Vanilla

Orchidaceae
Vanilla planifolia or fragrans

- Perennial vine (10-15 m)
- Leaves
  - Large
  - Succulent
- Stem
  - Branched
  - Aerial roots (attachment)
- Rhizomes

Flowers
- Zygomorphic
- 10 cm diameter
- Pale greenish
- Fugacious (8 hrs)
- Aromatic
- Bee pollinated
  - Natural 1-3% set
- Inflorescence
  - 5-30 flowers

Flower Structure Prevents Self Pollination
- Rostellum
  - Flap like
  - Separates Γ & Φ
  - Obstructs selfing
  - Secretes sticky substance
    - Ensuring pollen adherence to pollinating insects

Fruit
- Fleshy elongated, straight capsules.
- Greenish yellow at maturity
  - 10 - 25 cm long
  - 8 - 15 mm wide
  - Very small black seed
**Adaptation: Lowland Forests**

- **Temperature** (< 200 m)
  - Cannot survive frost
  - Warm 21 - 32°C year round
  - Average 25 - 27°C
- **Moisture**
  - 2000 - 3000 mm (80 - 125”) 10 months
  - Followed by 2 mos dry season
    - Checks vegetative growth
    - Induces flowering

**Soil**
- Friable clayey loam
- Thick layer of organic matter
  - Roots/rhizomes superficial
- pH 6.0 to 7.5
- Susceptible to waterlogging
- Partial shade needed for good growth

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**Origin of Vanilla**

*Vanilla planifolia*

- Indigenous to SE: Mexico to Guatemala and Panama
- Used by the Aztecs
  - Chocolatl
  - Tribute to Aztec leader
- Shipped to Spain in 16th century
- Early 1800s
  - Indonesia
- Mid to late 1800s
  - Production begins
    - Indonesia
    - Reunion
    - Mauritius
    - Madagascar
    - Seychelles
    - Comoro Islands
    - Hand pollination showed to increase yields

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**Vanilla Production**

FAOSTAT, 2003

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**World Production of Vanilla**

FAOSTAT, 2003

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**Vanilla Yield in the World**

FAOSTAT, 2003
**Propagation**

- **Seed**
  - Very small
  - Difficult to germinate
- **Stem cuttings are best**
  - Staked for support
  - Longer -> quicker fruit
    - 30 cm >> 3-4 years to fruit
    - 90 cm >> 3 years to fruit
      - Recommended
    - 350 cm >> 2 years to fruit
- **Direct in field or in pots**

**Planting**

- **Need to plant shade trees first**
  - Partial shade (30-60%)
    - Prevent sun burn
    - Prevent desiccation from winds
  - Regulate shade
    - 50-60% in dry sunny season
    - 30-35% in cloudy, rainy season
  - Prune support/shade trees
    - 1.5 meters

**Planting**

- **Density**
  - 1 x 1 m (10,000/ha)
  - 3 x 2 m (1,666/ha)
- **Precocity**
  - First good crop - 3rd year
  - Maximum yields from year 7 to 12
  - Yields decline
  - Vines replaced 20-25 years old

**Culture**

- **Floor Management**
  - Roots superficial
  - Organic matter is beneficial
- **Training**
  - Vines trained at about 1.5 m
    - Pollination
    - Harvest
    - Head back to induce branching

**Pathogens: Fusarium**

*Fusarium oxysporum f. sp. vanillae*

- Most serious world wide pathogen
- **Symptoms**
  - Stop growth and increase aerial root formation
- **Control**
  - Avoid plant stress
  - Proper spacing
  - Shade regulation

**Pathogens: Anthracnose**

*Glomerella vanillae*

- All growing regions
- **Symptoms**
  - Lesions on stem and leaves
  - Plant wilt
  - Fruit, black at tips/midsection, fall
- **Encouraged by**
  - Prolonged humidity or rain
  - Poor drainage
  - Excessive shade or crowding
### Flowering
- Mexico - during dry season
  - March to May
- Natural pollination
  - Bees and hummingbirds
  - 1-3% fruit set
- Artificial pollination
  - Needed for commercial yields

### Artificial Pollination
- Albius method (1841)
  - Use a rounded bamboo stick
  - Draw back labellum (lip)
  - Break anther cap
  - Press rostellum down under anther
  - Press anther and stigma together

### Artificial Pollination
- Flower for 2-3 months
- Inflorescence
  - One flower per day
  - Last 6-8 hours
- Pollinate in the morning
  - 750-2,000 per day
  - Daily for 2-3 months
- 40% of labor cost

### Regulate Number of Pods
- Pods per plant
  - 3rd year >> 30-100 fruit
  - 4th year >> 60-150 fruit
- Overcropping
  - Small fruit
  - Stressed plant
- Pods growth
  - Full length in 5 - 6 weeks
  - Maturity after 4-9 months

### Harvesting
- Harvest before completely mature.
  - Turn yellowish green
  - Does not have vanilla flavor yet
- Harvest daily over 2-3 months
  - Mexico, November to January
  - Deliver pods to processor
Processing in Mexico

• Preparation
  – Sorting
  – Peduncle removal
• Curing vanilla pods (“beans”)
  – Killing or Wilting
  – Sweating
  – Drying
  – Conditioning

Wilting or Killing

• Purpose
  – Stop bean growth
  – Initiates enzymatic reactions
  – Pod/bean turns brown
• Methods
  – Sun wilting
  – Oven wilting

Oven Wilting

• Temperature
  – 60 C for 36 hours
  – Cool to 40 C

Sweating

• Purpose is to promote
  – Enzymatic activity
  – Initial drying
• Method
  – Remove from oven (40 C)
  – Sweating boxes
  – Cover to keep in heat for 24 hours

Drying

• Purpose
  – Slow drying
  – 30% of original weight
• Sun drying
  – Laid out on mat cover concrete or brick floor
  – 4-6 hours
  – Pick up and return to sweat boxes
• Cycle repeated 11 to 25 times

Conditioning

• Purpose
  – Allow full development of aroma and flavor
• Methods
  – Packed in bundles of 50 beans
  – Wrapped with waxed paper
  – Stored in closed boxes
  – At least three months
Final product

- Final product
  - 1 kg cured beans
  - 3.5-4.5 kg picked beans

- New method
  - McCormick has developed mechanized procedure that takes 4 days

Uses

- Flavorings
  - Widely used flavoring
  - Major component
    - Vanillin (oleoresin) at 1.5 to 3.5%
    - About 150 other flavor components

- Forms
  - Powder
    - Ground with sugar, starch and gum
  - Extract
    - Usually ethanol based
    - Also various concentrated forms

- Synthetic vanilla
  - First produced in 1874
  - Inferior quality because of other flavor components
    - Frequently blend to enhance flavor
  - Widely used but natural form is also in demand
    - 90% of US vanilla flavoring sector
    - 1% of the cost

Any questions?