Rubber

Cachuchu (Ameridian)
Caucho (Spanish)

Euphorbiaceae
Hevea
brasiliensis

Tree

- Height
  - In wild grows to 40 m
  - Cultivated 10-30 m
    - Growth restricted by tapping activity
- Early training remove all branches up to 2.5 m.
  - Smooth trunk for latex collection
  - When trunk reaches 500 mm circumference (15 cm diameter)

Latex Vessels

- Location
  - External bark
  - Latex vessels
  - Phloem
  - Cambium
  - Xylem
- Laticiferous vessels
  - Latex synthesis and transport
- Tapping
  - Important not to damage phloem sieve cells or cambium

Trifoliate Foliage

- Young leaves - copper colored
  - Green when mature
  - Young trees never devoid of foliage

- After tree is mature (5 years)
  - Wintering, at least once per year
    - Drop leaves
    - Takes 2 weeks to regrow leaf canopy
    - Yield low during this period
- Other reasons for defoliation
  - Drought
  - Cold and short days (outside trop)

Flowering

- Monoecious
  - Female flowers - tips of branches
  - Male flowers more numerous
- Cross pollinated
  - Anemophilic
  - Entomophilic
- Seed
  - Capsules with 3 seed
Rubber Origin and Dispersal

Native range of Hevea spp

Native range of Hevea brasiliensis

Adaptation: Rain forest species

- Temperature
  - Ideal temperature 22 - 30°C
  - Generally below 600 m above sea level
  - Up to 1000 m at equator

- Moisture
  - 1500 - 3000 mm / year
    - Does not flourish if pronounced dry season
    - Excessive rains interfere with tapping

Adaptation: Rain forest species

- Soil
  - pH 4.0 - 6.5
  - Well drained soil
    - Sensitive to flooding or high water tables

- Prone to wind damage
  - Especially in commercial plantings

- Prime growing region
  - 10° N and S of the equator

Origin of Rubber, Hevea brasiliensis

- Origin
  - Amazon Basin
  - Upper Orinoco
  - Guianas

- Wild trees harvested by local peoples
  - Footwear, bottles
  - Torches, balls
  - At least 1,000 years before the arrival of Europeans to South America

Development of Rubber

- Initially used little
  - Could not reliquify
  - Sensitive to temperature

- 1770 - Priestley in England
  - Rubber cubes introduced as erasers

- 1820’s
  - Methods to reliquify
  - Rubberized cloth -> MacIntosh
Development of Rubber

- 1840’s
  - Vulcanization with sulphur invented
  - Stabilized rubber at high and low temperatures
  - Many more uses were invented
    • Seals for sewers
    • Conveyor belts
    • Inflatable boats
    • Springs in railway and road vehicles

- Increased demand creates need for reliable source
  - Brazilian production based on tapping wild trees destructively

- British sent Sir Wickham to Brazil to collect seed
  - 1876 brought back 70,000 seed
  - Germinated at Kew Gardens
  - 2,700 seedlings sent mainly to Sri Lanka

Development of Rubber

- Invention of tires in late 1800s
  - Increased demand
  - Increased price of rubber

- Stimulated development of plantations in Asia, Africa, and South America
  - Successful in Asia and Africa
  - Unsuccessful in South America
    • South American Leaf Blight
    • Microcyclus ulei

Production

- Webster and Baulkyk, 1989

- World production
  - 5 million mt
    • 60-70% for tire manufacture
  - Most (85-90%) in Southeast Asia
    • Malaysia, Indonesia, Thailand, Sri Lanka, India
  - Little in South America due to SALB

- Production of synthetic rubber
  - 10 million mt

Propagation

- Rootstocks - established by seed

- Plant fresh seed
  - Begin lose viability within 7-10 days
  - Germinate in 1-3 weeks

- Nursery
  - 6 months 1-1.3 m tall
  - 10-15 months ready for transplant

Improved Varieties Budded

- Budding methods
  - Week before budding
    • Cut leaves subtending bud

- Patch budding - historic

- Green strip budding
  - Let scion latex drain 4 hrs before cutting buds from scions
Planting
- Density
  - 250 to 300 plants/ha
- Precocity
  - 5-8 years before begin tapping
  - Needs to be about 50 cm in circumference at 1 m height
  - Trunk diameter of 7-8 cm
- Productive life
  - Production increases until 15 years old
  - Normally tap for 20-25 years
  - Recommend replacement at 30 years of age
  - Harvest trees for timber

Tapping and Bleeding
- Begin to tap
  - 45 to 50 cm trunk perimeter
- Excision method of tapping
  - Cut groove 30° angle mark at 48” point
  - Draw 180° around tree (half way)
  - Groove does not injure cambium

Latex flowing in recently cut tree

Daily Schedule
- One person starts cutting at 0600
  - Morning is when flow the highest
  - Cut 500 trees by 0930
    - Anti-coagulant in each cup
    - Latex flows for 1-3 hours
- Collection begins at 1100

Tapping Life of Tree
- Depends on ability of tapper
  - Extend life by cutting thinner slivers
  - Consume bark at slower rate
- Tapping schedule
  - First side tapped for 4-5 years
  - Second side tapped for 4-5 years
  - Repeat cycle on original sides
  - An individual tree will last 20-25 years

Tapping and Bleeding
- Remove thin sliver of bark
  - 3 times/week
  - 1” vertical distance / month
  - 120-160 tappings per year
- Ethephon (early 1970s)
  - Applied to bark near cut
  - Delays plugging --> increased flow
- Research to decrease number of tappings needed
Second time to tap

Yields

- Unselected wild seedlings
  - 300 to 450 kg/ha
- Modern clones from Wickham population
  - 3 generations of breeding (100 years)
  - 700 to 2,000 kg/ha

Producers

- Currently plantation approach is in decline
  - Large demand for labor
- Small holder production is rising
  - Labor needed throughout year
  - Relatively low capital investment
  - Year round cash flow

Any Questions?