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SCIENTIFIC CULTIVATION OF LINSEED AND ITS NUTRITIONAL BENEFITS

Vijendra Kumar Meena[1], Priyanka Meena[2], P S Hindoriya[1], Deepak Bhardwaj[1] and Sanjeev Kumar[1]

Agronomy Section, ICAR-National Dairy Research Institute, Karnal Haryana 132001

Ph.D. Student, SKN College of Agriculture, Jobner Rajasthan

Corresponding author: kumar.ladla@gmail.com

ABSTRACT

Linseed is one of the potential oil seed crops that contains an excellent amount of nutrition and possesses various health benefits. Interestingly, Linseed seeds' health benefits are mainly attributed to the omega-3 fatty acids, lignans and fibre they contain. It is used in different forms, such as whole and flour. The flour is used in bakery products and provides a nutty flavour and nutritional and health benefits for the final product. Furthermore, consumption of this oil seed may lower both total and LDL cholesterol because of its low saturated fat content and high PUFA and phytosterol content. In addition, the processing of flax seeds makes their nutrients bioavailable.

INTRODUCTION

Linseed is one of the oldest cultivated crops, grown for fibre and oil. The crop is cultivated commercially for its fibre in temperate regions of the world, while in India, commercially cultivated for oil. Madhya Pradesh, Karnataka, Chhattisgarh, Jharkhand, Bihar, Maharashtra, Odisha, Uttar Pradesh and Assam are central linseed-growing states. The linseed contains about 33-37% oil, rich in linolenic acid, and is quick-drying oil. Therefore, it is extensively used in the paint and varnish industries. In addition, linseed cake contains more than 30 % protein, which makes it a vital livestock feed, and good manure contains N (5%), P (1.5%), and K (1.8%).

It has a well-developed fibrous root system with many lateral roots. The stem is greyish green with leaves narrow and alternate. Linseed is a highly self-pollinated crop, and the inflorescence is corymbose type, with a single flower borne terminally on the pedicel in a multi-

flowered panicle. Fruit is a globular, mostly dehiscent capsule known as a seed ball. Seeds are compressed, shining yellow or light brown. The seed types with branching habits have less harvest index than the fibre types

CLIMATE

Its cultivation is confined to low elevations but can be successfully grown up to 770 metres. Areas with annual rainfall ranging from 45-75 cm are best suited for their cultivation. The seed crop does well under moderate or cool temperatures during vegetative development and dry weather during crop maturity, but fibre crops grow well in cool and moist climates. The plants are susceptible to frost while reasonably resistant to drought.

SOIL

Linseed grows well on well-drained, fertile, medium soils. The crop also grows well on the deep black soils of the central and peninsular regions and alluvial loams of the Indo-Gangetic plains. It is tolerant to a wide range of pH whereas a pH of 6 was reported to be the best.

LAND PREPARATION

The land should be ploughed 2 to 3 times with a cultivator and harrow, followed by planking. Then, a fine weed-free seedbed needs to be prepared for sowing. Aldine or Chlordane 5% dust at 25-30 kg per ha is mixed within the soil during the last ploughing before sowing to protect the seedlings against white ants and early damage from cutworms.

SOWING TIME

The primary season of sowing is October to November, and the first fortnight of October is the best sowing time for linseed. The rain-fed crop requires early sowing. Early sowing also helps the crop to escape from powdery mildew, rust diseases etc. The crop has sown either broadcast or is drilled in lines 20- 30 cm apart. For broadcast, the seed rate is kept at 40 kg per ha. For line-sowing, the seed rate is 20-30 kg per ha, depending on the seed size. The depth of sowing should be 4-5 cm. Seed treatment with Thiram or Bavistin at a 2-3 g kg^{-1} seed rate protects the crop against seed-borne disease.

POPULAR VARIETIES

LC 2063 (2007): This variety is suggested for irrigated areas. It has 158-160 days of maturity in rainfed and irrigated areas. It has blue and profuse capsule-bearing flowers. Its seeds are medium-sized and contain 38.4% oil. This variety is resistant to powdery mildew. Its average yield is 4-5 quintals per acre.

LC 2023 (1998): This variety is suggested for irrigated and rain-fed areas. It is tall with a blue-coloured flower, and its seed contains 37.5% oil and yields 4.5 q/acre. It matures in 155-165 days. It is resistant to powdery mildew.

Surbhi (KL-1): It is the best-yielding variety resistant to rust, lodging, powdery mildew, and drought. It matures in 165-170 days and contains 44% oil. Its average yield is 3-6 quintals per acre.

Jeevan (DPL-21): It is a dual-purpose variety. It is tall, with an average height of 75 cm and 85 cm. The seed is brown coloured, medium in size and the flowers are blue colored. It matures in 175-181 days. It is resistant to wilt, rust, and powdery mildew.

Other important varieties are Pusa-3, LC-185, LC-54, Sheela (LCK- 9211), and K-2.

NUTRIENT MANAGEMENT

Under rainfed conditions, 30-40 kg N ha^{-1} and 15 kg P_2O_5 and under irrigated conditions, the linseed crop requires 60 kg of N and 30-40 kg of P_2O_5 and K_2O ha^{-1} are recommended for optimum yield. The deep placement of fertilizer at sowing in the case of the rainfed crop gives better results. Under irrigated conditions, nitrogen is applied in two splits-half the dose as basal and the other half at the first irrigation, 40-50 days after sowing. In S-deficient soils, 30 S kg ha^{-1} is given through gypsum. Linseed is considered moderately susceptible to B and Zn deficiency. Hence soil application of 1.0 to 1.5 kg B and 20 to 25 kg $ZnSO_4$ per ha to calcareous soils or recently limed soil has been suggested.

WEED MANAGEMENT

The crop-weed competition studies indicate that the initial 20-45 days after sowing are critical and the major weed associated with linseed are: *Anagallis arvensis*, *Vicia hirsuta*, *Fumaria parviflora*, *Melilotus* spp., *Asphodelus tenifolious*, *Chenopodium album*, *Phalaris minor* etc. under irrigated conditions, two weeding manually at 20 and 35-40 days after sowing are essential. Weeds are controlled by herbicides such as Fluchloralin, Alachlor and Oxadiazon etc. However, the crop is frequently infestation with Dodder (*Cuscuta*) weed which causes severe yield losses. Fluchloralin or Pendimethalin at the rate of 1.0 g/ha as pre-plant or pre-emergence application, respectively, could reduce *Cuscuta* infestation.

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IRRIGATION MANAGEMENT

The crop responds to irrigation positively. Seedling, branching, flowering and seed maturation are critical stages for irrigation. The frequency of irrigation depends on climatic conditions and the type of soil. Generally, 2-4 irrigations are required to get optimum yield.

Fig. 1 Lucerne caterpillar

PLANT PROTECTION

Linseed budfly, semi looper, wireworms, cutworms and termites are major insect pests on linseed and rust; powdery mildew, and alternaria wilt are serious diseases.

Lucerne caterpillar: It causes damage to leave as well as to pods. **Control:** Spray 600-800 gm of sevin/Hexavin 50 WP (carbaryl) or 400 ml of malathion 50 EC in 80-100 Ltr of water/acre.

Disease and their control:

Rust: It is like pink spot-on leave surface, pods and stems.

Control: spray with sulphur @7 kg acre^{-1} or Indofil Z-78 @500 gm in 150 ltr of water.

Wilt: Young crops are more prone to this disease. Crops first turn yellow and then die.

Control: Cultivate the varieties which can tolerate this disease.

Fig. 2 Rust damage

HARVESTING

The linseed crop starts, maturing by the middle of February, depending on winter spread and sowing time. Harvesting occurs when the crop is dead ripe with a sickle or by uprooting the plants. When the fibre is also desired along with the seed, the harvesting of the crop is done at the stage of capsule maturity, even when the crop is light green. The average yield of a pure crop varies from 210 to 450 kg per ha of seed under rainfed cultivation. The irrigated crop may yield 1,200-1,500 kg per ha.

Fig. 3 Crop wilt damage

POST-HARVEST

After harvesting, pack the plants and place them in the threshing area for 4-5 days for drying. Threshing is conducted by beating the crop with sticks or even trampling by bullocks. Retting is a process of treating linseed stalks for fibre extraction. It can be done either with cold water or hot water. Generally, it takes 4-6 days for proper retting when the temperature is around 40 degrees celsius when harvesting the crop.

NUTRITIONAL VALUE OF LINSEED CROP:

Linseed crop is a good source of essential fatty acids and organic acids. It is also a rich source of dietary fibre, total dietary fibre of 28%, protein of 20%, antioxidants, and vitamins E, K, C, B1, B3, B5, and B6. Linseed crop is also found to be an equally good source of minerals, such as magnesium, calcium, phosphorus, iron, zinc and some sodium.

BENEFITS OF LINSEED CROP:

1. Lingams in linseed seeds are a good source of soluble fibre and have diverse biological activities. Its derivatives get metabolized into the mammalian lingams. Linseed seeds comprise of a rich amount of nutrients and provide several health benefits.
2. Linseed seeds contain polyunsaturated fatty acids and dietary fibre and are thus considered a favourite food that helps reduce weight and change the lifestyle-human body.
3. According to crop, the ingestion of Linseed seeds by healthy improved the strongest values of glucose in them and supplementation of lignan in the daily diet in the human body. Diabetic patients are more suitable for healthy growth, improved and more active in regular work, resulting in low yet statistically significant advances in glycaemia control without any significant impact on lipid profile, fasting glucose, and insulin sensitivity.
4. Linseed lignin reduces visceral and liver fat accumulation due to a high-fat diet. In addition, it improves hypercholesterolemia, hyperinsulinemia, hyperlipidaemia and hyperleptinemia. This ability of Linseed lignin may help in preventing obesity.
5. Linseed seeds are loaded with antioxidants, which exist in lignans. This antioxidant activity is responsible for the ability of linseed to prevent early skin ageing and pigmentation and to strengthen immunity.
6. The antioxidant property of Linseed seeds has been capable of reducing platelet aggregation and total cholesterol levels. In addition, the antioxidant activity is also suggested to be responsible for the hypoglycaemic effect in type-2 diabetes.

7. Primary risk markers of mammary and colonic carcinogenesis have been demonstrated to be reduced by linseed in animal models. In addition, linseed seed lignans have been studied for their ability to reduce mammary tumour size in carcinogen-treated rats.
8. A study of the effect of Linseed consumption on cancer risk markers in humans demonstrated that eating Linseed seeds daily in diet stimulated various hormonal changes in the body related to the reduction of the risk of breast cancer.
9. The fatty acids of linseed promote bone health by blocking excessive bone turnover.
10. As per animal models studies, linseed derivatives, such as oil and lax lignans, alter the development of renal conditions like polycystic kidney disease.
11. High soluble and insoluble dietary fibres in linseed help maintain regular bowel movements, thus controlling constipation.
12. Magnesium in linseed is responsible for relaxing the digestive tract muscles and, therefore, sustaining a healthy gut.
13. Linseed as Alasi is beneficial to solve skin problems such as Picchaila (lubricous), Balya (improves tensile strength or elasticity of the skin), Madhura (balances the skin pH), Grahi (improves moisture holding capacity of skin), Vranahrit (wound healing), Tvagdoshahrit (removes skin blemishes).

CONCLUSION

Linseed is one of the oldest cultivated crops, grown for fibre and oil. The crop is cultivated commercially for its fibre in temperate regions of the world, while in India, commercially cultivated for oil. The linseed contains about 33-37% oil, rich in linolenic acid, and is quick-drying oil. It is also a rich source of dietary fibre, total dietary fibre of 28%, protein of 20%, antioxidants, and vitamins E, K, C, B1, B3, B5, and B6. The scientific cultivation of linseed will help improve the yield and quality of linseed crops. Adding linseed oil and linseed seed to the human diet may help improve human health by reducing the chances of occurance of various diseases.