IMPORTANCE OF SUNFLOWER OIL

- Among the vegetable oils most suitable to coronary system
- High level of linoleic acid and absence of linolenic acid
- PUFA (Polyunsaturated fatty acid) – Linoleic content is more (67%) and about 90% unsaturated (+monounsaturated 21%)
- Major ingredient in margarine and shortening products

Origin & spread

- Probably from South - West America
- Sunflower was introduced into Europe in 16th century
- Reached Europe from Mexico via Spain
- It was ornamental
- Reached Russia via Holland in 18th century
- First commercial production for oil -1830-40

Sunflower world scenario in 1999 (Million ha & million t)

<table>
<thead>
<tr>
<th>Country</th>
<th>Area</th>
<th>Production</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russian Federation</td>
<td>5.94</td>
<td>6.75</td>
<td>1.14</td>
</tr>
<tr>
<td>Argentina</td>
<td>2.19</td>
<td>3.80</td>
<td>1.73</td>
</tr>
<tr>
<td>Ukraine</td>
<td>3.92</td>
<td>5.32</td>
<td>1.36</td>
</tr>
<tr>
<td>India</td>
<td>2.13</td>
<td>1.12</td>
<td>0.53</td>
</tr>
<tr>
<td>USA</td>
<td>0.71</td>
<td>0.96</td>
<td>1.36</td>
</tr>
<tr>
<td></td>
<td>Area ('000 ha)</td>
<td>Production ('000 t)</td>
<td>Productivity (kg/ha)</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>--------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Romania</td>
<td>0.98</td>
<td>1.53</td>
<td>1.55</td>
</tr>
<tr>
<td>China</td>
<td>1.03</td>
<td>1.82</td>
<td>1.77</td>
</tr>
<tr>
<td>World</td>
<td>23.70</td>
<td>31.33</td>
<td>1.32</td>
</tr>
</tbody>
</table>

(FAOSTAT, 2006)

Indian Scenario of sunflower

<table>
<thead>
<tr>
<th>State</th>
<th>Area ('000 ha)</th>
<th>Production ('000 t)</th>
<th>Productivity (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karnataka</td>
<td>1427</td>
<td>787</td>
<td>552</td>
</tr>
<tr>
<td>Maharastra</td>
<td>355</td>
<td>206</td>
<td>580</td>
</tr>
<tr>
<td>AP</td>
<td>444</td>
<td>298</td>
<td>671</td>
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<tr>
<td>Punjab</td>
<td>17.8</td>
<td>28.7</td>
<td>1612</td>
</tr>
<tr>
<td>Bihar</td>
<td>22.6</td>
<td>26.4</td>
<td>1345</td>
</tr>
<tr>
<td>UP</td>
<td>12.6</td>
<td>16.1</td>
<td>1278</td>
</tr>
<tr>
<td>TN</td>
<td>17.1</td>
<td>21.2</td>
<td>1240</td>
</tr>
<tr>
<td>India</td>
<td>2339.6</td>
<td>1439</td>
<td>615</td>
</tr>
</tbody>
</table>

(Ministry of Agriculture, Govt. of India, 2005-06)

Favourable features for growth of sunflower in India

- Wide adaptability
- Photoperiod insensitiveness
- Shorter duration (60-100 days)
- High quality edible oil (PUFA)
- High seed multiplication ratio (>1: 80)
- Easier & cheaper cultivation
- Remunerative market price
- Suitable for mechanization
Stages of Sunflower

- Erect, tall usually un-branched
- Plant height, head size, days to flowering & maturity are all vary due to environment
- Root – tap root - but thick root mat with short tap root is common
  - May be problem in light soil to heavy mass - lodging
  - Limitations in the exploitation of soil moisture & nutrients
  - Earthing-up interferes with roots
  - Irrigation frequency should be short to meet the demand
  - Waterlogging adversely affects the crop due to weakening of anchorage and proliferation of fungal diseases
- The stem
  - Mostly unbranched
  - Branching is not desirable
    - Basal branching may be useful
    - Leaf axil branching problem
    - N triggers branching
  - Green stem contributes for photosynthesis
  - Ht varies
    - 80-120 short can accommodate more plants
- 120-150 medium
- 150-180 tall

- The leaf
  - Varies with plant type and environment
  - Limited to number of nodes
  - 8 to as many as 70
  - Arranged alternate at right angle

- The inflorescence
  - Capitulum borne terminally
  - Surrounded by one or more whorls of bracts called involucre (modified leaves)
  - Head diameter is yield deciding factor

- Anthesis and fertilization
  - Flowering from periphery
  - Outermost opens first
  - Daily 1-5 rows continues up to 5-10 days

- The seed
  - Seed is called ‘achene’
  - Seed size 7-25mm long, 4-13m long, 3-7.5mm thick
  - Dormancy normally 10-45 days
  - Oil content 36-37%
  - 1000 seed weight 43-45g

- The climate
  Temp range 8-34°C
  Optimum 20 & 25°C
  Requires cooler (15-20°C) growing period and warmer maturing period (20-25°C)
  Base minimum is 10°C
  High temp (>38°C) in post-anthesis inhibit quantity and quality of oil
  Rainfall of 500mm, with 300 mm it can yield
  Avoid flowering coincide continuous drizzle

- Soil
  - Can be in wide range of soils
  - Any soil with good drainage is more important
  - Neutral to moderately alkaline soils
pH ranges 6.5 to 8.0
- Complete failure in sandy soil with pH 4.6

**Varieties**
- CO1, CO2, CO 3, CO 4
- Modern, K2, K1, BSH 1
- EC 68415

**Hybrids have advantage than varieties**
- High yield potential
- Uniform crop stand
- More self-fertile, less problem of seed set
  - MSFH 1, BSH 1

**Seasons**
- Rainfed
  - June-July, Kharif in North
  - Oct-Nov
- Irrigated
  - Dec - Jan
  - April – May

**Field preparation**
- Fine tilth
- Apply FYM / Compost incorporate
- Ridges and furrows

**Spacing**
- 30 to 60cm according to variety
- 10 to 15 cm for short & medium stature
- 15 to 30 cm for tall (>120cm)

**Seed rate**
- @ 2 seeds per hole
- Seed weight of 45g/1000
  - 30 x 10 30 kg
  - 30 x 15 20kg
  - 30 x 30 10kg
  - 60 x 30 5kg

**Seed treatment**
- Trichderma 4 g /kg
- Azospirillum 600 g to one ha
- Soaking the seeds
  - 2% ZnSO4 for 12hrs and
  - Shade drying for rainfed sowing is desirable

**Sowing**
- Well prepared deep, friable seedbed is more preferable
- Depth of sowing 3-5cm

**Plant population**
- 55,000 to 98,000 /ha almost same yield
- If the head diameter is <10cm more population
- If >20cm less population

**Thinning**
- Highly sensitive to intra-specific competition

**Nutrient management**
- Fast growing high oil yielding thus requires more nutrients
- Low yield in India is attributed to poor fertile soil, cultivated in rainfed conditions
- A crop yielding 2 t seed, 3.2t stover and 0.8t root uptakes
  - 82 kg N, 13 kg P, 60 kg K, 9.4 kg S, 37 kg Ca and 21 kg Mg.

**State wise nutrient recommendation**
- TN  40-20-20
- UP  80-60-40
- AP - Rainfed  60-30-0
  - Irrigated Hybrids  60-90-30; Variety  30-60-30
Weed management
- Fluchloralin / Pendimethalin
  - 2.0kg as pre-mergence
  - High volume spray
- Hoeing and weeding on 15th day & 30th day
- Within three days irrigate the filed

Water management
- Immediately after sowing
- 4-5 days later once
- Interval of 7-8 days
- Seeding, flowering and seed development stages are critical

Seed setting and filling
- Problem is seen with poor seed setting
- This problem is more in warmer regions
- In India seed filling under good management is only 75%
- It will be as low as 10-20%
- Reasons
  - Genetic
  - Environmental
  - Physiological
  - Availability of pollinators

Maturity
Physiological maturity (30-40% seed moisture)
- When the back of the head turns green to lemon yellow
- There will be 5-6 green leaves at this stage

Harvest maturity (10-12%)
- Delay beyond harvest maturity severe yield loss
Cropping systems

Sequential cropping

- Southern India
  - Rainfed - Sunflower – millets/pulses
  - Irrigated- Rice – sunflower
- North
  - Rainfed - SF – wheat / chickpea

Row intercrop

- Groundnut + SF
- Pigeanpea + SF
- Castor + SF
- Pulses + SF

Multiple choice questions

1. Origin of sunflower is ______
   a. India    b. Argentina    c. South west America

2. Scientific name of sunflower is ______
   a. Helianthus annuus    b. Carthamus tinctorious    c. Sesamum indicum

3. Total production of sunflower in the world is ____ m tonnes
   a. 22.27    b. 28.48    c. 33.23

4. Total production of sunflower in India is ______ m tonnes
   a. 2.25    b. 1.25    c. 3.25

5. Oil content of sunflower is _________
   a. 38-40 %    b. 30-32 %    c. 36-37 %

6. Nutrient recommendation for sunflower in Tamil Nadu is ________ kg NPK/ha
   80:60:40    b. 60:30:0    c.40:20:20

7. Saturated fatty acid content in sunflower is ________
   a. 12 %    b. 15 %    c. 10 %

8. Mono unsaturated fatty acid content in sunflower is ________
   a. 16 %    b. 15 %    c. 10 %