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# Effect of spacing on growth and yield of linseed (*Linum usitatissimum* L.) varieties

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**Abstract**
A field experiment was conducted during the *rabi* season 2016-2017 0n vertisol at Oilseed Research Station, Latur. To asses the response of linseed varieties to different spacing and fertilizer levels. The experiment was laid out in a factorial randomized block design with eighteen treatment combinations, consisting of two varieties of NL-260 (V1) and LSL-93 (V2), three spacing's viz., 30 cm x 5 cm (S1), 45 cm x 5 cm (S2), 30 cm x 10 cm (S3) and three fertilizer levels viz. 50% RDF (F1), 100% RDF (F2) and 150% RDF (F3) replicated twice. The recommended dose of fertilizer (RDF) was 60:30:00 NPK kg ha-1. The result indicated that growth and yield contributing character of linseed viz., number of branches plant-1, spread plant-1, total dry matter plant-1, number of capsule plant-1, weight of capsule plant-1, number of seed capsule-1, seed yield plant-1, test weight (g) were appreciably improve with the variety LSL-93 (V2) except plant height, straw yield and biological yield (kg ha-1). The variety LSL-93 (V2) was found significantly effective in producing higher seed yield, oil yield (kg ha-1), GMR, NMR and B: C ratio over the variety NL-260(V1). Among the different spacing a wider spacing of 30 cm × 10 cm (S3) produced significantly higher growth and yield attributing characters over the spacing of 30 cm × 5 cm (S1) and found at par with 45 cm × 5 cm (S2). The closer spacing of 30 c m × 5 cm (S1) was effective in producing highest seed yield, oil yield and straw yield, GMR, NMR and B: C ratio.

**Keywords:** Linseed, varieties, spacing, fertilizer levels

## Introduction
Linseed or flax is one of the most important *rabi* oilseed crop. It contains 35 to 45% oil. It is grown either for the oil extracted from the seed or fibre from the stem. Every part of the linseed plant is utilized commercially either directly or after processing. Edible linseed oil is used for human consumption and contains α-linolenic acid (ALA) a poly unsaturated fatty acid that has nutritional and health benefits, apart from ALA, linseed is widely used as nutritional and functional food in the western world due to its high contents of therapeutic health promoting sustains such as omega-3 fatty acid, soluble and insoluble fiber and lignin and its suitability to use with bread, breakfast cereals and other food products. Omega -3 fatty acid help to reduce the risk of cardiovascular disease and cancer. The linseed oil is an important ingredient in the manufacture of paint varnish, printing ink and linoleum.

Linseed is one of the most important crop of the world cultivated in over an area of 22.70 lakh ha with a production of 22.39 lakh tonne and productivity of 986 kg/ha. In India, it occupies an area of 3.38 lakh ha with a production of 1.47 lakh tonne and a productivity of 435 kg/ha (Anonymous-2014) [4]. The area under linseed in Maharashtra is 39 thousand ha, with an annual production of 10 thousand tones and average productivity is 246 kg/ha. The area under linseed in Marathwada is 16 thousand ha, with an annual production of 15 thousand tonnes and average productivity is 312 kg/ha (Anonymous, 2013) [3].

Recently Oilseed Research Station, Latur has released new linseed variety LSL-93. The yield is influenced by plant density suggested by various workers. At closer spacing, number of capsule per plant, number of seed per capsule, weight of capsule and seed weight per plant were decreased and at wider spacing number of capsule per plant, number of seed per capsule, weight of capsule and seed weight per plant were increased. Therefore it is necessary to find out the optimum plant population for getting higher yield.

## Materials and Methods
A field experiment was conducted during 2016-17 in *rabi* season at Experimental Farm, Oilseeds Research Station, Latur. Geographically Latur is situated between $18^0$ 05' to $18^0$ 75' North latitude and between $76^0$ 25' to $77^0$ 25' East longitude.

It's height from Mean Sea Level is about 540.63 m and has sub-tropical climate. The experimental soil was medium black with initial soil fertility of alkaline in nature ($P^H$ 8.0) containing low in available nitrogen (188.8 kg $ha^{-1}$), available phosphorus (14.82 kg $ha^{-1}$) and high in available potassium (588.72 kg $ha^{-1}$).The experiment was laid out in Factorial Randomised Block Design (FRBD) with eighteen treatment combinations consisting of two varieties of NL-260 ($V_1$) and LSL-93 ($V_2$), three spacing's *viz*., 30 cm x 5 cm ($S_1$), 45 cm x 5 cm ($S_2$), 30 cm x 10 cm ($S_3$) and three fertilizer levels *viz*. 50% RDF ($F_1$), 100% RDF ($F_2$) and 150% RDF ($F_3$) replicated twice. The recommended dose of fertilizer (RDF) was 60:30:00 NPK kg $ha^{-1}$. A half dose of nitrogen along with full dose of phosphorus was applied at the time of sowing and remaining half dose of nitrogen was applied 30 DAS. The crop was sown at different spacing and net plot size was (4.8 m X 4.2m for 30 cm row spacing and 4.5 m X 3.9 m for 45 row spacing). The source of nutrient were Diammonium phosphate (DAP) and Urea.

## Results and Discussion

### Effect of Spacing

### Growth and yield attributes

The plant height were not observed due to different spacings. Similar result was recorded by Malik *et al*. (2008) [15]. The data revealed that the spacing of 30 cm × 10 cm produced significantly higher number of branches $plant^{-1}$ and total dry matter and superior over the spacing 45 cm × 5 cm and 30 cm × 5 cm. It might be due to wider spacing which favored the plant to produce maximum branches. Similar results were observed by Hassan *et al.* (2012) [10], Shinde *et al.* (2011) [21]. Among the various spacing, the spacing of 30 cm × 10 cm recorded significantly higher spread and which was at par with 45 cm ×5 cm and found significantly superior over 30 cm × 5 cm. Linseed can compensate for low plant stands through extensive branching and increased spread when sown at wider spacing. Similar result was recorded by Girase *et al.* (1980) [7] and Gabiana *et al*. (2005) [6].

The yield attributing character of linseed influenced significantly due to different spacings, the spacing of 30 cm × 10 cm recorded significantly higher number of capsule $plant^{-1}$ over 30 cm × 5 cm and found at par with spacing of 45 cm × 5 cm. weight of capsule $plant^{-1}$ and seed yield $plant^{-1}$ influenced significantly due to different spacing and recorded highest value with the spacing of 30 cm × 10 cm highest value of number of capsule $plant^{-1}$ and test weight was also observed with spacing of 30 cm × 10 cm. Similar results were also recorded by Gokhale *et al.* (2008) [8], Chaudhary (2009) [5], Shinde *et al*. (2011) [21], Hassan *et al*. (2012) [10], Ali *et al.* (2016) [2].

### Seed yield of linseed

Perusal of data presented in Fig. 2 indicated that seed yield and oil yield (kg $ha^{-1}$) was influenced significantly due to different spacing. The spacing of 30 cm × 5 cm produced significantly high seed yield (1021 kg $ha^{-1}$) and oil yield (393 kg $ha^{-1}$) over the spacings of 30 cm × 10 cm and 45 cm × 5 cm. The oil content (%) in linseed was not influenced significantly by different spacings. Similar result were also recorded by Gokhale *et al.* (2008) [8], Hassan *et al*. (2012) [10], Kumar *et al*. (2015) [13].

The mean straw yield was influenced significantly due to different spacings. The spacing 30 cm × 5 cm recorded significantly higher straw yield (1554 kg $ha^{-1}$) which was at par with 45 cm × 5cm (1410 kg $ha^{-1}$) and significantly superior over 30 cm × 10 cm (1360 kg $ha^{-1}$). The results are in the line with findings of Sharma *et al*. (1996) [20], Mirza *et al*. (2007) [17]. Data on biological yield (kg $ha^{-1}$) presented in Table revealed that the spacing of 30 cm × 5 cm recorded highest biological yield (2567 kg $ha^{-1}$) which was significantly superior over rest of spacing. It might be due to higher plant population per unit area in closer spacing. Similar result was recorded by Ali *et al*. (2016) [2]. Closer spacing gave lower harvest index similar result was recorded by Mirza *et al*. (2007) [17].

### Economics

From the economic analysis (Table 2) it is observed that the spacing of 30 cm × 5 cm recorded significantly higher gross monetary return (Rs.50626) over rest of spacings. Highest net monetary return (Rs.28645) was also observed with spacing of 30 cm × 5 cm which was significantly superior over 45 cm × 5 cm and found at par with spacing of 30 cm × 10 cm. The highest B:C ratio (2.32) was observed with the spacing of 30 cm × 5 cm followed by 30 cm × 10 cm similar result was recorded by Kathmale *et al*. (2008) [12].

**Table 1:** Growth studies of linseed as influenced by different treatments

| | Treatment | Plant height | No. of branches | Spread $plant^{-1}$ | Total dry matter | No. of capsule $plant^{-1}$ |
|---|---|---|---|---|---|---|
| **(A)** | **Varieties (V)** | | | | | |
| | $V_1$ – NL-260 | 55.19 | 5.08 | 11.96 | 11.43 | 44.74 |
| | $V_2$ – LSL-93 | 38.82 | 5.40 | 12.48 | 12.02 | 56.81 |
| | S.E.± | 0.73 | 0.10 | 0.17 | 0.20 | 1.25 |
| | C.D. at 5% | 2.17 | 0.29 | 0.51 | 0.59 | 3.71 |
| **(B)** | **Spacings (S)** | | | | | |
| | $S_1$ – 30 cm x 5 cm | 45.83 | 4.54 | 11.62 | 10.91 | 43.50 |
| | $S_2$– 45 cm x 5 cm | 47.32 | 5.31 | 12.36 | 11.64 | 53.07 |
| | $S_3$– 30 cm x 10 cm | 47.85 | 5.88 | 12.74 | 12.63 | 55.76 |
| | S.E.± | 0.89 | 0.12 | 0.21 | 0.24 | 1.53 |
| | C.D. at 5% | NS | 0.36 | 0.63 | 0.73 | 4.55 |
| **(C)** | **Fertilizer levels (F)** | | | | | |
| | $F_1$ – 50% RDF | 43.97 | 4.44 | 11.50 | 10.78 | 40.52 |
| | $F_2$ – 100% RDF | 47.79 | 5.38 | 12.32 | 11.98 | 54.74 |
| | $F_3$ – 150% RDF | 49.25 | 5.92 | 12.82 | 12.42 | 57.06 |
| | S.E.± | 0.89 | 0.12 | 0.21 | 0.24 | 1.53 |
| | C.D. at 5% | 2.65 | 0.36 | 0.63 | 0.73 | 4.55 |
| **(D)** | **Interactions (4)** | | | | | |
| | V x S | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | S.E.± | 1.25 | 0.16 | 0.29 | 0.34 | 2.15 |
| | C.D. at 5% | NS | NS | NS | NS | NS |
| | V x F | | | | | |
| | S.E.± | 1.25 | 0.16 | 0.29 | 0.34 | 2.15 |
| | C.D. at 5% | NS | NS | NS | NS | NS |
| | S x F | | | | | |
| | S.E.± | 1.54 | 0.20 | 0.36 | 0.42 | 2.64 |
| | C.D. at 5% | NS | NS | NS | NS | NS |
| | V x S x F | | | | | |
| | S.E.± | 2.18 | 0.29 | 0.51 | 0.59 | 3.73 |
| | C.D. at 5% | NS | NS | NS | NS | NS |
| | General Mean | 47 | 5.24 | 12.22 | 11.73 | 50.78 |

**Table 2:** Economics of linseed as influenced by different treatments

| | Treatment | Harvest index | Gross monetary returns (Rs.ha$^{-1}$) | Cost of cultivation (Rs.ha$^{-1}$) | Net monetary return (Rs.ha$^{-1}$) | Benefit: cost ratio |
|---|---|---|---|---|---|---|
| **(A)** | **Varieties (V)** | | | | | |
| | $V_1$ – NL-260 | 34 | 43751 | 21310 | 22441 | 2.05 |
| | $V_2$ – LSL-93 | 46 | 51805 | 20866 | 30939 | 2.48 |
| | S.E.± | 1 | 831 | - | 831 | |
| | C.D. at 5% | 2 | 2479 | - | 2479 | |
| **(B)** | **Spacings (S)** | | | | | |
| | $S_1$ – 30 cm x 5 cm | 40 | 51026 | 21981 | 29045 | 2.32 |
| | $S_2$– 45 cm x 5 cm | 39 | 45041 | 20741 | 24300 | 2.17 |
| | $S_3$– 30 cm x 10 cm | 42 | 47267 | 20541 | 26726 | 2.30 |
| | S.E.± | 1 | 1017 | - | 1017 | |
| | C.D. at 5% | NS | 3036 | - | 3036 | |
| **(C)** | **Fertilizer levels (F)** | | | | | |
| | $F_1$ – 50% RDF | 39 | 39710 | 20259 | 19451 | 1.96 |
| | $F_2$ – 100% RDF | 41 | 50453 | 21088 | 29365 | 2.39 |
| | $F_3$ – 150% RDF | 41 | 53172 | 21917 | 31255 | 2.42 |
| | S.E.± | 1 | 1017 | - | 1017 | |
| | C.D. at 5% | NS | 3036 | - | 3036 | |
| **(D)** | **Interactions (4)** | | | | | |
| | V x S | | | | | |
| | S.E.± | 1.32 | 1439 | - | 1439 | |
| | C.D. at 5% | NS | NS | - | NS | |
| | V x F | | | | | |
| | S.E.± | 1.32 | 1439 | - | 1439 | |
| | C.D. at 5% | NS | NS | - | NS | |
| | S x F | | | | | |
| | S.E.± | 1.62 | 1762 | - | 1762 | |
| | C.D. at 5% | NS | NS | - | NS | |
| | V x S x F | | | | | |
| | S.E.± | 2.30 | 2492 | - | 2492 | |
| | C.D. at 5% | NS | NS | - | NS | |
| | General Mean | 40.26 | 47778 | 21088 | 26690 | 2.26 |

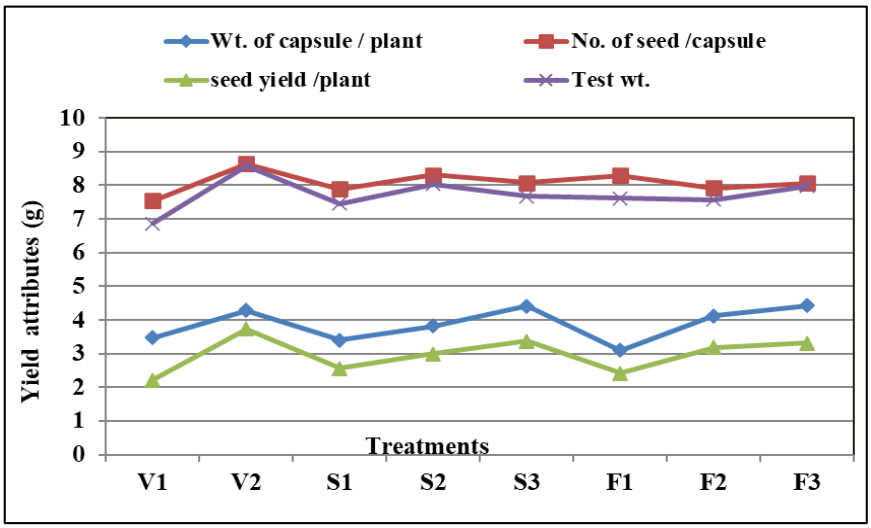


**Fig 1:** Treatments

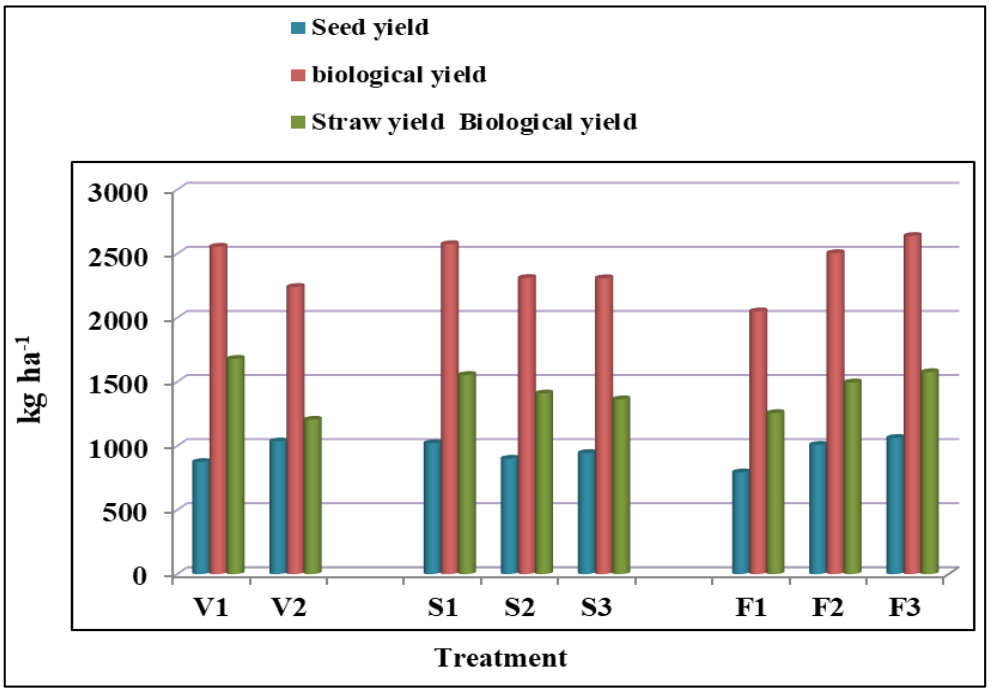


**Fig 2:** Treatments

## References


1. Ahmed MK, Saad AO, Thalooth AT, Kabesh MO. Response of sesame to inorganic, organic and biofertilizer. Ann. Agric. Sci. Ain Sham Univ. 1997; 42(2):365-375.
2. Ali M, Hasan FU, Afzal M. Response of linola (*Linum usitatissimum* L.) to difernt spacings under rainfed conditions Cercetari Agronomice in Moldova. 2016; 166(2):87-96.
3. Anonymous. All India area, production and yield of linseed (*Linum usitatissimum* L.), 2013.
4. Anonymous. Annual report of inseed, All India Coordinated Research Project on Linseed, Project Coordinating Unit (Linseed), Kanpur, 2014, 270
5. Chaudhry S. Study on row spacing for different varieties of linseed (*Linum usitatissimum* L.) Inter. J Plant Sci., (July to December, 2009) 2009; 4(2):373-374.
6. Gabiana C, McKenzie BA, Hill GD. The influence of plant population, nitrogen and irrigation on yield and yield component of linseed. Agronomy N.Z. 2005; 35:44-56.
7. Girase PD, Wani AG, Deokar AB. Response of safflower varieties to plant densities and nitrogen levels. J of MAU. 1980; 5(1):53-55.
8. Gokhale DN, Wadhvane SV, Kalegore NK, Khalge ML, Shaikh FG. Response of linseed (*Linum usitatissimum* L.) Varieties to row spacing and phosphorus level under irrigated condition. J Oilseeds Res. 2008; 25(1):94-95.
9. Gupta M, Kour S, Gupta S, Bharat R, Sharma C. Effect of different doses of fertilizers on yield and NPK uptake of linseed (*Linum usitatissimum* L.) Bangladesh J Bot. 2017; 46(2):575-581.
10. Hassan FU, Arif M. Response of white mustard (*Sinapis alba* L.) to spacing under rainfed condition. J Animal and Plant Sci. 2012; 22(1):137-141.
11. Husain K, Kumar V. Performance of linseed varieties sown after medium duration paddy in relation to row spacing. ISOR National Seminar, 2007, 324-325.
12. Kathmale DK, Danawale NJ, Deshpande AN. Response of castor to different spacing and fertilizer levels under dryland conditions. J Oilseed Res. 2008; 25(2):206-209.
13. Kumar H, Umraom R, Tripathi MK. Varietal performance of linseed (*Linum usitatissimum* L.) planted different spacing unde teak (*tectonagrandis*) based agroforestry system. Journal of International Academic Research For Multidisciplinary. 2015; 2(12):261-268.
14. Kumar R, Deka BC. Response of fertility levels and seeding rates on production potential and moisture use efficiency of linseed under foot hill condition of Nagaland. I. J. of Hill Farming. 2016; 29:(1-5)
15. Malik YP, Hussain K, Alam K. Impact of spacings and fertilizer application on linseed and infestation of bud fly, *Dasyneura lini* Barnes. J Oilseeds Res. 2008; 25(1):106-107.
16. Maurya AC, Raghuveer M, Goswami G, Kumar S. Influences of date of sowing on yield attributes and yield of linseed (*Linum usitatissimum* L.) varieties under dryland condition. Int. J Curr. Microbiol. App. Sci. 2017; 6(7):481-487.
17. Mirza H, Fazlul KM. Performance of rapeseed (*Brassica campestris* L.) CV. SAU Sarisha-1 under different row spacing and irrigation levels. J of Agric. And Bio Sci., 2007; 3(6):960-965.
18. Patel RM, Patel BK. Effect of fertility levels on yield of different castor (*Ricinus communis* L.) genotypes under irrigated conditions. J Oilseeds Res. 2012; 29(2):129-130.
19. Rajiv, Singh DP, Prakash HG. Response of sesame (*Sesamum indicum* L.) varieties to sulphur and potassium application under rainfed condition. I. J Agric. Sci. 2012, 476-478.
20. Sharma A, Hunsigi G. Performance of two linseed genotypes at different spacings and nitrogen levels under irrigate condition. Karnataka J. Agric. Sci. 1996; 9(1):16-20.
21. Shinde SD, Raskar BS, Tamboli BD. Effect of spacing and sulphur levels on productivity of sesame (*Sesamum indicum* L.) under summer condition. J Agric. Res. Technol., 2011; 36(1):28-31.
22. Singh DN, Bohra JS, Singh JK. Influence of NPK, S and

growth, yield and quality of irrigated linseed (*Linum usitatissimum* L.) I. J Agric. Sci. 2013; 83(4):456-458.
23. Suryavanshi VP, Suryawanshi SB, Ghodke MK. Studies on yield and economics of sunflower hybrid and varieties as influenced by different fertilizer levels. J Oilseeds Res. 2012; 30(1):31-33.
24. Tanwar SPS, Rokadia P, Singh AK. Effect of row ratio and fertility levels on chickpea (*Cicer arientinum*) and linseed (*Linum usitatissimum* L.) intercropping system. Indian Journal of Agronomy. 2011; 56(3):217-222.