

LECTURE 11
SUNFLOWER
Helianthus annuus

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)

Country	Area	Production	Productivity
Russian Federation	5.94	6.75	1.14
Argentina	2.19	3.80	1.73
Ukraine	3.92	5.32	1.36
India	2.13	1.12	0.53
USA	0.71	0.96	1.36

Romania	0.98	1.53	1.55
China	1.03	1.82	1.77
World	23.70	31.33	1.32

(FAOSTAT, 2006)

Indian Scenario of sunflower

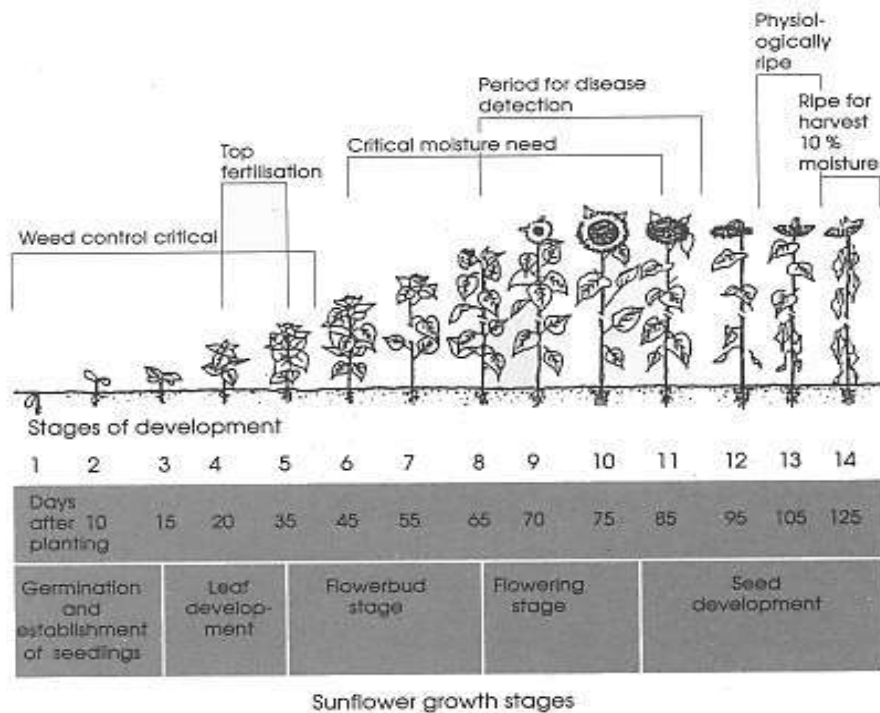
State	Area ('000 ha)	Production ('000 t)	Productivity (kg/ha)
Karnataka	1427	787	552
Maharashtra	355	206	580
AP	444	298	671
Punjab	17.8	28.7	1612
Bihar	22.6	26.4	1345
UP	12.6	16.1	1278
TN	17.1	21.2	1240
India	2339.6	1439	615

(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 accomodate 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, 4-13mm 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

- Trichoderma 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 field

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
 - Pigeonpea + 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
 - a. 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 %