Lesson 6

**Safflower**

*Carthamus tinctorius*

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**Economic Importance**

- Rich in PUFA (78%) – to reduce blood cholesterols
- Used for preparation of:
  - Margarine, and salad dressing
  - Varnishes, paints and surface coating materials
- Oil (28-32%) is also used in:
  - Infant food and liquid nutrition formulations
  - Effective non-allergenic dispersant for injectable medicines
  - Charred oil is used to heal sores and rheumatism
- Flowers
  - For dye extraction – red dye
  - Cosmetics preparations
  - Petals reported to have effects on circulatory systems
- Cake (30%)
  - Un decorticated cake as manure
  - Decorticated fed to ruminants and mono-gastric animals
  - Can be as human food, if bitter principles and phenolics are removed
- Hulls (40%) can be used for manufacture of
  - Cellulose, insulations, abrasions, hard boards and as fuel
- Thinned young plants are used as vegetables
  - Since contains carotene, riboflavin and vitamins
- It is crop as border against animals

**Origin and distributions**

- Vavilow (1926): India, Afghanistan or Ethiopia
- De Candole (1886): Arabia
- Modern assessment:
  - Area encompassing S. USSR, W. Iran, Iraq, Syria, S. Turkey, Jordan and Israel
- Distributed now:
  - Between 14° & 45° N and 15° & 35° S

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**World scenario – safflower (million ah & million t)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Area</th>
<th>Production</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>0.704</td>
<td>0.43</td>
<td>0.67</td>
</tr>
<tr>
<td>Canada</td>
<td>0.097</td>
<td>0.16</td>
<td>1.69</td>
</tr>
<tr>
<td>USA</td>
<td>0.095</td>
<td>0.20</td>
<td>2.05</td>
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<tr>
<td>Ethiopia</td>
<td>0.069</td>
<td>0.04</td>
<td>0.51</td>
</tr>
<tr>
<td>China</td>
<td>0.011</td>
<td>0.02</td>
<td>1.91</td>
</tr>
<tr>
<td>Australia</td>
<td>0.034</td>
<td>0.02</td>
<td>0.59</td>
</tr>
<tr>
<td>World</td>
<td>1.039</td>
<td>0.93</td>
<td>0.90</td>
</tr>
</tbody>
</table>
India Scenario – safflower (million ah & million t)

<table>
<thead>
<tr>
<th>State</th>
<th>Area</th>
<th>Production</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maharastra</td>
<td>0.49</td>
<td>0.23</td>
<td>0.48</td>
</tr>
<tr>
<td>Karnataka</td>
<td>0.19</td>
<td>0.08</td>
<td>0.42</td>
</tr>
<tr>
<td>AP</td>
<td>0.02</td>
<td>0.01</td>
<td>0.38</td>
</tr>
<tr>
<td>Gujarat</td>
<td>0.01</td>
<td>0.01</td>
<td>0.60</td>
</tr>
<tr>
<td>MP</td>
<td>0.01</td>
<td>0.01</td>
<td>0.58</td>
</tr>
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</tr>
</tbody>
</table>

**Climate**
- A day neutral plant
- But short day can prolong rosette stage
- Temp is more important than day length
  - Thermo-sensitive
    - Extremes of cold and heat not suitable
  - Tolerance to low temp at vegetative
  - But susceptible to high temp during flowering
  - For germination 15°C
  - Vegetative: 20-21°C
  - Flowering: 24 to 32°C
- Rainfall at flowering affects pollination
- Excessive humidity at any stage affects
- More suitable for rabi season in India

**The Plant**
- Highly branched, herbaceous
- Annual height varying from 30-150cm
- Well defined fleshy tap root system
- Stem is stiff cylindrical fairly thick at base and thin at top
- Central stem branches at 15-20cm to secondary
- Each branch terminates in a flower head
- The angle of branching is varietals but can be by environment also
- The leaf deeply serrated on lower stem, short, stiff, ovate at the inflorescence
- The inflorescence – numerous florets
- Flower color may vary from whitish yellow to red-orange
- The capitula, head size may vary from 1.25 to 4.0 cm
- The fruit achene, resembles small slightly rectangular sunflower seeds
- Seed weighs 250 – 800mg/grain

**Soils**
- Fertile, fairly deep and well-drained
- pH range of 5-8
- Shallow soils irrespective of fertility seldom produces high yield
- In traditional belts it is black cotton soil
- On heavy soils
  - This crop follows early Kharif crops
  - Or may often single crop in Rabi
o It is considered as salt tolerant next to cotton
o Tolerant to Na salts but < to Ca & Mg
o Salinity reduces seed size and oil content

**Seeds and sowing**

**Varieties**
- K1 120 days, CO 1 125 days
- Bhima (33% oil) - Maharastra
- JSF 1 (30%) – Rajasthan & MP
- Manjira – AP
- Nira – (30%) Maharastra & TN
- HUS 305 (35%) for Peninsular India

**Seed rate**
- 7-20 kg depending upon spacing and variety

**Spacing**
- 45 x 15 cm  in TN
- 45 x 20 cm
- 60 x 30 cm etc

**Seed treatment**
- Pre-sowing seed hardening
- Use fresh seeds every year

**Sowing**
- From last week of Sep to end of Oct
- Early sowing has advantage
- Line sowing using improved seed drill
- Ferti cum seed drill is more desirable
- Seeds can be sown behind the plough also
- Small furrow may be opened and seeds dropped and half coved
- Depth of sowing may be 5-7.5 cm
- Light planking for the soils which looses moisture

**Nutrient management**

**Rainfed crops**
- N ranges from 25 kg N to 50 kg
- P₂O₅ – 20 to 50 kg
- K₂O – Mostly not recommended
- General: 40:20:0

**Irrigated**
- 60:30:20 (Chatisgarh) to
- 75:75: 35 (Karnataka)

**Time of fertilizer application**
- Rainfed – basal – deep placed by ferti-cum seed drill
- Irrigated 50% N+ full P & K as basal
- Remaining half N at 5th week during 1st irrigation
**Water management**
- It is deep rooted xerophytic plant, can thrive under scarce soil moisture
- One or two irrigations (25 & 75 DAS) is optimum
- Sensitive to excess moisture at any stage
- If the soil profile contains 250mm ASM
  - ET of the season is 250-300mm - no response to irrigation
- Under irrigated condition the crop may be sown under Broad beds of 1.35 to 1.8m and furrow
  - To drain the excess water
- Points to remember:
  - If one irrigation is possible, provide it at critical period
  - Avoid contact of above ground parts with irrigation water

**Weed management**
- Being wider spaced
  - Critical periods for weed management extends up to end of rosette (25-50DAS)
- Hand weeding and hoeing
  - At 20 and 35 DAS is good
- Herbicides
  - PPI – Fluchloralin 0.75 to 1.0 kg
  - PE – Oxadiazone – 0.75 -1.0 kg or
  - PE – Pentimethalin – 0.75 kg

**Important intercultural operations**
- Thinning to single plant and filling the gap at the early stage (before 15DAS)
- Nipping of central shoot to induce branching
- Bird damage:
  - By parrots at Isolated pockets
  - Cultivate in contiguous block
  - Bird scaring - morning and evening during
    - Seed filling to physiological maturity

**Harvesting**
- Duration of the crop varies due to regions
  - 115-140 days
  - 120-125 days in TN
  - Gujarat & Orissa – 140-150days
  - In cooler regions 150-180days
- Maturity
  - When the lower leaves and most of the bracteoles dry and brown
  - Harvest in the early hours
    - Shattering minimum
    - Spines relatively soft
  - Combine harvester is becoming popular now since
    - Manual harvesting, bundling, threshing are all becoming problematic
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**Yield**
- In improved agro-techniques are used
  - Under scanty moisture – 800-1200 kg/ha
  - Under favourable 1500-2000 kg
  - Under irrigated – 1800-2800 kg/ha

**Storage**
- 5% moisture, clean and dry

**Cropping system**
- It is potential crop to replace dry rabi crops
  - Wheat, coriander, linseed, chickpea, pulses
- In traditional areas it is raised as intercrops
  - Sorghum, wheat, linseed, chickpea, coriander etc.
- Sequence cropping
  - Farmers rarely raise more than one crop due to non availability of moisture
  - There is scope for double cropping either preceding with Kharif crop or after rabi by irrigation