

LECTURE 13**SAFFLOWER*****Carthamus tinctorius***

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 distribution

- *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

World scenario –safflower (million ah & million t)

Country	Area	Production	Productivity
India	0.42	0.23	0.55
Canada	0.002	0.002	1.00
USA	0.086	0.087	1.02
Ethiopia	0.009	0.006	0.67
China	0.012	0.03	2.50
Australia	0.033	0.036	1.09
World	0.822	0.58	0.71

(FAOSTAT, 2006)

India Scenario – safflower

State	Area ('000 ha)	Production ('000 t)	Productivity (kg/ha)
Maharashtra	263	159	605
Karnataka	81	60	741
AP	17	80	471
Orissa	1.3	0.8	615
MP	1.0	0.3	300
India	364.6	228.6	627

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

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
- It is considered as salt tolerant next to cotton
- Tolerant to Na salts but < to Ca & Mg
- Salinity reduces seed size and oil content

Seeds and sowing

Varieties

- K1 120 days, CO 1 125 days
- Bhima (33% oil) - Maharashtra
- JSF 1 (30%) – Rajasthan & MP
- Manjira - AP
- Nira – (30%) Maharashtra & 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 covered
- Depth of sowing may be 5-7.5cm
- Light planking for the soils which loses 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 – 800-1200kg/ha

- Under favourable 1500-2000 kg
- Under irrigated – 1800-2800kg/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

Multiple choice questions

1. Scientific name of safflower is _____
 - a. *Helianthus annuus* **b. *Carthamus tinctorious*** c. *Sesamum indicum*
2. Oil content of safflower is _____
 - a. 24-28 % b. 26-28 % **c. 28-32 %**
3. Which of the following is used for dye extraction
 - a. Sunflower **b. Safflower** c. Sesame
4. Total production of safflower in the world is _____ m tonnes
 - a. **0.93** b. 0.98 c. 0.88
5. Total production of safflower in India is _____ m tonnes
 - a. 0.70 **b. 0.43** c. 0.67

6. Spacing followed for safflower in Tamil Nadu is _____
 - a. 40 x 20 cm
 - b. 60 x 30 cm
 - c. 45 x 15 cm**
7. Seed rate for safflower varies from _____ to _____ kg/ha depending upon the variety and spacing
 - a. 7 – 20**
 - b. 5 – 10
 - c. 20 – 25
8. General fertilizer recommendation for rainfed safflower is _____ kg NPK /ha
 - a. 60:30:20
 - b. 40:20:0**
 - c. 75:75:35
9. Saturated fatty acid content in safflower is _____
 - a. 12 %
 - b. 15 %
 - c. 10 %**
10. Mono unsaturated fatty acid content in safflower is _____
 - a. 12 %
 - b. 15 %
 - c. 14 %**