

Short Communication

Pak. j. sci. ind. res., vol. 36, no. 8, August 1993

Influence of Inter and Intra Row Spacings on the Growth, Seed Yields, Oil and Protein Content in Linseed (*Linum Usitatissimum* L.)

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(Received May 6, 1990; revised June 17, 1993)

Linseed or flax is a dual purpose crop that can be grown for oil or fibre. The seed or oil yield per unit of area of flax is determined by number of plants/area, number of seeds/capsule, mean seed weight and oil content. These components show great variability, depending on genotype and/or environment [1]. Besides these factors, spacing between rows and plants has a considerable impact on the development of linseed.

Keeping in view the above factors, an experiment was conducted to determine the influence of inter and intra row spacings on the growth, seed yield, oil and total protein in linseed.

The experiment was designed and conducted at Karachi Laboratories experimental plot during winter of 1988-89, to assess the influence of inter and intra row spacing combinations (25 x 10 cm, 25 x 16 cm, 25 x 24 cm, 45 x 10 cm, 45 x 16 cm, 45 x 24 cm, 60 x 10 cm, 60 x 16 cm, and 60 x 24 cm) on the growth, seed yield, oil and total protein in linseed. The seeds of a local linseed variety were drilled at a rate of 13 kg/ha in plots having a net area of 4.32 sq. meters each. The experiment was laid in randomized complete block design with 4 replications. A basal fertilizer dose of 100 kg/ha, 50 kg/ha and 25 kg/ha of nitrogen, phosphorus and potassium respectively was applied in the form of urea, di-ammonium phosphate and sulphate of potash. The full dose of phosphorus and potassium and half of nitrogen was applied at the time of land preparation whereas the remaining half of nitro-

gen was given at flowering. All the required cultural operations were followed in all the plots. At maturity, 5 plants in each treatment were tagged for recording the observations on plant height, number of branches/plant, number of capsules/plant, seed weight/plant, oil and protein content percentage. Oil and total protein were extracted and estimated on Tecator Soxtec system TT₂ and Kjeltec system of tecator respectively. However, seed yield/ha was calculated from the harvested yield per plot. The collected data were subjected to analysis of variance. To test the superiority of treatment mean, LSD test was used following Gomez and Gomez [2].

Mean squares corresponding to various sources of variations for growth, seed yield, oil and protein content percentages given in Table 1 depict that various row and plant spacing combination had a pronounced effect ($P \leq 0.01$) on plant height, number of branches/plant, number of capsules/plant, single plant weight, seed yield/ha and protein content. It however, did not have any appreciable effect on oil percentage. Increasing row spacing coupled with closer plant spacing, 60 x 10 cm, resulted in maximum plant height (68.0 cm Table 2) followed by 45 x 10 cm (67.50 cm) and 25 x 10 cm (66.5 cm) respectively. It was further noted that both wider row and plant spacing 60 x 24 cm, produced greater number of branches (28.75), maximum number of capsules (256.50) and seed weight per plant (6.22 g, Table 2). The data further indicated that protein content improved (20.80%) when plant spacing was increased to 45 x 24 cm. However, reason for such increase at present is not clear and is being investigated. Total seed yield (1526.04 kg/ha, Table 2 was superior under closer row and plant spacing (25 x 10 cm) but declined as inter and intra row spacings increased. This reduction in seed yield was mainly due to reduced plant population. These results are in agreement with the findings of Anonymous [3], Bagge [4], Bjorklund [5], Klages [6] and Agha *et al.* [7], who found maximum seed yield of linseed under closer spacings. They further reported that wider spacings improved the growth

TABLE 1. MEAN SQUARES CORRESPONDING TO VARIOUS SOURCES OF VARIATIONS FOR GROWTH, SEED YIELD, OIL AND PROTEIN (PERCENTAGE) IN LINSEED AS EFFECTED BY INTER AND INTRA RAW SPACINGS.

Sources of variation	Degrees of freedom	Plant height	No. of branches/plant	No. of capsules/plant	Seed yield/plant	Seed yield/ha (kg)	Oil content (%)	Protein content (%)
Replication	3	1.06 ^{NS}	0.19 ^{NS}	1.21 ^{NS}	0.001 ^{NS}	22.28 ^{NS}	1.92 ^{NS}	0.02 ^{NS}
Treatment	8	4.65 ^{XX}	22.55 ^{XX}	801.16 ^{XX}	2.64 ^{XX}	316031.22 ^{XX}	4.27 ^{XX}	2.49 ^{XX}
Residual	24	1.08	0.54	24.99	0.01	121.66	4.59	0.02

xx= Significant at $P \leq 0.01$ percent level of probability; NS= Non significant.

TABLE 2. AVERAGE YIELD, ITS COMPONENTS, OIL AND TOTAL PROTEIN PERCENTAGE IN LINESED AS EFFECTED BY INTER AND INTRA ROW SPACINGS.

Treatments	plant height (cm)	No. branches/plant	No. capsules/plant	Seed yield/ha (kg)	Oil content (%)	Protein content (%)	Seed weight (g)
25 x 10	66.50 abc	21.75 d	214.0 e	1526.04 a	36.41 d	19.10 cd	4.04 g
25 x 16	65.75 bcd	23.75 c	229.25 d	1390.63 b	33.70 a	19.60 b	4.55 e
25 x 24	65.80 bcd	26.00 b	238.5 c	1160.59 d	34.80 a	20.70 a	5.33 d
45 x 10	67.50 ab	22.25 d	218.5 e	1240.16 c	36.16 a	19.00 d	4.23 f
45 x 16	66.25 bc	24.50 c	227.0 d	1115.16 e	33.60 a	19.10 cd	5.45 d
45 x 24	64.50 d	27.75 a	243.75 bc	803.24 h	34.60 a	20.80 a	5.67 c
60 x 10	68.00 a	23.75 c	217.5 e	917.25 f	33.80 a	18.50 e	4.18 fg
60 x 16	65.75 bcd	26.00 b	246.75 b	866.32 g	34.31 a	19.00 d	5.84 b
60 x 24	65.25 cd	28.75 a	256.5 a	686.90 i	34.10 a	19.30 c	6.22 a
S. E. \pm	0.73	0.52	3.53	7.80	1.51	0.10	0.07
cd i	1.50	1.07	7.27	16.07	—	0.21	0.14
cd ii	2.04	1.46	9.88	21.84	—	0.28	0.20
c.v.	1.57	2.95	1.84	1.02	6.19	0.73	1.98

Values followed by similar letter are not significantly different at $P \leq 0.05$ level of probability.

characters like number of branches, capsules and single plant yield, but are at variance with the findings of Knowles *et al.* [8] who reported that increasing row spacings did not effect seed yield.

In summation, 25 x 10 cm or 25 x 16 cm row and plant spacing combination are optimum for obtaining better linseed seed yield, and can be adopted agronomically.

Key words: *Linum usitatissimum* L., Inter and intera row spacing, Oil and protein content.

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