The Crop Production of Linseed

Hasmat Ali[1*], Kiran pal[2], Javed Ahmad Siddiqui[3]

[1*,3]Department of Botany, D.A.-V. (P.G.) College, Kanpur

[2] Department of Zoology D.B.S P.G College, Kanpur

E-mail: hasmatbot@gmail.com

Abstract

Linseed is ancient perennial plant species regarded as a multipurpose plant mostly due to its seed unique richness in omega-3 fatty acids and a rich source of protein, fat, vitamins, minerals, and some antioxidants. Linseed also known as flax in U.P, is one of the earliest cultivated fields crops, initially grown for its fiber. Linseed the oilseed crop with the highest content of the omega-3 fatty acid called alpha-linolenic acid. Cultivated linseed varieties contain 46-50% oil on a dry-weight basis. The versatility of linseed is exemplified by its multiple end uses as human food, animal feed and industrial applications. Traditionally, linseed has been used for both human and animal consumption, especially in winter season due to its high-energy content. Linseed oil is used for industrial purposes like production of paint. The by-product of linseed (cake and meal) is used in animal diets as a source of protein and energy. Linseed occupies an area of 32.23 lakh ha yielding 30.68 lakh tonnes with an average productivity of 952 kg/ha in the world whereas in India, it occupies an area of 1.7 lakh ha with production and productivity of about 1 lakh tonnes and 574 kg/ha, respectively. Madhya Pradesh and Uttar Pradesh together contribute to the national linseed production to a greater importance among oilseeds owing to its various uses and special qualities. It is grown mainly for seed used for extracting oil in rainfed conditions. Linseed is a rich green, upright plant, generally hairless. The Hindi meaning of linseed is alsi.

Key Word: versatility, alsi, omega-3 fatty acid, perennial plant, alpha-linolenic and rainfed condition.

Introduction

Linseed is the oilseed crop with the highest content of the omega-3 fatty acid called alpha-linolenic acid. Linseed is cultivated for its fiber, seed, oil and by-products. Traditionally, linseed has been used for both human and animal consumption, especially in winter season due to its high-energy content. Linseed oil is used for industrial purposes like production pf paint (Ahmad *et.al* 2017). Oil seeds occupy an important position in the agricultural economy of India. Among the different oilseeds crops grown in country, linseed is considered the most important oilseed crop of India and stands next to rapeseed-mustard in winter season (Rabi) oilseed crop in area and production (Kumar *et.al* 2018).

Annual production of flax was 3.06 million tons and Canada is the world's largest producer of flax (about 38% of total production) (Anonymous, 2000). Flaxseed is grown as either oil crop or a fiber crop with fiber linen derived from the stem of fiber varieties and oil from the seed of linseed varieties (Diederichsen *et.al* 2003; Vaisey-Genser *et.al* 2003). Oilseed-type plants are usually shorter have more branches and produce more seeds while fiber flax types are generally taller, have few branches, and have been selected for fiber (Gill, 1987). Fine flax fibers are used for linens and textile while coarser fibers are used for nonwoven textile and twine. Both flax types have a short tap root system with fibrous branches. Flax is relatively shallow rooted, with only 4-7% of root mass deeper than 60cm (Gan *et.al* 2009). Organic products in India is still a small market hence; at present there is not a sufficient number of producers to meet the growing demand in the cities. Coupled with inadequate transport infrastructure, lack of storage facilities and high losses, this brings up the cost of organic produce. At the same time many organic farmers do not have access to organic markets and are forced to sell their produce in conventional outlets, losing out on the premium (Singh *et.al* 2018). The main product from linseed is linseed oil, which is used in the manufacture of paints, varnishes, linoleum and other products. The residue which remains after the oil has been extracted from the crushed and partly cooked seed is made into linseed meals and cake- valuable stock food concentrate (Gross, 1951). These products have been proposed as additives in the making of a number of dietary items such as salad toppings, meat extenders, bread, muffins, spaghetti, baked cereal products, ready to eat cereals and fibre bars (Singh *et.al* 2011). Indian rural and urban population came up with two healthy recipes to include linseed in their daily diet: Alsi Laddu (Chauhan *et.al* 2009). It serves as a good source of minerals especially, phosphorous (650mg/100g), magnesium (350-431mg/100g), calcium (236-250mg/100g) and has very low amount of sodium (27mg/100g) (Carter 1993; Ganvit *et.al* 2018; Morris 2007; Rabetafika *et.al* 2011 and Rubilar *et.*al 2010). Liseed used for fibre purpose were found to have higher percentage of glycosides than the seed type. Moreover, ripe seed contain glycosides than the immature seed (Singh *et.al* 2011). The value of linseed protein and amino acid profile is comparable to that of soya proteins (Madhusudan and Singh 1985 and Oomah and Mazza 1993). Linseed also contains secondary metabolites. A good amount of phenolic compounds can be found in linseed. Phenolic compounds are well known for anticancer and anti-oxidative properties (Oomah *et.al* 1992). Despite the potential uses of linseed fibre especially for composites and bio-based industries linseed fibre production is still economically marginal (Rennebaum *et.al* 2002). This may be due to the wide use of conventional linseed cultivars which produce high seed and iolyield but low stem and fibre yield. However recently there has been increased interest in breeding and growing dual purpose linseed cultivars which can be harvested for both seed and fibre (Foster *et.al* 1997).

Three categories of food product

There are three categories of food products are: **Yellow-logo**- the products that display the yellow logo are ‘natural’ this includes products produced by small farmers, who use organic techniques. It also includes some processed foods that do not contain colors or synthetic preservatives or additives. **Blue-logo**- the products that display the blue logo are ‘conversion’ that means the product is using completely organic technology and is following its set standards and is registered. **Green-logo**- products displaying our green logo are fully certified organic all process, from growing to preparing to packing have been done according to National and International standards, verified by accredited agencies.

Every part of the linseed plant is utilized commercially, either directly or after processing. Seed contains 33 to 47% of oil. The seed is directly used for edible purpose. The total 20% oil produced is used at farmers’ level, and the rest 80% oil goes to industries in various forms, urethane oil, isomerized oil, eposidized oil and aluminated oil etc (Singh *et.al* 2018).

Climate requirements

The temperature during the vegetative development of the crop should be moderate or cool. Temperature above 32^{0}C accompanied with drought during the flowering stage reduces the seed yield, oil content in seed and also the quality of the oil. Moderate temperatures (21-26^{0}C) are ideal. At the flowering, frost is very harmful to the crop (Singh *et.al* 2018).

Soil and its preparation

Linseed can be profitably raised in places where the other crops may fail. Hence, it is often grown on marginal and sub-marginal rainfed soils as pure crop, mixed crop, intercrop and paira or utera crop (Singh *et.al* 2018).

National Scenario

The major linseed growing states: Madhya Pradesh, Nagaland, Odisha, Karnataka, Bihar, Chhattisgarh, Jharkhand, Maharashtra, West Bengal and Uttar Pradesh. Area under linseed cultivation has declined from 4.68 lakh ha (2007-2008) to 3.03 lakh ha during 2013-2014. However, the productivity of linseed has increased from 413 kg/ha to 462 kg/ha during the same period (Singh *et.al* 2018)

Materials and Method

Cluster front demonstrations (CFLDs) constitute one of the most efficient approaches to extension because, in general" farmers are encouraged by the idea that "seeing is believing." Cluster frontline demos' significant goal is to display recently released crop production and protection on the internet, as well as their management methods, on a farmer's field in a microfarming scenario (Tiwari *et.al* 2023). With the goal of providing selected farmers with an improved set of executions, an extensive investigation was conducted to gather data progressively from them.

All other step, including site selection, farmer selection, demonstration layout, farmer participation, etc., were carried out according to (Choudhary 1999) suggestions. Each demonstration's data on production was carefully recorded. The following formula was used to analyse the yield data from the demonstration and control plots using the appropriate statistical methods for the various parameters.

$$\textbf{Per cent increase in yield} = \frac{\textbf{Yield gain in IT plot (q/ha)} - \textbf{yield gain in FP plot (q/ha)}}{\textbf{Yield gain in FP plot (q/ha)}} \times 100$$

The extension gap (q/ha), technology gap (q/ha) and technology index (%) were calculated using the following formula as suggested by (Samui *et.al* 2000; Kadian *et.al* 2004; Sagar and Chandra 2004).

$$\text{Extension gap (q/ha)} = \text{DY (q/ha)} - \text{LY (q/ha)}$$

$$\text{Technology gap (q/ha)} = \text{PY (q/ha)} - \text{DY (q/ha)}$$

$$\text{Technology index (\%)} = \frac{\text{Technology gap (q/ha)}}{\text{PY (q/ha)}} \times 100$$

Where is, DY = Demonstration Yield, LY = Local check Yield, PY = Potential Yield of variety

The B:C was calculated based on the net return and cost of cultivation in each treatment.

The climate of district is tropical with dry winters and summers. The district average annual temperature is 28.68^{0}C, so it's 2.71% more than the national average for India. Ratlam usually has 97.18 wet days in a mean rainfall of roughly 121.39 millimetres (Tiwari *et.al* 2023).

Results and Discussion

Analysis of the differences among recommended and current practices

Table 1 indicates the disparity in recommended and present chnologies for the linseed crop in the district of Ratlam. The use HYVs, seed treatment and fertilizer application, sowing method, weed control. Irrigation and plant protection measures all demonstrated full spaces, while the seed rate and field preparation showed partial spaces. The primary reason for the variation in farmer's practices were a lack of prompt and local seed delivery as well as a lack of awareness (Tiwari *et.al* 2023). Because of a lack of Knowledge and interest farmers used more seed than was suggested did not use seed techniques to manage disease that are passed on via seeds, and did not know how to apply micronutrients like sulphur and zinc to increase linseed yield and quality (Patel *et.al* 2013, 2014).

Yield Attributing Characteristics

Table2 depicts the linseed yields under suggested practices and farmer activity over the years, in addition to Yield-contributing variables like the number of Capsules per plant and the harvest index (%). Compared to the range of 44 to 42 with a mean of 43 found under farmer's reality, the number of capsules or plant of linseed under suggested practice in farmer's fields ranged from 60 to 62 with a mean of 61. The greater values of capsules and plants in recommended usage compared to farmer's practices may be explained by the use of high-yielding cultivars, integrated nutrition management, integrated pest control and other parameters (Patel *et.al* 2013).

Seed Yield

The yield performance of the suggested address and farmer practices is presented in Table 2. The demonstration plot's performance during both of the following years of demonstrations in contrast to the farmer's practices of 14.44 and 12.78 q/ha, the demonstration's yield of linseed in 2021 and 2022 and 2022 to 2023, respectively was 21.58 and 19.56 q/ha. Compared to the farmer's methods, the yield improved by 38.46 % and 31.97%, respectively as outcome of the technology intervention. In both years the cumulative effect of technological intervention results in an average production of 20.57 q/ha which is 35.215% more than the average yield of farmers (13.61 q/ha). Changes in social, economic and biological factors can be used to explain variations in yield from year to year (Sharma *et.al* 2011; Singh *et.al* 2018).

Technology Gap, Extension gap and technology index

Technology Gap- The demonstration yield and expected output differed during the study period, as shown by the average technological gap of 2.43 q/ha (Table 2). The technology gap showed an average of 4.42 q/ha in 2021-2022 and 0.44 q/ha in 2022-2023, respectively and this show how the farmers worked collectively to carry out these tests and showed excellent outcomes in the following years. Difference in soil fertility levels and local conditions variations in appropriateness and technological adoption could all contribute to the observed technology gap.

Extension Gap- the extension gap is a parameter that helps explain yield differences between the technology that was displayed and the farmer's reality and the data that was actually collected is presented in Table 2. The extension gap ranged from 9.14 to 5.78 q/ha during the study period, with the average of 7.46 q/ha.

Technology index- the technology index showed that cutting-edge technologies could be used on farms. The technology index foe cluster front-line demonstration was found to be 8.77% (Table 2). In the periods 2021-2022 and 2022-2023, the technology index average 12 and 5.54% respectively. The technology index decrease in value indicates that farmers are becoming increasingly interested in using technology.

Economic Parameter- Table 3 depicts the economic performance of linseed in a frontline demonstration. In contrast with farmer's behaviours, the investment in production by adopting recommended practices ranged from Rs 21685 to 20463 Rs/ha, with mean value of Rs 21074 Rs/ha during the demonstration. Linseed cultivation adhering to indicated uses provided a larger net return of Rs 100694 to 113172 Rs/ha than cultivation under farmer's behaviours

in the periods 2021-22 and 2022-23 respectively. The average benefit cost ratio of recommended practices varied from 5.64 to 3.52 and was 4.58 overall, while the ratio for farmer's practices was 3.6 generally and varied from 5.19 to 2.01.

Conclusion

Farmers were effectively affected by the cluster frontline demonstration to adopt integrated crop management in the production of linseed. Linseed yield, net return and B:C were all found to be greater in the display plot than in the farmer's practice. Assessments of the technology, the farmers showed a favourable attitude towards the demos. To decrease extension gaps, technology gaps, technology index gaps, adoption gaps and thus yield gaps the technology has to be made accessible to more people if farmers are to make greater profits.

Table1 Comparison between technological interventions and existing farmers practice under cluster front line demonstration programme

S.No	Particular	Recommendation	Existing	Gap (%)
1	variety	Improved variety pratap-2	Old variety	Full gap
2	Seed rate	18-20 kg/ha	30-35 kg/ha	Partial gap
3	Field preparation	The importance of obtaining the land with adequate tilth. 2 to 3 ploughings were needed	Only one or two ploughs are used which keeps the soil from splitting down into tiny fragments.	Partial gap
4	Seed treatment and fertilizer	That is no soil testing done. Fertilizer is rarely used by farmers because it is grown as a residual crop. Usually, farmers apply 10 kg of DAP per acre.		Full gap
5	Sowing time	25 oct to 10 Nov	Oct to Nov	No gap
6	Sowing method	Line sowing	broadcasting	Full gap
7	weed control	Hand weeding was done once 30 days after sowing.	No weeding	Full gap
8	irrigation	Fields were irrigated before to sowing and at pre-flowering (35 DAS) and seed setting stage (70 DAS)	This is not practiced by farmers	Full gap
9	Plant protection	One spray of profenophos @ 750 ml/ha +ready mix combination of carbendazim +mancozeb @ 2.5 g/lit water was applied at 30 DAS.	No preventive measure is followed	Full gap

Table 2: According to the recommendations and farmer practices, yield measurements, the technology gap, the extension gap, and the technology index of linseed are all affected

year	Area (ha)	No of farmers	No of capsules/plant RP	No of capsules/plant FP	Grain yield (q/ha) RP FP	% increase over FP	Straw yield (q/ha) RP FP	Technology Gap (q/ha)	Extension Gap (q/ha)	Technology Index (%)
2021-22	12.11	27	60	44	21.58 14.44	38.46	30.45 22.11	4.42	9.14	12.00
2022-23	31.35	72	62	42	19.56 12.78	31.97	27.98 20.29	0.44	5.78	5.54
Total/averag	43.46	99	61	43	20.57 13.61	35.215	29.215 21.2	2.43	7.96	8.77

Table 3: cluster front line economics a demonstration of the way recommended follows and farmer procedures impact linseed

Year	Gross expenditure (Rs/ha)		Additional expenditure (Rs/ha)	Gross return (Rs/ha)		Net return (Rs/ha)		Additional returns (Rs/ha)	B:C Ratio	
	RP	FP		RP	FP	RP	FP		RP	FP
2021-22	21685	18545	3142	122378	77752	100694	59206	41482	6.64	5.19
2022-23	20463	17852	2610	133639	89571	113172	71714	41456	3.52	2.01
Total/ average	21074.5	18198	2876.5	128007.5	83660	106933	65462	41471	5.08	3.6

References

1. Ahmad, S., Kamran, Z and Koutoulis, K.C (2017), supplemental linseed on egg production egg innovations and strategies for improvement. Chapter-33 349-363 ISBN: 9780128008799.
2. Anonymous (2000), oil world statisfication update oil world 31:9-10.
3. Chauchan, M., Singh, S and Singh, A.K (2009), post-harvest use of linseed. Journal of Human Ecology 28.3:217-219.
4. Carter, J.F (1993), omega report North Dacota legislature 53rd proceedings.
5. Choudhary, B.N (1999), Krishi Vigyan kendra-A guide for KVKmanagers, publications division of agricultural extension, ICAR:73-78.
6. Diederichsen, A and Richards, K (2003), cultivated flax and the genus linum L taxonomy and germplasm conservation flax the genus linum taylor strancis 22-54.
7. Foster, R., Pooni, H.S and Mackay, I.J (1997), quantitative evaluation of linum usitatissimum varieties for dual-purpose traits. Journal of Agricultural Science Cambridge 129:179-185.
8. Gill, K.S (1987), flax. Indian council of agricultural. Research new delhi india 386p.
9. Gan, Y., Basnyat, p., Donald, M.C., Campbell, C.A and Liu, L (2009), water use and distribution profile under pulse and oilseed crops in semiarid northern high. Latitude areas. Agriculture water management 96:337-348.
10. Gross, F.C (1951), linseed a useful crop for south Australia. Journal of Agriculture Leaflet No 11/51, 3:7.
11. Ganvit, J.B., Sharma, S., Surve, V.H and Ganvit, V.C (2019), effect of sowing dates and crop spacing on growth, yield and quality of linseed under south Gujarat condition. Journal of Pharmacognosy and Phytochemistry 8(1):388-392.
12. Kumar, S., Singh, J.K and Vishwakarma (2018), importance of linseed crops in agricultural sustainability. International Journal of current microbiology and applied sciences 7 (12):1198-1207.
13. Morris D.H (2007), flax primer, a health and nutrition primer: flax council of Canada:9-19.
14. Madhusudan, K.T and Singh, N (1985), effect of detoxification treatment on the physiochemical properties of linseed proteins. Journal of Agricultural and Food Chemistry 336:1219-`12222.
15. Oomah, B.D and Mazza, G (1993), flaxseed proteins- a review food chemistry 48:109-114.
16. Oomah, B.D., Mazza, G and Kenaschul, E.O (1992), cyanogenic compounds in flaxseed. Journal of Agricultural and food Chemistry 40(8):1346-1348.
17. Patel, A.K., Singh, D., Baghel, K.S., Pandey, A.K (2014), enhancing water productivity to improve chickpea production in Bansagar Command Area of Madhya Pradesh. Journal of Agricutlural Search 1(1):19-21.
18. Patel, M.M., Jhajharia, A.K., Khadda, B.S and Patil, L.M (2013), frontline demonstration: an effective Communication Approach for dissemination of suitable cotton production technology. Ind.J.Extn.Edu and R.D 21:60-62.
19. Rubilar, M., Gutierrez, C., Verdugo, M and Shene, C (2010), flaxseed as a source of functional ingredients. Journal of Soil Science and Plant Nutrition 10(3):373-377.
20. Rabetafika, H.N., Remoortel, V.V., Danthine, S.M and Paquot, M (2011), flaxseed proteins: food uses and health benefits. International Journal of Food Science and Technology 4692):221-228.

21. Rennebaum, H., Grimn, E., Warnstorff, K and Diepenbrock, W (2002), fiber quality of linseed of and the assessment of genotypes for use of fibres as a by-product.Indian Crops Production 16:201-215.
22. Sharma, A.K., Kumar, V., Jha, S.K and Sachan, R.C (2011), frontline demonstration on Indian mustard: An assessment India. Res.J.Ext. Edu 11(3):25-31.
23. Singh, D., Kumar, C., Chaudhary, M.K and Meena, M.L (2018), popularization of improved mustard production technology through frontline demonstration in pali district of Rajasthan. Indian Journal of Extension Education 54(3):115-118.
24. Tiwari, G.P., Tripathy, S., Bhandari, J., Sharma, B., Ghaswa, R., Bhadauria, R.S., Jakhar, S.R and Mishra, S (2023), economic production and yield fields on linseed crops. International Journal of Statistics and Applied Mathmatics 8(5):1083-1086.