

Linseed: An oilseed crop

harnessing the power of nature

Parkash Verma, Supriya*, Rakesh Kumar, Birendra Kumar and Bal Krishna

ICAR-National Dairy Research Institute, Karnal, Haryana 132 001

Linseed, also known as flaxseed, is an oilseed crop that has gained significant attention in the field of agronomy due to its numerous benefits. With its versatile nature, linseed holds immense potential not only as a cash crop but also as a source of nutrition and industrial applications. The oil extracted from linseed is rich in omega-3 fatty acids, making it highly sought after in the food and health industry. Its nutritional properties contribute to improved cardiovascular health and cognitive function, leading to increased demand for linseed oil-based products such as cooking oils, dietary supplements, and salad dressings. Linseed also possesses high-quality fibre having remarkable properties, including high strength and absorbency, making it ideal for various applications. In the textile industry, linseed fibre is used to produce linen fabrics known for their durability, breathability, and luxurious feel. The plant also improves soil fertility, reduces soil erosion, and requires fewer pesticides and fertilizers compared to other crops. Moreover, the use of linseed plant as a whole to produce innovative industrial products would enhance the sustainability of natural resources.

Keywords: Flaxseed, Linoleum, Retting, Utera

Linseed (*Linum usitatissimum*) is a versatile and highly valued oilseed crop with a rich history dating back thousands of years. Belonging to the Linaceae family, this annual plant has been cultivated for its seeds, which are commonly referred to as flaxseeds. It is mainly grown in Madhya Pradesh, Chhattisgarh, Karnataka, Jharkhand, and Bihar. The current status of linseed production is 3.34 million metric tonnes. India ranks 3rd and shares about 9% of world's linseed production. India is expected to produce around 140 metric thousand of linseed. Linseed is renowned for its multiple applications in various industries, including food, medicine, and textiles. Linseed oil, also called flaxseed oil, is rich in omega 3 fatty acid, lignans and other beneficial compounds, making it a valuable dietary supplement and ingredient in various health products. Linseed fibre, derived from the stems of the flax plant,

holds significant importance as a versatile natural resource. This fibrous material, extracted from the plant's stalks, offers numerous benefits across various industries, including textiles, construction, and even healthcare.

Plant structure

Linseed is an annual herbaceous plant that typically grows upright, reaching heights of around 1–1.5 m (3–5 feet). The stem is slender, erect, and branching with a smooth texture.

Leaves

The leaves of the linseed plant are simple, narrow and alternate. They are lanceolate in shape, measuring about 2–4 cm (0.8–1.6 inches) in width and 2–6 cm (0.8–2.4 inches) in length. The leaves are sessile or have very short petioles and have a prominent midrib running along their length.

Flowers

Linseed produces attractive, delicate flowers that bloom from late spring to early summer. The flowers are typically pale blue, although cultivars with white or pink flowers also exist. The flowers are symmetrical, with five petals arranged in a cup-shaped structure. Each flower has a diameter of approximately 2 cm (0.8 inches). The plant is also known for its transient blossoms, with individual flowers lasting only a day.

Fruit and seeds

After pollination, the flowers give rise to a fruit called a capsule or boll. The capsule is round and measures about 6–8 mm (0.2–0.3 inches) in diameter. Within the capsule are small, flat, oval-shaped seeds, which are the linseeds or flaxseeds. These seeds are usually shiny and range in colour from golden yellow to reddish-brown.

Roots

Linseed plants have a fibrous root system, with numerous small, branching roots that spread out horizontally in the soil. These roots help anchor the plant and absorb water and nutrients from the surrounding soil.

Cultivation practices

Soil preparation and planting: Linseed thrives in well-drained loamy or sandy soils with a pH range of 6.5–7.5. Before planting, conduct a soil test to assess nutrient deficiencies and adjust accordingly. Prepare the field by ploughing, followed by harrowing to create a fine seedbed. Optimal sowing time varies depending on the region, but generally, linseed is sown in early spring.

Seed rate: 25–30 kg/ha.

Spacing: 20–30 cm × 7–10 cm.

Sowing method: Can be drilled in the field directly or broadcast in standing rice which is known as Utera cultivation.

Sowing time: October to the first fortnight of November.

Variety: Some important varieties of linseed are R-7 (Jawahar-7), R-552, Kiran, Deepika, RLC-81, 133, 161, 153, 148, 167,

Nutrient management: Fertiliser at a rate of 40 kg/ha N, 20 kg/ha P, and 20 kg/ha K is required. Dual cropping (oil+fibre) requires a higher dose of fertilizers.

Irrigation: The critical stages of irrigation are branching followed by flowering and grain filling. This crop requires 3–4 irrigations.

Weed control: In this crop, *Cuscuta* is a major parasitic weed. Crop rotation has been proven to be highly successful. The post-emergence treatment of the weedicide isoproturon @1.00 kg/ha at 30–35 DAS might be used to control weeds. In contrast, if broad leaf weeds are a concern as well, 2,4-D (Na) @0.5 kg/ha may also be used with isoproturon in the tank.

Pest and disease: Linseed is susceptible to various pests and diseases, including aphids, caterpillars, powdery mildew, and wilt. Spinosad 45 SC (0.015%) used twice a week can reduce bud

fly infection by up to 78% while increasing seed output by up to 63%. Two applications of a commercial formulation made from neem that contains 300 ppm of azadirachtin reduce bud infection by up to 63%, increasing seed output by up to 40%.

Harvesting and post-harvest handling: Linseed is ready for harvest when the lower capsules turn brown and the seeds rattle within the capsules. Ideally, harvest when the moisture content of the seeds is around 10%. Swathing or direct combining can be employed, depending on local conditions. After harvest, ensure proper drying and cleaning to maintain seed quality.

Yield: Approximately, 8–10 q/ha in rainfed area and 16–20 q/ha in irrigated area.

Industrial uses of linseed

- Paints and varnishes
- Printing inks
- Linoleum and floor coverings
- Wood finishes and furniture care



Harvesting of linseed plant

Source: <https://www.krishisewa.com/component/content/article.html?id=714:flax-cultivation-technique>

- Adhesives and sealants
- Textiles and fabrics
- Nutraceuticals and dietary supplements
- Personal care products

Multipurpose applications

Human civilisation has been using flax for a variety of purposes for generations. In general, flax is thought of as a plant with two main uses: fibre and seeds. High strength and durability are two characteristics of the flax stem fibre. The seeds offer digestible proteins, lignans, and oil that contain omega-3 fatty acids. Furthermore, linseed has a lot of potential as a source of phenolic compounds and is a potent source of soluble fibre and high-quality protein. Linseed has thus emerged as one of the most significant oilseed crops for industrial uses, as well as being a source of food and feed, as well as fibre.

Specifications of linseed oil

Linseed oil is a versatile natural



Drying of linseed plant in field



Linseed grown for fibre purpose, retting operation (fibre extraction)
Source: https://www.krishisewa.com/index.php?option=com_content



Linseed plant, seeds and oil

Source: <https://www.chemarc.com/bizhub/pranavagro/wesell/14137756307055183>

oil that is derived from flaxseed. It has several applications and specializations based on its processing and additives.

Raw/unrefined linseed oil: This is the purest form of linseed oil obtained by cold-pressing flaxseed. It is commonly used in traditional oil painting as a binder for pigments.

Boiled linseed oil: Boiled linseed oil is raw linseed oil that has been heated to enhance its drying time. It contains added drying agents such as metallic salts or petroleum-based additives. Boiled linseed oil dries faster than raw linseed oil and is commonly used as a wood finish, either alone or blended with other oils.

Stand oil: Stand oil is a highly refined and polymerized form of linseed oil. It undergoes a heating process to increase its viscosity and improve its drying properties. Stand oil dries slowly, giving a glossy finish and enhancing the durability of the paint film.

Sun-thickened linseed oil: Sun-thickened linseed oil is obtained by exposing raw linseed oil to sunlight or UV radiation. This process causes the oil to polymerize and thicken. It is used in various applications such as varnishes, wood treatments, and as a traditional medium for oil painting.

Modified linseed oil: Modified linseed oil refers to linseed oil that has undergone chemical modifications to enhance specific properties. These modifications can include polymerization, oxidation, or the addition of other compounds. Modified linseed oil may have improved drying time, increased

film flexibility, or other specialized characteristics tailored for specific applications.

Specifications of bast fibre

Fibre flax, also known as linen flax or textile flax, is a variety of flax plants cultivated specifically for its long, strong fibres. This ancient crop has been valued for centuries for its exceptional fibre quality and versatility.

High-quality natural fibre: Fibre flax is renowned for its long, fine fibres that are derived from the stem of the plant. These fibres possess exceptional strength, durability, and lustre, making them highly sought after in the textile industry. The fibres are used to produce linen fabrics, which are valued for their coolness, breathability, and ability to withstand frequent laundering.

Sustainability and environmental friendliness: Fibre flax is a sustainable and eco-friendly crop. It requires fewer pesticides and fertilizers compared to other fibre crops like cotton. Flax plants have a relatively short growth cycle, reducing the need for excessive water consumption.

Hypoallergenic and anti-bacterial properties: Linen fabrics derived from fibre flax have hypoallergenic properties, making them suitable for individuals with sensitive skin or allergies. Linen's natural fibres are resistant to dust mites and mould, and possess natural anti-bacterial properties, providing a cleaner and healthier sleeping environment.

Strength and durability: Fibre flax fibres are known for their strength and durability, making linen

fabrics long-lasting and resistant to wear and tear. Linen garments can withstand frequent washing and have a higher resistance to pilling compared to other fabrics. This durability ensures that linen products have a longer lifespan, reducing the need for frequent replacements.

Versatility in textile applications: Fibre flax offers versatility in textile applications beyond clothing. Linen fabrics derived from flax are used in home textiles such as bed sheets, towels, table cloths, and upholstery.

Thermal and moisture regulation: Linen fabrics made from fibre flax possess excellent thermal regulation properties. They keep the body cool in hot weather by allowing heat to dissipate, while also providing insulation in colder temperatures. Linen fabrics are highly absorbent, capable of absorbing and releasing moisture rapidly, making them ideal for summer clothing and bedding.

Future perspective

The synchronization of fibre and seed maturation poses a scientific and possibly industrial challenges for flax. It is generally known that for both the fibrous and linseed plant varieties, stem maturation and seed maturation are independent processes. When the secondary phloem fibre cells have fully developed and the stems have almost completely defoliated, fibrous flax is ready to be harvested. Flax now offers good fibre output and quality. However, harvesting the plant at this stage puts the quality of the planting seed in danger. On the other side, harvesting at a later time

results in increased lignification and worse fibre quality. Thus, more fruitful harvesting will result from more synchronised maturity of stem fibres and seeds.

Flax raw material is now being evaluated for the production and commercialization of biodegradable composite, implants, wound dressing, alternative antibiotics, anti-atherosclerotic, anti-tumour, and anti-inflammatory preparations as previously only utilised for the production of textiles and oil. However, further technological advancement is required to help boost flax output and improve the quality of raw materials in order to achieve this advantageous goal.

SUMMARY

Linseed cultivation, when approached with sound agronomic practices, offers farmers a profitable

opportunity with a wide range of applications. By understanding the crop's growth requirements, implementing effective pest and disease management strategies, and ensuring proper post-harvest handling, farmers can unlock the full potential of this versatile oilseed and fibre crop, both economically and environmentally. Throughout history, this tiny seed has been revered for its nutritional value and diverse applications in various industries. Its rich composition of essential fatty acids, antioxidants, and fibre makes it a powerhouse of health benefits when consumed as part of a balanced diet. Linseed has gained recognition for its role in promoting heart health, reducing inflammation, and improving digestive function, helping to lower cholesterol levels and maintain optimal blood pressure. It exhibits

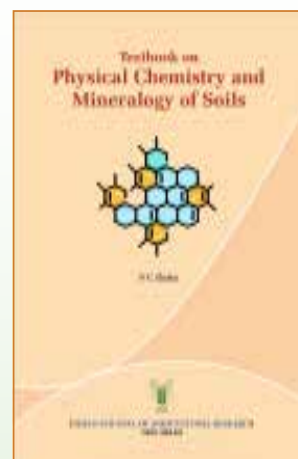
potent anti-inflammatory effects, which may alleviate symptoms of chronic diseases like arthritis and asthma. Beyond its nutritional advantages, linseed has found extensive use in various industries, including textiles, cosmetics, and construction. The fibre derived from linseed plants are used in the production of high-quality fabrics and textiles, renowned for their strength, durability, and eco-friendliness. Furthermore, linseed oil-based paints and coatings have gained popularity as a sustainable alternative to traditional petroleum-based products in the construction sector, reducing environmental impact.

*Corresponding author's e-mail:
supriya.ndri5@gmail.com

Textbook on Physical Chemistry and Mineralogy of Soils

Physical chemistry of soil and soil mineralogy are the two pillars which form the basic foundation of soil science. Once the students become familiar with these basic concepts, they can easily understand the other properties of the soil, say physical and biological properties, pedology and soil fertility. To become an expert of soil fertility, comprehensive knowledge of all the soil properties is essential which in turn is supported by the knowledge of physical chemistry of soils and soil mineralogy.

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TECHNICAL SPECIFICATIONS

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Directorate of Knowledge Management in Agriculture
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