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Growth and Yield Comparison of different Linseed (*Linum usitatissimum* L.) Genotypes Planted at Different Row Spacing

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ABSTRACT

Eight linseed genotypes namely P14-80-79-52, Randkat, PB-180, P16-80-99, Royal-4, LS-30, T-5 and Carlos-80 were cultivated at two row spacings of 30 and 45 cm under irrigated field conditions at Multan. Growth and yield parameters like plant height, number of branches per plant, number of capsules per plant, 1000-seed weight, biological yield, seed yield, straw yield and harvest index were influenced significantly under various interactions of row spacing and genotypes. All the genotypes included in this study produced higher seed yield when sown at 30 cm apart rows. The genotype, Carlos-80 produced the maximum seed yield.

Key Words: Genotypes; Linseed; Row Spacing; Yield.

INTRODUCTION

Linseed (*Linum usitatissimum* L.) is a conventional oilseed as well as a fiber crop. Linseed has numerous medicinal uses. Its fiber is used in the manufacturing of canvas, cloth, water resistant pipes, paper and strawboard. Linseed oil is used in the manufacturing of paints and varnish, oil cloth and linoleum (Hatim, 1994). In Pakistan, linseed is grown on an area of 4.7 thousand hectares with annual production of 2.71 thousand tones, with an average yield of 573 kg ha^{-1} (Anonymous, 2001). Genotypes differ from each others in genetic make up for growth and yield. Proper row spacing is an important aspect for better growth and enhancing production potential of a crop by optimizing the utilization of moisture, nutrients and interception of light. Vender *et al.* (1995) reported that the plants height and number of branches were significantly greater at 45 cm spacing where as the number of capsules $plant^{-1}$, seed and straw yields ha^{-1} and oil yield ha^{-1} were greater at 15 cm spacing. Fontana *et al.* (1996) tested ten linseed cultivars and observed their variation for seed yield, 1000 seed weight and oil yield. Kurt (1996) compared eight linseed cultivars and found that there were significant differences among cultivars for plant height, number of capsules $plant^{-1}$, number of seeds $capsule^{-1}$, 1000 seed weight and harvest index. Pandey *et al.* (2002) found that the biomass and net primary productivity were comparatively higher in linseed cv. LC-54 than cv. NP-5. Singh (2001) observed that differences were significant for days to flowering, seed yield, plant height and number of branches $plant^{-1}$ in twenty varieties of linseed. Khare *et al*. (1996) concluded that the mean seed yield was higher with 30 cm row spacing as compared to 25 cm spacing. Sharma and Hunsigi (1996) reported that the seed yield was higher with 30 cm than 10 cm spacing in two linseed genotypes. Rennebaum *et al.* (2002) concluded that the plant characteristics relevant to fibre production, oil yield and straw yield were highly variable in eleven linseed genotypes. Jain *et al*. (1995) observed that seed yields were highest in linseed cv. Jawahar-23 (1.61 t ha^{-1}) followed by RLC-1 (1.51 t ha^{-1}), RLC-2 (1.42 t ha^{-1}) and T-397 (1.28 t ha^{-1}), where as, the maximum seed yield (1.53 t ha^{-1}) was obtained at a row spacing of 30 cm. The present study was conducted to evaluate comparative growth and yield performance of some linseed genotypes planted at two row spacings.

MATERIALS AND METHODS

This study was conducted during 2002-03 at the Agronomic Research Area, University College of Agriculture, Bahauddin Zakariya University, Multan. The soil was clayey loam and deficient in organic matter. The experiment was laid out in randomized complete block design with split plot arrangement in three repeats. Two row spacings i.e. 30 cm and 45 cm apart were randomized in main plot and genotypes viz. P14-80-79-52, Randkat, PB-180, P16-80-99, Royal-4, LS-30, T-5 and Carlos-80 in subplots. Net plot size for 30 cm row spacing treatments was 1.2 m x 6 m. while for 45 cm spaced rows it was 1.8 m x 6 m. All other agronomic practices were kept normal and uniform for all the treatments. Data collected were analyzed, statistically using Fisher's analysis of variance technique and least significant difference test at 0.05 probability level was employed to compare the differences among the treatment means (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Plant population was not affected significantly by different row spacings and genotypes. The interactive effect of both these factors was also found to be non-significant. This was due to the use of uniform seed rate and uniform

germination in all the treatments (Table I).

Plant height was significantly affected by the interaction of row spacing and genotypes. The plants in genotype P16-80-99 planted at 45 cm row spacing attained the maximum plant height of 88.35 cm while the genotype Royal-4 in 45 cm row spacing produced plants with minimum average height of 66.25 cm. The individual effect of row spacings and genotypes was also found to be significant. It may be ascribed to the availability of more space and solar radiation (Vender *et al.,* 1995 and Singh, 2001).

Number of branches plant^{-1} varied significantly under different row spacings and among the genotypes (Table I). The genotype Carlos-80 in 30 cm row spacing produced maximum number of branches plant^{-1} (4.60) and the genotype LS-30 in 45 cm row spacing produced minimum number of branches plant^{-1} (3.17). Number of branches per plant is genetically controlled characteristic (Vender *et al.,* 1995), however, planting geometry may have reasonable effect on the development of branches (Singh, 2001).

Number of days taken to flower initiation differed significantly among the genotypes due to diversity of genetic makeup (Table I). The genotype Royal-4 took maximum days (74.83) to flower initiation, while T-5 took minimum days (63.83) than the rest of genotypes. Singh (2001) also, found the significant differences for linseed genotypes for days to flowering. The effect of row spacings and interaction effect of row spacings and genotypes was observed to be non-significant.

Number of capsules plant^{-1} was affected significantly by different genotypes, row spacings and their interaction. The genotype T-5 in 30 cm row spacing produced maximum number of capsules plant^{-1} (122.3) and the genotype P16-80-99 in 30 cm row spacing produced the minimum number of capsules plant^{-1} (77.67). In 30 cm spacing competition for space resulted in reduction of number of capsules per plant as compared to 45 cm row spacing (Kurt, 1996).

Number of seeds capsule^{-1} did not vary significantly among different genotypes, row spacing and their interaction. Non-significant variation in number of seeds capsule^{-1} may be attributed to same potential of genotypes for producing number of seeds capsule^{-1}.

Thousand seed weight was differed significantly among different genotypes, row spacings and their interaction. The maximum 1000-seed weight of 6.55 g was obtained from the genotype P14-80-79-52 when grown in 45 cm row spacing, where as, the minimum 1000-seed

Table I. Growth and yield comparison of different linseed genotypes plant at different row spacing

Treatments	Plant density (m^{-2})	Plant height at maturity (cm)	No. of branches plant^{-1}	No. of days to flower initiation	No. of capsules plant^{-1}	No. of seeds capsule^{-1}	1000-seed weight	Biological yield t ha^{-1}	Seed yield t ha^{-1}	Harvest index (%)
30 cm apart (R1)	246.7 ns	74.36 b	3.53 ns	70.29 ns	94.33 a	8.84 ns	5.44 b	4.00 a	1.06 a	26.58 a
45cm apart (R 2)	249.5	79.16 a	3.66	70.08	89.33 b	8.86	5.66 a	3.50 b	0.88 b	25.32 b
S x	-	4.16	-	-	4.9	8.84	0.10	0.01	0.00	0.16
Royal-4	245.3	69.10 c	3.63 bc	74.83 a	82.33 d	8.9	5.27 d	3.48 d	0.87 e	24.94 c
LS-30	245.3	69.29 c	3.25 c	70.50 bcd	85.17 d	8.4	5.39 d	3.18 e	0.83 e	26.02 abc
P14-80-79-52	247.1 ns	75.77 b	3.45 bc	69.00 d	82.50 d	8.9 ns	6.12 a	3.70 cd	1.00 c	27.03 ab
PB-180	245.5	76.92 b	3.57 bc	72.00 b	94.17 c	8.7	5.39 d	3.91 abc	0.99 cd	25.42 bc
T-5	250.8	78.02 ab	3.58 bc	63.83 e	112.5 a	8.7	5.89 ab	4.02 ab	1.06 ab	26.35 abc
P16-80-99	248.5	80.68 ab	3.40 bc	71.50 bc	84.50 d	9.2	5.22 d	3.74 bcd	0.94 d	25.32 bc
Carlos-80	255.6	81.08 ab	4.11 a	70.33 bcd	101.8 b	9.0	5.46 cd	3.91 abc	1.09 a	27.64 a
Randkat	246.8	83.22 a	3.77 ab	69.50 cd	91.67 c	8.8	5.65 bc	4.08 a	1.01 bc	24.85 c
Sx	-	5.96	0.47	2.08	9.00	9.00	0.25	0.30	0.05	0.27
LS-30 R 1	238.0	68.98 e	3.333 bcd	70.67	86.67 ef	8.90	5.243 e	3.303 efg	0.9200 e	27.86 ab
Royal-4	251.3	71.95 de	3.700 bcd	74.67	83.67 ef	8.47	5.207 e	3.778 d	0.995 cd	26.31 bcde
PB-180	246.3	72.09 de	3.300 cd	71.00	91.00 de	8.73	5.277 e	3.993 bcd	1.004 cd	25.22 cdef
P16-80-99	247.3	73.02 de	3.200 cd	71.00	77.67 f	9.27	5.203 e	4.233 abc	1.063 bc	25.23 cdef
T-5	251.3	73.13 de	3.367 bcd	64.67	122.3 a	8.40	5.810 bc	4.295 ab	1.129 b	26.34 bcde
P14-80-79-52	249.3 ns	73.35 cde	3.200 cd	70.0 ns	84.67 ef	8.77 ns	5.697 bcd	3.694 def	0.990 cde	26.97 bcd
Carlos-80	248.6	80.01 abcd	4.600 a	71.67	111.0 b	9.23	5.550 cde	4.553 a	1.349 a	29.59 a
Randkat	241.3	82.33 ab	3.567 bcd	68.67	97.67 cd	9.00	5.547 cde	4.223 abc	1.057 bc	25.11 cdef
Royal-4 R 2	239.3	66.25 e	3.567 bcd	75.00	81.00 f	9.43	5.337 e	3.191 g	0.752 gh	23.58 f
LS-30	252.6	69.60 e	3.167 d	70.33	83.67 ef	7.97	5.540 cde	3.061 g	0.732 h	24.19 ef
P14-80-79-52	245.0	78.19 bcd	3.700 bcd	68.00	80.33 f	9.10	6.553 a	3.724 de	1.010 cd	27.10 bc
PB-180	244.6	81.76 abc	3.833 bc	73.00	97.33 cd	8.80	5.517 cde	3.827 cd	0.972 de	25.61 bcdef
Carlos-80	262.6	82.15 ab	3.633 bcd	69.00	92.67 de	8.80	5.373 de	3.276 fg	0.837 f	25.69 bcdef
T-5	250.3	82.91 ab	3.800 bcd	63.00	102.7 bc	8.97	5.977 b	3.755 d	0.990 cde	26.36 bcde
Randkat	252.3	84.12 ab	3.967 ab	70.33	85.67 ef	8.67	5.760 bc	3.943 bcd	0.971 de	24.59 def
P16-80-99	249.6	88.35 a	3.600 bcd	72.00	91.33 de	9.17	5.253 e	3.243 g	0.820 fg	25.41 cdef
Sx	-	8.43	0.66	-	-	-	0.35	0.42	0.07	0.39

ns = non-significant; Figures followed by different letters are significantly different at 0.05 probability levels using LSD

weight of 5.20 g was obtained by the genotype P16-80-99 when grown in 30 cm row spacing. More space provided more light for accumulation of photosynthates (Fontana *et al.*, 1996 and Kurt, 1996) and consequently seeds in 45 cm row spacing gained more weight as compared to 30 cm row spacing.

Difference in biological yield was significant under row spacings, genotypes and their interaction effects. The genotype Carlos-80 in 30 cm row spacing produced the highest mean biological yield (4.55 t ha^{-1}) and the genotype LS-30 in 45 cm row spacing produced the lowest biological yield (3.06 t ha^{-1}). This may be due to lesser plants per unit area as well as genetic make of the genotype (Pandey, 2002).

Seed yield was affected significantly by row spacings, genotypes and their interaction. The genotype Carlos-80 in 30 cm row spacing produced the highest mean seed yield of 1.35 t ha^{-1} and the genotype LS-30 in 45 cm row spacing produced the lowest seed yield of 0.73 t ha^{-1}. Reason for this is 33% lesser planting density (Sharma & Hunsigi, 1996) as optimum plant population is very important yield component in field crops (Khare *et al.*, 1996; Jain *et al*., 1995 and Rennebaum *et al.*, 2002).

Harvest index was affected significantly by row spacings, genotypes and their interaction. The genotype Carlos-80 with 30 cm row spacing gave the maximum harvest index value of 29.59 % and the combination of genotype Royal-4 with 45 cm row spacing gave the minimum harvest index value of 23.58 %.

CONCLUSION

Genotypes Carlos-80 and T-5 are recommended to be planted at 30 cm row spacing for obtaining maximum seed and oil yield under irrigated conditions of Multan.

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