

# Linseed: A promising option for crop diversification, intensification, and income generation

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*The North-Eastern Hill (NEH) region of India, characterized by its varied agro-climatic conditions, provides a distinctive prospect for cultivating linseed (*Linum usitatissimum*). Recognized for its conventional oilseeds, the region demonstrates notable potential for expanding linseed cultivation, given its adaptability and ability to yield both oil and fibre. Linseed can be a good option for crop diversification enhancing cropping intensity by utilizing rice fallow land in the NEH region. Despite occupying only 5.6% of the cultivated area, oilseed cultivation in the NEH region shows promise for enhanced productivity, exemplified by linseed yielding 721.96 kg/ha in 2019-20. The diverse significance of linseed, stemming from its versatility and broad applications, including industrial and medicinal uses, positions it as a valuable crop and a compelling opportunity for increased cultivation in the NEH region.*

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Linseed or flaxseed (*Linum usitatissimum*), commonly referred to as *alsi*, *jawas* or *akse bija* in India, holds a venerable status as one of the earliest cultivated crops, valued for both its oil and fibre. This annual herbaceous plant stands as a versatile dual-purpose resource, offering two primary yields of fibre and oilseed. The inherent qualities of flax fibre make it an exceptional material, distinguished by its relative lack of elasticity compared to cotton yet bolstered by remarkable strength and innate softness, sheen, flexibility and smoothness. These attributes render it invaluable in the production of linen fabrics and various other commodities. Moreover, linseed's seeds are pressed to extract edible oil, boasting an oil content ranging from 33 to 47%. This linseed oil showcases rapid drying and water-resistant properties, positioning it prominently within a spectrum of industrial applications.

Beyond its industrial utility, linseed also emerges as a nutritional powerhouse. Rich in omega-3 fatty acids, lignans and dietary fibre, linseed offers a vital source of these

essential nutrients, with omega-3 fatty acids, in particular, being indispensable to our diets due to our inability to synthesize them internally. Beyond its culinary and industrial applications, linseed is revered for its myriad medicinal and health benefits, reinforcing its enduring significance in agriculture and well-being.

The North-Eastern Hills Region of India boasts a wealth of diverse fruits and vegetables, yet traditional crops like rice and maize have long dominated the farming landscape. However, as modern farming techniques gain traction, there is a notable shift towards the cultivation of unconventional crops such as pulses and oilseeds. Among these emerging crops, linseed stands as a relative newcomer, with many farmers in the Eastern Himalayan Region still in the process of acquainting themselves with its potential.

## **Agro-climatic diversity of NEH region**

The North-Eastern Hill Region's agricultural dynamics are intricately linked to its diverse agro-climatic

and geographical features. Characterized by significant variations in altitude, the region encompasses a mix of hilly and mountainous terrains, valleys and slopes. Its prevailing climate leans towards a humid subtropical pattern, marked by hot and humid summers, intense monsoons and mild winters. Temperature patterns fluctuate with altitude, with the warmer zones found in the Brahmaputra and Barak River plains, while the colder climes reside at higher elevations. For instance, the valleys of Assam maintain an average winter temperature between 16°C and 17°C, whereas mountainous areas in Arunachal Pradesh and Nagaland may see temperatures maxing out at 14°C. During the summer, temperatures range from 30°C to 35°C in the plains, while the hilly regions enjoy a more temperate average of around 20°C. Precipitation plays a pivotal role in the North-Eastern Region, with an annual average rainfall of 2,068 mm. The region experiences heavy to very heavy rainfall primarily during the Southwest monsoon period,

which typically extends from April to late October. Notably, June and July emerge as the rainiest months during this season.

Encompassing a vast expanse of 2.6 million square kilometers, the North-Eastern Hill (NEH) Region harbours a population where 70% of its residents rely on agriculture for their livelihoods. Astonishingly, despite the considerable landmass, only 16% of the total area is under active cultivation. The agricultural practices in this region are categorized into two primary types. Jhum cultivation, also recognized as shifting cultivation or slash-and-burn, predominates in the hilly regions, while terrace or bun cultivation thrives in the valleys and foothills. Remarkably, jhum cultivation claims a significant 85% share of the cultivated land. This distinctive blend of diverse geography and agro-climatic conditions, combined with an abundance of natural resources and organic matter, presents an expansive canvas for agricultural development within the NEH region.

#### Current scenario of NEH region of India

The oilseed scenario in the NEH Region of India is characterized by a diverse landscape and a mix of traditional and emerging trends in oilseed cultivation. The region presents unique opportunities and challenges for oilseed production and has been known for the cultivation of traditional oilseeds, which have been important staples for local consumption.

In recent years, there has been a growing interest in the cultivation of commercial oilseeds like soybean and linseed, which offers the potential for higher yields and improved oil extraction rates, aligning with efforts to enhance oilseed production and reduce dependency on imports. Linseed, in particular, has gained attention for its dual-purpose nature, providing both oil and fibre, making it an attractive choice for farmers in the region.

Rice is the staple food of the region, covering a substantial 81% of

the total cultivated area. However, during the *rabi* season, most of the farmers in the region leave their lands fallow after the harvest of rice, mainly due to inadequate irrigation facilities and the early withdrawal of monsoons, which results in moisture stress. Linseed, being a resilient, hardy, short duration crop that demands minimal management practices, can thrive even under moisture stress conditions. With its low production costs and relative resistance to pests and diseases compared to other crops, linseed presents a promising alternative for utilizing these fallow lands. This approach will not only secure consistent and additional income for farmers but will also diversify their agricultural practices, leading to increased farm productivity.

Despite being a relatively recent addition to the region's agricultural practices, linseed production is steadily gaining momentum. The region achieved an impressive linseed yield of 721.96 kg/ha in 2019-20 (Table 1). This remarkable output was the result of cultivation across 10.96 thousand hectares, culminating in a total production of 7.92 thousand tonnes.

The ICAR Research Complex for NEH Region, Nagaland Centre has conducted evaluations on various linseed varieties and has identified

Priyam and LSL-93 as the top-performing varieties for the region (Table 2). Notable for its shorter duration, increased capsule count per plant and comparatively higher seed yield, Priyam and LSL-93 stand out as the superior choices. To facilitate its adoption and enhance productivity, the center has organized demonstrations on seed production of these varieties for local farmers, aiming to promote their cultivation and encourage improved agricultural outcomes in the region.



Evaluation of linseed varieties for suitability in the NEH region



Demonstration on seed production of Priyam at research farm of ICAR Nagaland centre

**Table 1.** Area (in thousand hectare), production (in thousand tonnes) and yield (in kg/ha) of linseed in NER region from 2017 to 2020

| State             | 2017-18 |      |        | 2018-19 |      |        | 2019-20 |      |        |
|-------------------|---------|------|--------|---------|------|--------|---------|------|--------|
|                   | A       | P    | Y      | A       | P    | Y      | A       | P    | Y      |
| Arunachal Pradesh | 0.04    | 0.06 | 1465   | 0.00    | 0.00 | -      | 0.04    | 0.10 | 2273   |
| Assam             | 5.00    | 3.07 | 613    | 4.76    | 2.90 | 608    | 4.89    | 3.00 | 614    |
| Meghalaya         | 0.09    | 0.05 | 591    | 0.09    | 0.06 | 596    | 0.09    | 0.05 | 600    |
| Nagaland          | 5.85    | 4.75 | 813    | 5.85    | 4.76 | 814    | 5.86    | 4.77 | 814    |
| Tripura           | 0.12    | 0.08 | 700    | 0.05    | 0.04 | 774    | 0.09    | 0.00 | -      |
| Total             | 11.1    | 8.01 | 727.27 | 10.75   | 7.76 | 721.86 | 10.97   | 7.92 | 721.96 |

**Table 2.** Evaluation trial of 6 varieties of linseed for yield and yield attributing traits at ICAR Research Complex for NEH Region, Nagaland Centre

| Variety | 50% flowering | 80% maturity | Plant height (cm) | No. of branches | Plant stand | No. of capsules per plant | Test weight (g) | Yield (q/ha) |
|---------|---------------|--------------|-------------------|-----------------|-------------|---------------------------|-----------------|--------------|
| JLS-95  | 72.7          | 96.7         | 64.2              | 9.8             | 442.7       | 72.1                      | 0.6             | 7.30         |
| RLC 153 | 76.0          | 114.3        | 70.2              | 7.7             | 396.0       | 63.3                      | 0.5             | 5.45         |
| Shekar  | 70.7          | 94.7         | 65.4              | 8.0             | 441.3       | 84.9                      | 0.5             | 7.95         |
| LSL-93  | 58.0          | 91.0         | 30.9              | 8.1             | 464.0       | 65.9                      | 0.8             | 8.77         |
| Priyam  | 75.3          | 105.7        | 64.0              | 7.7             | 473.7       | 79.3                      | 0.4             | 8.83         |
| T 397   | 80.7          | 119.0        | 61.6              | 5.5             | 531.3       | 81.5                      | 0.4             | 5.68         |



Seed production and demonstration of LSL-93 at research farm of ICAR Nagaland centre

### Economic importance and potential of linseed

The cultivation of linseed in the North-Eastern Hills (NEH) Region of India holds significant economic importance owing to its versatility and broad range of applications. This crop serves various purposes, from oil production to fibre extraction, playing a crucial role in the agricultural landscape of the NEH region. The oil and fibre extracted from linseed are integral to various industries and traditional medicinal practices in the NEH region.

Linseed oil, prized for its quick-drying and water-resistant properties, finds applications in the production of paints, varnishes, soaps, resins, printing inks, linoleum and waterproof fabrics. Its oil, rich in essential fatty acids, has gained popularity as a functional food, incorporated into specialized diets for specific health benefits. The oil is notable for its high content of unsaturated fatty acids and is the richest plant source of  $\alpha$ -linolenic acid (ALA), which is an omega-3 fatty acid. ALA plays a significant role in several health aspects, including lowering cholesterol levels, mitigating inflammatory disorders like rheumatoid arthritis, enhancing immune function and providing cardiovascular benefits. This omega-3 fatty acid constitutes a significant portion, approximately 57% of the total fatty acids in linseed. Additionally, linoleic acid (LA), an omega-6 fatty acid comprising about 16% of the total fatty acids, is also present and these two polyunsaturated fatty acids are considered essential for human health.

The fibre obtained has diverse

uses, from manufacturing linen fabrics for the textile industry to producing ropes, twine, canvas, papers and even items like banknotes and tea bags. The by-product of oil extraction, known as oil cake, is a valuable resource, serving as an excellent protein source for livestock and organic manure for enriching the soil.

The cultivation of linseed in the NEH Region of India is not just an economic asset but also contributes to various sectors, including agriculture, industry and healthcare, making it a valuable component of the regional economy and agricultural landscape.

### Challenges and future outlook

While linseed production in the North-Eastern Region of India is still low as compared to that of other states, the potential for it to emerge as an economically significant crop in the NEH region is substantial. Overcoming existing constraints is crucial to realizing this potential. The current agricultural landscape faces several challenges that warrant attention. Given that rice serves as the staple food crop in the region, with a predominant practice of monocropping and fallow lands during the *rabi* season, integrating linseed as a *utera* crop in these rice fallows can prove highly beneficial and foster diversification in cropping systems.

One significant limitation is the inadequate availability of high-quality seeds, which leads to lower yields. Additionally, challenges such as insufficient marketing linkages, poor road connectivity to rural areas and limited transportation options hinder easy access for farmers to reach potential buyers. Given that linseed is relatively new to the region, there is a notable lack of awareness and knowledge among farmers regarding its potential and benefits. Consequently, there is a pressing need for comprehensive extension programmes aimed at educating farmers on optimal cultivation practices and raising awareness about the numerous advantages associated with linseed.

Despite these challenges, the prospect of linseed evolving into a valuable crop in the North-Eastern Region is imminent with effective management practices and the diversification of cropping systems, which would contribute to the region's economic growth. Given linseed's versatility and the increasing demand for healthy and organic food products, its future appears promising.

### SUMMARY

Linseed, or flaxseed, is gaining prominence in the North-Eastern Hill (NEH) Region of India, known for its dual-purpose as an oilseed and fibre crop. Linseed is a versatile crop, with seed and flax types offering oil and fibre, respectively. Being rich in omega-3 fatty acids, contributes to its significance in agriculture, health and industry. The unique agro-climatic diversity of the region, marked by variations in altitude and climate, presents ample opportunities for linseed cultivation. Despite the region's considerable landmass, only 16% of the total area is under active cultivation. Rice occupies a substantial share of the cultivated area, while oilseed covers a relatively modest 5.6%. However, there is potential for increased oilseed cultivation, especially with emerging crops like linseed. Despite challenges like seed quality and market accessibility, linseed production in the NEH Region is growing. In 2019-20, a yield of 721.96 kg/ha across 10.97 thousand hectares was achieved, with Arunachal Pradesh, Nagaland, and Assam exhibiting high productivity. Since linseed is comparatively new to the region, most of the farmers lack proper knowledge about the wide range of applications, different health benefits and the scope of linseed cultivation. However, with effective management and awareness programmes, linseed has the potential to become a valuable crop, contributing to the region's economic growth.

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