Carob planting systems and orchard management

Dr. Joan TOUS
Empresas Innovadoras Garrofa (EiG), Spain
joan.tous.eig@garrofa.org
Carob growing areas in the Mediterranean basin

Carob production ≈ 300,000 t
Carob world globality

- Economic and environmental importance (300,000 t of carob) in the Mediterranean basin
- Spain (30% world crop, 80,000 t of carob, ≈)
- Morocco (18%, top world seed producer,↑)
- Italy (16%, decreasing crop; Sicily)
- Portugal (14%, new orchards)
- Greece (7%, stable crop; Crete ≈ 80% total)
- Australia (≈ 2000 t, new orchards)
Carob World Globality (I)

- Spain, Balearic
- Morocco
- Tunisia
- Portugal, Algarve
- Italy, Cerdeña
Carob World Globality (II)

Turkey, Antalya

Cyprus

Crete (Greece)

Australia, SA
Carob in Mediterranean basin: Current situation

- **Dryland traditional orchards**: cultivars with high pulp content and low densities (50 trees/ha)
- **Well suited to “part-time farming”**
- **Problematic aspects**: old orchards (90% of the total), small size, intercropping with other crops, pollination deficiencies and little cultural cares
- **Low yields, alternate bearing (drought, frost)** and low commercial quality
- **Low economic returns** (high harvest cost)
<table>
<thead>
<tr>
<th>Model</th>
<th>trees/ha</th>
<th>Training</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>≈ 50</td>
<td>vase</td>
<td>Mediterranean</td>
</tr>
<tr>
<td>Intensive (IR, II)</td>
<td>100-200</td>
<td>tall vase</td>
<td>Spain, Australia</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>100</td>
<td>tall vase</td>
<td>Australia, S.Africa</td>
</tr>
<tr>
<td>Intercropped</td>
<td>50-100</td>
<td>vase</td>
<td>Mediterranean</td>
</tr>
</tbody>
</table>
Traditional orchards
Intensive Orchards (IR, II)
Intercropped with carob trees
Intensive orchards: plant material
Carob tree yields (kg/ha): Comparison Traditional vs IS orchards

<table>
<thead>
<tr>
<th>Orchard age (years)</th>
<th>Traditional (45 trees/ha)</th>
<th>Modern (156 trees/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th/81</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6th/82</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7th/83</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8th/84</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9th/85</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10th/86</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11th/87</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12th/88</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13th/89</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14th/90</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15th/91</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: The comparison shows the yield increase over time for both traditional and modern orchards.
Pollination design
Hermaphrodite cultivars

Pollinators (12%)

Relation 1 P : 8 F

Pollinators, relation 1:2 (33%)
Plant Material Quality

- Propagation methods
  - Seed, budding, cuttings, “in vitro”
Orchard management

- Planting
- Pruning
- Soil management
- Fertilization
- Support irrigation (RDI)
- Pest and diseases
- Harvesting
Tie tree to stake

Training Pruning
Soil management:

- Mechanical tillage (majority) or green cover between rows
- No-tillage (herbicides), inter-row-disk or weed trimmer between trees, or more sustainable systems (pasturable).
Orchard management

- **Fertilization**
  - **Doses** (aprox.): 50 kg/ha N, 20 kg/ha P, 50 kg/ha K
  - **N**: 70% (March-June), 30% (Set-October)
  - **K2O**: May-July (*fruit quality*)

- **Support irrigation**
  - Drip irrigation (≈1000-2000 m³/ha)
  - April-July (*floral induction and fruit growth*)
  - **Advantages**: › yield, › pod quality, ‹ alternate bearing, and improve the economic return
● Pest and diseases

- Oidium
- Zeuzera
- Cercosporiosis, Pestalotiopsis sp.
- Rats
- Sexual confusion trap
Harvesting

- **Traditional**
  - Most usual. Main crop cost (0.15-0.18 €/kg)
  - Manual systems (long poles, rakes, plastic nets, bags, sacks, etc.).

- **Mechanical (few cases)**
  - Soil preparation (blowers, rollers..)
  - Fruit drop (trunk or branch shakers, ↓ FRF..)
  - Fruit drop and simultaneous harvesting (shakers with inverted umbrella or side-by-side trunk shaker)
  - Fruit harvesting on the ground (sweeper-row, vacuum-cleaners, pin-covered-roller, pick up harvester, etc.)
Traditional harvesting: Knocking down, long poles, bags, rakes, plastic nets, etc.
Mechanical harvesting:

Soil preparation: Blowers, compacting roller
Drop mechanization and fruit reception:
Trunk shaker with umbrella frames
Fruit harvesting on the ground: Sweeper-rows, Vacuum-cleaners, pin-covered-roller, pick up harvester
CONCLUDING REMARKS

- Traditional orchards in Mediterranean countries: small size, poor pollination, low cultural cares, with low yields and alternates and high harvest cost. Most of them are not competitive on the global market.

- Intensive models (IR,II), with high yielding cultivars, are the most sustainable options in both the larger orchards (> 25 ha, trunk shakers-TS, pick up harvesters and cleaned equipment), and the smaller orchards (using sweeper-vacuum harvesters, pin-covered-roller, and TS).

- Alternative crop adapted to part-time agriculture in dryland or in support drip irrigation areas with Mediterranean climates.
Thanks for your attention