Lesson 4

Sunflower

Helianthus annuus

About sunflower

- It was an ornamental before 1969 in India
- It is popular oil seed crop today
- Its name is with reasoning
- Annual but there are perennials
- Competing with 4 major oil seeds of the world after mid 19th century
  - Soybean, rapeseed, cotton seed, peanut
  - Soybean and cotton seed has other values as protein meal and fibre

Specialty 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
- After second world war introduction of Russian varieties such as Peredoviv, Mennonite & Sunrise led to the development of this crop in Europe & America
- In India it was only ornamental till 1969
  - Introduction of Peredoviv, Armveski varieties from Russia in 1969 led for the spread

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

Country	Area	Production	Productivity
Russia	3.98	4.20	1.05
Argentina	3.79	6.50	1.72
Ukraine	2.78	2.75	0.99
India	2.25	1.25	0.56
USA	1.39	1.99	1.41
Romania	1.04	1.21	1.17
Spain	0.87	0.56	0.64
China	0.86	1.55	1.80
South Africa	0.82	1.21	1.46
France	0.80	1.87	2.34
Turkey	0.55	0.86	1.58
World	**22.84**	**1.25**	**28.48**

Indian Scenario of sunflower in 1999 (million ha & million t)

State	Area	Production	Productivity
Karnataka	0.88	0.36	0.41
Maharastra	0.52	0.32	0.62
AP	0.29	0.22	0.75
Punjab	0.10	0.16	1.54
Haryana	0.06	0.11	1.76
UP	0.03	0.04	1.46
TN	0.02	0.02	1.17
India	**2.25**	**1.25**	**0.56**

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

The plant

- 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 accomododate 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

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