
- Set parthenocarpically
  - Only one cultivar planted in a field
- Pollinated by hummingbirds
  - Can produce seed if cross pollinated

**Fruit Description**

- Terminal Fruit
- Crown - leafy apical shoot
- Multiple fruit
  - White to Yellow flesh
  - 10-18% brix
  - 0.5 - 1.6% acidity
**Pineapple is a Multiple Fruit**

- Many flowers on one inflorescence
- Multiple fruit
  - Fusion of berry-like fruitlets
  - Bases of sepals and bracts

Probably domesticated by the Tupi-Guarani people in the Paraná-Paraguay river drainage area.

Spread through the tropical Americas and Caribbean before Columbus arrived in 1493.

Carried on ships as protection against scurvy.

**Tropical Fruit Production**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Production (1000s mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana</td>
<td>72,167</td>
</tr>
<tr>
<td>Plantains</td>
<td>25,309</td>
</tr>
<tr>
<td>Mangoes</td>
<td>28,730</td>
</tr>
<tr>
<td>Pineapple</td>
<td>15,723</td>
</tr>
<tr>
<td>Papaya</td>
<td>5,878</td>
</tr>
</tbody>
</table>

**Pineapple Production**

<table>
<thead>
<tr>
<th>Region</th>
<th>1,000s mt</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>2,620</td>
<td>17%</td>
</tr>
<tr>
<td>Asia</td>
<td>8,347</td>
<td>53%</td>
</tr>
<tr>
<td>Americas</td>
<td>4,455</td>
<td>28%</td>
</tr>
<tr>
<td>USA (Hawaii)</td>
<td>301</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15,723</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Now Produced throughout the Tropics**

![World Map highlighting tropical regions](http://www.example.com/tropicalareas.png)

**Pineapple Production and Yield**

<table>
<thead>
<tr>
<th>Region</th>
<th>1,000s mt</th>
<th>Mt/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>2,620</td>
<td>12.1</td>
</tr>
<tr>
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<td>8,347</td>
<td>19.5</td>
</tr>
<tr>
<td>Americas</td>
<td>4,455</td>
<td>22.0</td>
</tr>
<tr>
<td>USA (Hawaii)</td>
<td>301</td>
<td>37.3</td>
</tr>
<tr>
<td>Total</td>
<td>15,723</td>
<td></td>
</tr>
</tbody>
</table>

*FAOSTAT database, 2000-2002*

**Adaptation: Temperature**

- **Average yearly temperature**
  - 65-79°F
- **Poor growth**
  - Below 55-60°F
  - Above 95°F
- **Optimum growth conditions**
  - Cool nights with sunny days
  - Day temp 70-85°F

**Adaptation: Rain**

- **Drought tolerant plant**
  - Leaf adaptations
  - CAM type plant
- **Grown in range of rain conditions**
  - 24” (600 mm) - works well if even distribution
  - 150” (3600 mm) per year

**Adaptation**

- **Soil**
  - Acid soil, pH 4.5 to 5.6
  - Good drainage
  - Fertility
    - Best production at high fertility
    - Tolerates low fertility
    - Tolerates high levels of Al³⁺ and Mn²⁺
  - High OM and K desirable for best yields

**Propagation of the Pineapple**

- **Vegetative propagation**
  - Crowns
  - Slips
  - Hapas
  - Suckers

*Fig. 5 A DIETING PINEAPPLE PLANT*
Propagation - Crowns

- Crowns preferred
  - Preformed roots and good reserves
  - Best grade by weight to reduce variability
- Cannery byproduct
  - Twisted off at fruit harvest time
  - Dried or dipped in fungicide
  - Trimmed, weighed
  - Better roots than slips
- Fresh pineapples marketed with crowns

Propagation - Slips

- Rudimentary fruit with crown
  - From axis of leaves on fruit stalk
  - Curved at base
    - Visible when fruit 1/2 developed
- After harvesting the fruit
  - Allow to develop another 4-5 months
- Storage
  - Can store for 1 year upside down in sun
  - Best yield if plant within 1 month

Propagation - Suckers

- From axillary buds on stem
  - Begin to grow during floral differentiation
- Cut from stem after fruit harvest
- Larger than crowns/slips when collected
  - Floral precocity → uneven harvest

Sucker versus a Crown
**Time to Harvest varies with Planting Material**

- Suckers
- Slips
- Crowns

Uneven Fruiting and Increased Harvest Cost

**Growing Cycle - 3 harvests**

Hawaii - 20-22 degrees north

- Plant Growing Force Flower Harvest
  - 1st Ratoon Sucker Development: Force 11 Flower 14 Harvest 18
  - 1st Ratoon Crop: Force 25 Flower 28 Harvest 32
  - 2nd Ratoon Sucker Development: Force 38 Flower 42 Harvest 46

**Crop Cycle**

- Planted year round
  - Forced 9 - 13 mos later
- Plant crop duration
  - In Hawaii (20-22 degrees north): 15-20 months
  - More tropical areas where warmer: 11 - 14 months

**Ratoon Crop**

- Forced 5-7 months post plant harvest
- Ratoon fruits
  - Smaller
  - Sweeter, less acidic, more aromatic
- Second ratoon crop possible if
  - Soil is fertile and low nematode

**Smaller Fruit Size with Each Crop**

- Fig. 6 Diagram to show the manner of perennial growth of the pineapple, crosses with terminal inflorescence.
**Fruit Size**
- Largest size for processors
- Regulate size by the timing of flower forcing
- Fresh market
  - Forced earlier
  - Ratoon crops

**Pineapple fruit size is related to size of plant at time of flower induction**

<table>
<thead>
<tr>
<th>Fruit weight (lbs)</th>
<th>Number of leaves</th>
<th>'Smooth Cayenne' fruit wt = plant wt at time of flowering</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>3.5 lbs</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Forcing**
- Ethephon
  - Ethylene-releasing compound
  - Most common growth hormone used
- Why force?
  - Uniformity
  - Regulate harvest
- Forcing easier if:
  - Done near normal flowering time
  - Lower N & less vigor
  - Cool temp (< 24°C night temps)

**Planting**
- Double rows
  - Pineapple for processor
    - 122 x 60 x 28 cm (4 x 2 x 1 ft)
- Plant density regulate fruit size
  - Canning, 58,700/ha
  - Fresh, 75,000/ha
  - Fruit size decrease by 300 gm (0.7 lbs)

**Cultural Care in Hawaii** (Not equatorial climate)
- Fumigate/fertilize preplant
- Black plastic mulch
  - Nematicides under poly
  - Increases soil temp in rooting zone
  - Conserves moisture and weeds
- Drip irrigation

**Fertilizer**
- Nutrient requirements
  - High N, K, and Fe
  - Low requirement of P and Ca
- Nutrient scheduling
  - Less required for first 5 months
  - Peak 2 - 4 months before forcing
    - Need dark green leaves at forcing for best production
  - Minimal during flowering/fruiting
Pesticides and fungicides sprayed as necessary

Pineapple Harvest
Harvest as shell color changes from green to yellow at base

Pineapple Harvest

Pineapple Harvest

Pineapple Harvest

Pineapple Harvest
**Pineapple Harvest**

- **Cultivars**
  - ‘Smooth Cayenne’
  - Origin - not clear

**Distribution of Cayenne Pineapple**

- **Cayenne - most important**
  - **Processing**
    - Cylindrical for Canning
    - Leaves - no spines, slips few
    - Large fruits 2.5 - 3.5 Kg (5.5-7.7 lbs)
  - Common in USA grocery stores
  - Marginal for fresh market
    - Too high in acid
    - Skin is thin so bruise easily

**Red Spanish - 2nd**

- Well adapted for shipping fresh
  - 2-4 lbs
  - Pale yellow
- Grown in Cuba and Puerto Rico
- **Plant**
  - Hardy, spiny leaves
  - Many slips

**Sugar Loaf types**

- Widely grown in tropical America
  - Sweetest of white-fleshed forms
  - Lower acid than Cayenne
  - Many have small fruit (1/2 - 1 kg)
    - Kona Sugarloaf has fruit 2-2.5 kg size
Post Harvest - Storage

- Partially ripe
  - 50 - 55°F
- Ripe pineapples
  - 45°F
  - RH 85 - 90%
- Exposure sub 45°F → chilling injury

Any Questions about Pineapple?