Minor Fruits from Asia and Africa

- Moraceae
  - Breadfruit
- Guttiferae
- Sapindaceae
- Bombacaceae
- Oxalidaceae
- Leguminosae

Related Plants

- All multiple fruit
  - Multiple pistils on one flower
  - Form one fruit
- Family Moraceae
  - Mulberry
  - Fig
  - Osage orange

Plant

- Tree
  - Grows up to 85' (26 m)
  - Relatively few thick branches
  - Large leaves
  - All parts of tree rich in milky gummy latex

Flowers and Fruit

- Monoecious
  - Male and female flowers on one same plant
- Fruit is a multiple fruit
  - Multiple flowers combining to form one fruit
**Flowers and Fruit**

- Fruit is a multiple fruit
  - Length 3.5-18’ (9-45cm)
  - Width 2-12” (5-30cm)
  - Inside, whitish, starchy
- Highly praised by early Europeans as food during famine

**Origin of Breadfruit**

- Spread to Melanesia, Micronesia and Polynesia during human migrations between 1000-2000 BC
- Widely spread in 18-19th centuries as an inexpensive food crop

**Captain Bligh’s trip to Tahiti in 1787**

- On the Bounty to take breadfruit to West Indies as food for slaves

**Adaptation**

- Ultra-tropical plant
  - Temperature between 60-100F (15-38C)
  - Rain 80-100” (2030-2540mm)
  - 70-80% relative humidity
  - Is grown successfully in drier and cooler conditions
- Soil
  - Much variability in adaptation

**Propagation**

- Seeded types
  - Seed
- Seedless types
  - Transplant natural root suckers
  - Induce suckering by uncovering and injuring root
  - Root cuttings

**Planting**

- Spacing
  - 25-40’ (7.5-12m)
  - 25 trees/acre (84 trees/ha) common
- Precocity and productivity
  - Fruit within 5 years
  - Productive for 50 years
Harvest

- Fruits all year but with 2 to 3 peaks
  - Fruit take 3 months to develop
- Ripe when small drops of latex appear on fruit
  - Climb tree and break fruit pedicel with fork stick
  - Allow to fall to ground
  - Some damage but done to avoid latex from cut stem

Yield
- 50-200 fruit per tree
- 16-32 MT/ha

Storage
- 10 to 15 days at 54F (12C) wrapped in polyethylene bags

Food Uses
- Under ripe fruit (starchy)
  - Eaten as a vegetable
  - Boiled, roasted
- Ripe fruit (sweeter)
  - Baked
  - Made into sweets
- Most varieties of breadfruit are purgative if eaten raw

Plant
- Tree
  - 30-70’ (9-21m) tall
  - Evergreen
  - Glossy, leathery leaves
  - All parts contain sticky white latex

Jackfruit
Moraceae
Artocarpus heterophyllus
Largest of all tree borne fruit.

Flowers
- Monoecious tree
  - Tiny male flowers
  - Female clusters are elliptical
- Pistillate flowers produced directly on trunk
**Fruit is very large**

(10-60 lbs or 4.5-20 kg)

- **Multiple Fruit**
  - Hard rind
  - Interior “bulbs”
    - Perianth
      - Yellow banana flavored flesh
    - Within each “bulb”
      - “seed” (endocarp)
      - Thin white membrane (exocarp)
    - Central pithy core

- **Ripe fruit**
  - Unopened
    - Disagreeable odor (decayed onions)
  - Flesh
    - Smells of banana and pineapple

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**Origin of Jackfruit**

Originated in the rainforests of the Western Ghats

Best guess

- India, rainforests of the western Ghats

Cultivation

- Common throughout India and southeast Asia
- 1700 and 1800s spread to New World

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**Adaptation**

- Humid tropical and near tropical climates
  - Below 5,000’ (1,500m)
  - Large trees tolerate cool better than breadfruit
- Soil
  - Best in rich, deep soil of medium to light texture
  - Sensitive to waterlogging

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**Production**

- Mainly at low elevations in Asia
  - India
  - Myanmar
  - Sri Lanka
  - Southern China
  - Malaysia
  - Philippines
### Propagation
- **Usually by seed**
  - Can only store for a month
- **Vegetative propagation**
  - Budding/grafting frequently no successful
  - Air layering is possible
- **Difficult to transplant seedlings**
  - Long delicate tap root

### Planting
- **Spacing**
  - 30-40' (9-12m) apart
- **Precocity**
  - Seedlings take 4 to 14 years to bear
- **Longevity**
  - Produce for up to 100 years although with declining years
  - In Thailand recommend replace 20 year old trees

### Harvesting
- **Fruits mature in 3-8 months after flowering**
- **Yield**
  - 150 large fruit per year
- **Storage**
  - Deteriorate quickly after ripening
  - Store for 3-6 weeks
    - 52-55 F (11-12.8 C)
    - 85-95% relative humidity

### Mangosteen
- **Guttiferae**
- **Garcinia mangostana**
- "Queen of Fruits"

### Flowers and Fruit
- **Flowers**
  - Male flowers have no pollen
  - Hermaphroditic flowers have no pollen
  - Flowers set parthenocarpically
- **Fruit**
  - 1.3-3" (3.4-7.5 cm) in diameter
  - Thick rind
  - Snow white, juicy, soft flesh

### Plant
- **Tree**
  - 20-82' (6-25m) tall
  - Erect with pyramidal shape
  - Slow growing
Origin of Mangosteen

- Only found in cultivation

Nature of Mangosteen
- Obligate agamosperm
- Natural allotetraploid
  - G. hombroniana
  - G. malaccensis
- Has reproduced asexually

Adaptation
- Wet lowland tropical climate
  - Below 1,500' (450m) in Malaysia
  - Does not tolerate
    - Below 40 F (4.4 C)
    - Above 100 F (37.8 C)
    - Rain > 50” (1,270mm)
  - Well distributed and no long drought periods
- Soil
  - Grows best in deep, rich organic soil
  - Well drained soils
  - Not adapted to calcareous soils
  - Sensitive to saline conditions

Production
- Mainly grown in Asia
  - Malaysia
  - Myanmar
  - Thailand
  - Philippines
  - Indonesia
- Limited areas planted in Americas and other tropical regions

Propagation
- Propagated by “seed”
  - Adventitious embryos
  - Seeds short lived
  - Seedlings are “true-to-type”
- Seedlings
  - Takes 2 years to size for field
  - Difficult to transplant

Planting
- Spacing
  - 35-40’ (10.7-12m) apart
  - Prepare planting hole with organic matter
  - Shade young tree for 3-5 years
  - Difficult to establish
- Precocity
  - Fruit in 7 to 9 years at earliest
  - Some take 10-20 years
**Fruiting**
- One or two harvest seasons
- Cropping is irregular
- Yield peaks at 30 years
  - Gradually declines
  - Can fruit to 100 years old

**Harvesting**
- Harvested by hand
  - Mature but slightly under ripe
  - Delicate so not allowed to fall
- Storage
  - 20-25 days in warm, dry conditions
  - Up to 49 days at
    - 39-42F (3.9-5.5C)
    - 85-90% relative humidity
- Eaten as fresh fruit

**Rambutan**
- Sapindaceae
- *Nephelium lappaceum*

**Related fruits within the Sapindaceae**
- Litchi or Lychee
  - *Litchi chinensis*
- Longan
  - *Euphoria longana*
- Pulasan
  - *Nephelium mutabile*
- Mamongcillo
  - *Melicocca bijuga*

**Plant**
- Evergreen tree
  - 50-80' (15-25m)
- Growth type
  - Seedlings
    - Upright
    - 6-8 yr to fruit
  - Grafted
    - Spreading
    - 2-4 yr to fruit

**Flowers and Fruit**
- Panicles- 3 flower types
  - Male
  - Hermaphrodite
    - Only functionally female
    - Functional female with a few male flowers
  - Need cross pollination
- Insect pollinated
**Flowers and Fruit**

- **Fruit** - drupe
  - Leathery, hairlike skin
  - 20-40 gm/fruit
  - Yellow, orange or red
  - White flesh
  - Sweet, acid, juicy
  - 15 to 18 weeks to mature

**Origin of Rambutan**

- Native to Malaysia
- Commonly produced in Malaysia and throughout Southeast Asia within 15° of the equator

**Adaptation**

- Tropical, humid conditions (within 15° of equator)
  - Ideal environment
    - Mean annual temperature 81 F (27°C)
    - 82% relative humidity
    - 71 inches (1,800 mm) rain
    - Rain days: 165 days
    - Dry season: <90 days
  - Generally below 1,800' (600m)
- **Soil**
  - Deep clay-loam
  - Sandy loam rich in organic matter
  - Deep peat

**Propagation**

- **Seeds**
  - Best to germinate promptly
  - For rootstock
  - Seedlings are variable
    - Many male plants
    - Most female seedlings not productive
- **Vegetative propagation**
  - Patch budding successful
  - Commercial varieties tend to have hermaphroditic and female flowers

**Planting**

- **Spacing**
  - 33-40' (10-12m)
- **Precocity**
  - Seedlings in 5 to 6 years
  - Budded or grafted trees in 2-3 years

**Harvest**

- Once or twice a year (4-7 week harvest period)
  - Malaysia, peak in June and December
  - Philippines, July to October
- **Harvest**
  - Cut off entire fruiting cluster
- **Yields**
  - Up to 40 MT/ha
Marketing

- **Keeping quality**
  - Usually 3 days before shrivelling/decay
  - Extend storage to 12 days
    - Sealed polyethylene bags
    - 50 F (10 C)
    - 95% relative humidity

- **Products**
  - Most commonly eaten fresh

Any Questions?