Lesson 8

Linseed

Linum usitatissimum

Linseed

- It is dual purpose crop like soybean and cotton. It is called 'Old world fibre'. Of late in India it is used primarily for oilseed.
- Linseed fibre or FLAX first of the vegetable fibres spun to cloth
- Oil in seed was used only later
- When grown for fibre called as Fibre flax
- When identified for oil then
    - Oil flax or
    - Seed flax or
    - Linseed
- Linola – (Edible linseed)

Importance of Linseed

- It is primarily considered for fibre - FLAX
- In India primarily for oil seed
- Entire plant has usage
- Oil
    - 80% for industrial purpose
    - Very small scale for direct consumption
    - Rich in Linolenic acid (66%)
        - Perfect drying oil, used in paint & varnish industry
    - Used for manufacture of lithographic inks and soaps and coating of high ways
    - After hydrogenation, substitute for tallow (hard fat from animals)
- Oil cake good for milch animal & as manure
- Stem yield good quality fibre (linen) having strength and durability
- Fibres are lustrous and blend well with wool, silk, cotton
- Strong canvas, suiting, shirting and various indispensable products for defense purposes
- Woody matter for high quality paper
- Demand is increasing, as a result import is going on

Problems and prospects for linseed in India

- As fibre there is scope, even today, but farmers' preference is for oilseed.
- As oil seed also its is importance for industry is declining due to:
    - Paint industries are relying on synthetic and petroleum based alternatives
- Expansion of area is limited to cooler regions only

World Scenario – Linseed - 1999-2000 (million ha & million t)

Country	Area	Production	Productivity
India	0.80	0.28	0.34
Canada	0.79	1.05	1.32
China	0.57	0.20	1.30
Ukraine	0.21	0.30	1.41
UK	0.21	0.30	1.41
Germany	0.20	0.34	1.69
USA	0.16	0.20	0.39
Russia	0.11	0.03	0.25
Argentina	0.10	0.09	0.84
World	**3.48**	**2.98**	**0.86**

Indian Scenario – Linseed – 1999 -200 (Million ha & million t)

State	Area	Production	Productivity
MP	0.40	0.13	0.34
UP	0.13	0.06	0.47
Maharastra	0.13	0.04	0.30
Bihar	0.06	0.03	0.57
India	**0.80**	**0.28**	**0.34**

Linseed is also cultivated in Assam, HP. J&K, Karnataka, AO, Nagaland, Orissa, Rajasthan, WB, and Punjab in India.

Origin

- No clear centre
- May be from Ethiopia
- Persian gulf
    - The Caspian sea and Black sea
- Possibilities of introduction to India
    - By Aryans from Central Asia
    - From Europe sources
    - Aryan materials crossed with other species
    - Independent origin of Peninsular linseed in the South and Gangetic linseed in the North

The plant

- Annual herb
- Tap root system
    - Gangetic group – shallow with secondary roots
    - Peninsular – deep tap root – drought tolerant
- Stem either erect or procumbent
    - Fibre varieties are thin, tall growing, less tillering
    - Oil seed are dwarf, highly tillering and branched
- Leaves
    - Attractive
    - Linear to lanceolate

    - Smooth, margin entire, tapering to blunt apex
    - Green to bluish green with variable size & thickness
- Inflorescence
    - Carymbose, with single flower
    - Petals 5, varying colors
    - Ovary is 5 celled, each locule divided into two by false septum thus making 10 roomed capsule with each with one ovule
    - The fruit is capsule of 5-10mm diameter
    - Mature capsule is dehiscent
- Seeds
    - Oval, smooth, shiny and pointed
    - Seed color varies from pure yellow, yellowish with brownish tinge, light brown, to deep brown
- Pale yellow – edible
    - Linola, Linoleic is higher
- Brown – industrial purpose

Climate

- Requires moderate to cool temp during vegetative
- Dry weather during maturity
- Crop for oil seed
    - Moderate cool climate
- Crop for fibre
    - Cool and moist climate
- Susceptible to frost
- Fairly resistant to drought
- Well distributed rainfall, but not heavy rains
- Also grown as irrigated in dry regions

Soils

- Variety of soils except sandy and poorly drained soils
- Well drained fertile, medium heavy soils, silty loam, clay loam and silty clay are best
- Soil pH 5.0 to 7.0
- Acid range 6.0 is more suitable
- Oil content decreases but iodine increases under saline

Management

- Field preparation
    - Beds and channel
    - For rice fallow in standing crop
- Varieties
    - For ‘Rice fallow’ – R 552
    - For ‘ Rainfed’ – Kiran, Sheetal
    - For Irrigated – Jawahar 23
    - For both rainfed & irriagted situation of Assam, Bihar, WB & Punjab:
        - Shubra, Himalini
- Season

    - Oct – Nov 15th
    - Middle of October is best suitable
- Seed rate
    - 25-50 kg varies due to
        - States
        - Varieties
        - Methods
    - Bold seeded 50 kg
    - Rice fallows
        - 35kg cuscuta free seeds
- Spacing
    - Drill seeding
        - 20-30cm row
        - Plant to plant 7-10cm
    - Rice fallow
        - Broadcast seeding
- Depth of sowing
    - 2-3cm, shallow seeding is good
- Seed treatment
    - With fungicides before sowing

Nutrient Management

- Irrigated crop
    - Seed purpose: 90:30:30
    - Double purpose: 120:40:40
    - Apply N in 2 splits
        - Basal
        - At first irrigation – 25-30DAS
- Rainfed
    - 40:20:20 all basal
- Rice fallow / Utera / Piara
    - Management starts with previous rice
    - Nutrients applied to rice
    - Leveling, weed management and water management all like rice fallow pulse of Tamil Nadu

Water Management

- Responds well to irrigation
- >90% is rainfed even then one or two irrigations will enhance the yield
    - Two irrigations at 35 & 75 DAS
    - In light soils 3-4 irrigations
    - Drought during after flowering reduces the seed yield
    - Moisture stress at stem elongation benefits seed yield
    - With more (>4) number of irrigations
        - WUE decreases
        - Oil content decreases

Weed Management

- Crop-weed competition is – 20-45 DAS

- Hoeing and aerating 15 and DAS
- Herbicides:
    - PPI – Fluchloralin @ 1.0 kg
    - PE – Methabenzthiozuran @ 1kg
    - Post Emergence – Dichlofop-methyl @ 0.7 kg at 30 DAS
- Cuscuta is menace with linseed
    - Crop rotation with non-host cereals
    - Herbicides:
        - Pronomide @ 1.5kg as post-emergence at 2-3 weeks stage
        - PPI of Fluchloralin itself is sufficient to reduce infestation

Maturity

- When the stem become
    - Woody
    - Capsules turn hard
    - Leaves dry
    - the capsules turn brown and
    - the seeds become shiny

Harvest

- Sickle the entire plant

Threshing & Post harvest processing

- Cut crop is field dried for 3-4 days
- Plants with secondary and tertiary branches to be separated with capsules for seed
- After threshing for seeds stalk are processed for fibre

Retting

- It is a process of fibre extraction
- Kinds of retting
    - Hot water, cold water, snow, dew retting
    - Temp decides duration of retting and quality
    - Standing warm water is more suitable than running cold water
    - Double retting is in practice in cold countries
    - Retting period is 4-6 days
- After retting cleaned in running water, dried and ready for scutching
    - To separate the valuable fibers of (flax, for example) from the woody parts by beating
- Rainfed areas in India water availability is problem hence they are not opting to fibre flax

Oil quality

- Depends up on hull thickness
- Yellow seeds possess thin hull and more oil
- Refining the pigments are necessary to improve the quality

Fibre

- Great strength, fineness & durability
- Less stretchy, more durable and better resistant to environmental fluctuations than cotton and jute

Double Purpose Linseed

- Looking for fibre and oil is advantageous

- Varieties needed for this purpose
- Double purpose varieties may show differential response
    - In temperate region with long growing period, controlled supply of N can do the need
    - Extraction of fibre requires cooler climate for retting
    - This is a major limitation in our country
    - Of late invention on development of dry scutching machine may be a boon to produce fibre from oil seed stems too

Cropping systems

- As pure crop
    - Cultivation is restricted to areas where no other crop is possible
    - Productivity under the situation is very low & subject to pests and disease outbreak
- As sequential crop
    - Hybrid maize – linseed + wheat
    - Groundnut – linseed + wheat
    - Rice (early) – linseed
- An intercrop
    - Linseed + chickpea / wheat / potato / safflower

Linola

- A new crop developed
- Low linolenic acid mutants
- Have elevated levels of linoleic acid, 65 - 76%.
- Reduction in linolenic acid greatly increases the oxidative stability of the oil
- It becomes an edible PUFA oil equal to sunflower in fatty acid
- The colour of the seed is also changed, with edible linseed being a pale yellow colour enabling it to be distinguished from non-edible linseed, which is brown

Development of edible linseed is a joint venture between

- CSIRO (Commonwealth Scientific and Industrial Research Organisation, Australia) and United Grain Growers Ltd of Winnipeg, Canada (UGG Ltd)
- This crop has been named Linola.
- Linola is a registered trademark of CSIRO
    - Specialty of Linola – it's oil quality
    - Mostly cultivated in Australia & Canada
    - 60-130 thousand ha =(0.06 to 0.13 m ha)

Fatty acid composition of Linola with 5 major vegetable oils (%)

Crop	Saturated	Mono unsaturated	PUFA		P/S
		Oleic	Linoleic	Linolenic	
Linola	10	17	71	2	7.3
Safflower	10	14	76	Trace	7.6
Sunflower	12	16	71	Trace	6.0
Maize	13	29	57	1	4.5
Soybean	15	23	54	8	4.1
Canola	7	61	21	11	4.6