Spices of the World

An Overview

Spices Drove Exploration

- Major voyages of exploration in search of spices
- Pepper and Clove
  - High demand in Europe
  - Very valuable commodity
  - Find and control source

Spices Important in World Trade

- 75% of World Trade
  - Pepper
  - Capsicums
  - Cinnamon
  - Ginger
  - Turmeric
### Percent of World Trade for Important Spices

<table>
<thead>
<tr>
<th>Spice</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pepper</td>
<td>33%</td>
</tr>
<tr>
<td>Capsicum</td>
<td>22%</td>
</tr>
<tr>
<td>Seed spices</td>
<td>15%</td>
</tr>
<tr>
<td>Tree spices</td>
<td>14%</td>
</tr>
<tr>
<td>Turmeric</td>
<td>8%</td>
</tr>
<tr>
<td>Ginger</td>
<td>6%</td>
</tr>
<tr>
<td>Cardamom</td>
<td>4%</td>
</tr>
<tr>
<td>Vanilla</td>
<td>2%</td>
</tr>
</tbody>
</table>


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### Tropical Spices imported in the USA

<table>
<thead>
<tr>
<th>Spice</th>
<th>USA imports</th>
<th>Producing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardamom</td>
<td>3,200</td>
<td>Guatemala, India</td>
</tr>
<tr>
<td>Chilli</td>
<td>54,000</td>
<td>India, Morocco, Sri Lanka, Tanzania</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>19,500</td>
<td>Madagascar, Indonesia, Sri Lanka, Seychelles</td>
</tr>
<tr>
<td>Clove</td>
<td>1,200</td>
<td>Indonesia, Madagascar, Sri Lanka, Tanzania</td>
</tr>
<tr>
<td>Cumin</td>
<td>7,200</td>
<td>India</td>
</tr>
<tr>
<td>Ginger</td>
<td>14,000</td>
<td>India (91,000 to Japan)</td>
</tr>
</tbody>
</table>

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### Tropical Spices imported (tonnes) in the USA

(Weiss, 2002)

<table>
<thead>
<tr>
<th>Spice</th>
<th>USA imports</th>
<th>Producing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mace</td>
<td>200</td>
<td>Indonesia, Grenada, Sri Lanka, India, Malaysia</td>
</tr>
<tr>
<td>Nutmeg</td>
<td>1,500</td>
<td>Indonesia, Grenada, Sri Lanka, India, Malaysia</td>
</tr>
<tr>
<td>Pepper</td>
<td>42,500</td>
<td>Brazil, India, Indonesia, Madagascar, Malaysia, Sri Lanka</td>
</tr>
<tr>
<td>Tumeric</td>
<td>2,300</td>
<td>India</td>
</tr>
<tr>
<td>Vanilla</td>
<td>1,900</td>
<td>Madagascar</td>
</tr>
</tbody>
</table>
### FAO Production Statistics

(FAOSTAT, 2000-2004)

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Africa</th>
<th>Asia</th>
<th>Latin America</th>
<th>Oceania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clove</td>
<td>118</td>
<td>26%</td>
<td>74%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>121</td>
<td>1%</td>
<td>98%</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Pepper</td>
<td>344</td>
<td>3%</td>
<td>79%</td>
<td>17%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Nutmeg</td>
<td>74</td>
<td>1%</td>
<td>70%</td>
<td>28%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Vanilla</td>
<td>6.5</td>
<td>45%</td>
<td>49%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

### Origin of Spices

- **Cinnamon**: Evergreen tree, tropical maritime climate. Origin: Moluccas (Indonesia).
- **Pepper**: Tree of the wet tropics. Origin: Hills of western India.
- **Clove**: Evergreen tree, tropical lowland. Origin: Moluccas (Indonesia), India, SE Asia.

### Habitat Characteristics

- **Vanilla**: Fleshy herbaecous.
- **Cinnamon**: Evergreen.
- **Pepper**: Tropical woody.
- **Nutmeg**: Evergreen.
- **Clove**: Evergreen.
Clove - *Syzygium aromaticum*

- Evergreen tree
  - Up to 15 m
  - Glossy green leaves
  - Fragrant red flowers
  - Purple fruit
- Harvest
  - Inflorescence
    - Buds at full size but before they open
  - Leaves
    - Leaf oil

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Clove Branch

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Clove Branch and Flower
Adaptation
Lower montane forests

- Partial shade
- Below 300 m
- Precipitation: 2,000 to 3,600 mm
  - Dry season needed for best production
  - Flower bud initiation
  - High humidity at flowering reduce yields
  - 3 month dry season (60-80 mm) for better quality

Early Trade and Use

- Chinese, 200-206 BC
  - From Philippines
- India, 2nd century AD
- Egypt, 1st century AD
  - Regular imports by 2nd century
  - 4th century, traded around the Mediterranean
- 13th century
  - Major source for Europe was Venice
  - Via Alexandria supplied by Arab sailors

Origin of Clove
Trade
- Arabs – traded with Europe
- Portuguese – 1512 found Moluccas
- Dutch – early 1600s
- French –
  - Mauritius, Ile de France, Reunion Island, Seychelles
  - Introduced to Zanzibar in 1818
- British
  - Occupation of Moluccas (1796-1802)
  - Penang and other British colonies

Recent Production History of Clove

Propagation
- Traditional from seed
  - Seed orchards from selected trees
  - Nursery production – 12 months
  - Transplant to field
    - 1-2 seedling per space
    - 8-9 m for clove production
    - 1 m in row to create hedge for leaf harvest
- New plantations need
  - Windbreaks
  - Shade
Harvest

- Production
  - Begins to bear 4-5 years
  - Full production at 20 years
  - Bear for 100 years
- Varies tremendously from year to year
  - Average 4-5 kg/tree (0-50 kg/tree)
  - Climatic conditions
  - Shoot and flower initiation
  - Fruit set

Harvest

- Clove clusters
  - Buds full size
  - Calyx base pink flush
  - Do not ripen uniformly
  - 5-8 hand harvests per tree
  - 25-55 kg of wet cloves per day

Commercial leaf oil production

- Hedge row planting
  - Only in Madagascar
  - Yield 2-3 mt leaves/ha
  - Picked every 2-3 weeks
- Harvest from clove orchards
  - Cut foliage off and strip off leaves
    - Top to encourage branching
    - Lower clove yields
  - Collect fallen leaves every 2-3 weeks
Processing

- Cloves
  - Buds separated from peduncles and pedicels
  - Dried
- Leaves
  - Oil extracted via steam distillation

Uses

- Cloves
  - Domestic cooking – whole cloves
    - Pies, stews, soups, ham, pork
  - Industrial food processing – powder
    - Baked goods, processed meats, pickles
  - Cigarettes
    - Indonesian Kretek cigarettes up to 8%

Uses – Oil

Main component is Eugenol

- Sources
  - Bud, stem, leaf
  - Bud is highest quality
- Uses
  - Seasonings and processed food (bud only)
  - Perfumery
  - Some in pharmaceutical and dental products
  - Antimicrobial, antioxidant, and insecticidal activity
Pepper
Piperaceae
Piper nigrum

Pepper
Perennial glabrous woody climber

Piperaceae

- *Piper* species
  - *nigrum*, Black/white pepper
    - Most important
  - *cubeba*, Cubeb pepper
  - *longum*, Long pepper

- *Peperomia* and 10 other genera
Origin of Pepper

Native to Wet Tropical Forests

- Commercial Production
  - 20º of the equator
- Temperature
  - 25-35 C
  - Minimum 15-18 C
- Rain, well distributed and humid
  - 2,000 to 3,000
  - If dry season, while berries maturing
- Cloudy, partial but not heavy shade
- Soil, well drained and slightly acid to neutral

Propagation

- Stem cuttings, 4-5 months in the nursery
Planting and pruning

- Planted with a support (3m x 3m)
  - Living or dead, 4-9 m in height
  - Tie 3 climbing vines to support
- Pruning
  - Repeated head back to cause branching
  - Every 10 nodes prune back
  - 7-8 prunings to top of support
  - Maximize # of fruiting branches

Harvest

- First harvest
  - 18-20 months after planting
  - Flower to harvest, 4-10 months
- Harvest over 3-4 months
  - White pepper, 1-3 berries ripe
  - Black pepper, berries still green
  - Harvest every 2-3 weeks

Yields

- Well managed orchard in Sarawak
  - 1st picking, 8,000 to 9,000 kg/ha
  - 6th – 10th picking, 18,000 kg/ha
- Small farmers – primary producers
  - India: 900 - 1,000 kg/ha
  - Sri Lanka: 1,350 - 2,500 kg/ha
  - Brazil: 600 – 4,000 kg/ha
Processing - Two Products

- Black pepper
  - Mature but green
  - Spikes, hours to begin fermentation
  - Stripped off, dried to 12% moisture

- White pepper (less pungent, mellow)
  - Ripe and red
  - Berries stripped, in bags in running water
  - Softened pericarp is removed, washed
  - Buff colored berries dried

Any Questions?