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 highways
  - 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 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)

<table>
<thead>
<tr>
<th>Country</th>
<th>Area</th>
<th>Production</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>0.80</td>
<td>0.28</td>
<td>0.34</td>
</tr>
<tr>
<td>Canada</td>
<td>0.79</td>
<td>1.05</td>
<td>1.32</td>
</tr>
<tr>
<td>China</td>
<td>0.57</td>
<td>0.20</td>
<td>1.30</td>
</tr>
<tr>
<td>Ukraine</td>
<td>0.21</td>
<td>0.30</td>
<td>1.41</td>
</tr>
<tr>
<td>UK</td>
<td>0.21</td>
<td>0.30</td>
<td>1.41</td>
</tr>
<tr>
<td>Germany</td>
<td>0.20</td>
<td>0.34</td>
<td>1.69</td>
</tr>
<tr>
<td>USA</td>
<td>0.16</td>
<td>0.20</td>
<td>0.39</td>
</tr>
<tr>
<td>Russia</td>
<td>0.11</td>
<td>0.03</td>
<td>0.25</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.10</td>
<td>0.09</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>World</strong></td>
<td><strong>3.48</strong></td>
<td><strong>2.98</strong></td>
<td><strong>0.86</strong></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>State</th>
<th>Area</th>
<th>Production</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>0.40</td>
<td>0.13</td>
<td>0.34</td>
</tr>
<tr>
<td>UP</td>
<td>0.13</td>
<td>0.06</td>
<td>0.47</td>
</tr>
<tr>
<td>Maharastra</td>
<td>0.13</td>
<td>0.04</td>
<td>0.30</td>
</tr>
<tr>
<td>Bihar</td>
<td>0.06</td>
<td>0.03</td>
<td>0.57</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td><strong>0.80</strong></td>
<td><strong>0.28</strong></td>
<td><strong>0.34</strong></td>
</tr>
</tbody>
</table>

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

Maturity
• When the stem become
  o Woody
  o Capsules turn hard
  o Leaves dry
  o the capsules turn brown and
  o 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
  o Hot water, cold water, snow, dew retting
  o Temp decides duration of retting and quality
  o Standing warm water is more suitable than running cold water
  o Double retting is in practice in cold countries
  o Retting period is 4-6 days
• After retting cleaned in running water, dried and ready for scutching
  o 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
    o In temperate region with long growing period, controlled supply of N can do the need
    o Extraction of fibre requires cooler climate for retting
    o This is a major limitation in our country
    o 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
  o Cultivation is restricted to areas where no other crop is possible
  o Productivity under the situation is very low & subject to pests and disease outbreak
• As sequential crop
  o Hybrid maize – linseed + wheat
  o Groundnut – linseed + wheat
  o Rice (early) – linseed
• An intercrop
  o 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
  o Specialty of Linola – it’s oil quality
  o Mostly cultivated in Australia & Canada
  o 60-130 thousand ha =(0.06 to 0.13 m ha)
<table>
<thead>
<tr>
<th>Crop</th>
<th>Saturated</th>
<th>Mono Unsaturated</th>
<th>PUFA</th>
<th>P/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linola</td>
<td>10</td>
<td>17</td>
<td>71 2</td>
<td>7.3</td>
</tr>
<tr>
<td>Safflower</td>
<td>10</td>
<td>14</td>
<td>76 Trace</td>
<td>7.6</td>
</tr>
<tr>
<td>Sunflower</td>
<td>12</td>
<td>16</td>
<td>71 Trace</td>
<td>6.0</td>
</tr>
<tr>
<td>Maize</td>
<td>13</td>
<td>29</td>
<td>57 1</td>
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<tr>
<td>Soybean</td>
<td>15</td>
<td>23</td>
<td>54 8</td>
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<tr>
<td>Canola</td>
<td>7</td>
<td>61</td>
<td>21 11</td>
<td>4.6</td>
</tr>
</tbody>
</table>