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HYBRID VIGOUR IN LINSEED (*LINUMUSITATISSIMUM* L.) FOR YIELD AND YIELD ATTRIBUTES UNDER RAINFED AND IRRIGATED ENVIRONMENTS

Linseed (*Linum usitatissimum L.*) is predominantly a self-pollinated crop of industrial importance. In India, it has been under cultivation from pre-historic times. In spite of significant increase in area and production, the productivity is still stagnant in linseed. In heterosis breeding programme, knowledge on extent of heterosis is not only helpful to identify high yielding cultivars but also substantiates the nature of heterosis.

Fourteen diverse germplasm lines as females were crossed with three testers to constitute 42 combinations in line x tester fashion. These 42 crosses along with the 17 parents were grown in a randomised block design with three replications under both irrigated and rainfed situations during winter 1982-83 at the oil seeds experimental area of the Birsa Agricultural University, Ranchi. Each entry had one row of 3 m length, having row-to-row distance of 30 cm and plant-to-plant distance of 15 cm under both the situations. Observations were recorded on eight important quantitative characters. Variance estimates for mid-parent and better parent were calculated.

The analysis of variance with 59 entries including parents and crosses, revealed significant differences among parents as well as among crosses for all eight characters studied under both the environments. Extent of positive heterosis over better parent was the highest for seed yield per plant (57.9% and 101.1%) followed by secondary branches per plant (52.8% and 62.2%), number of capsules per plant (43.5% and 56.8%), primary branches per plant (26.5% and 45.7%), plant height (16.9% and 17.5%), days to first flowering (5.8% and 8.6%), number of seeds per capsule (5.0% and 5.3%) and days to maturity (3.4% and 3.5%) under irrigated and rainfed situations. The extent of positive heterosis over mid-parent was also highest for seed yield per plant under both the situations (66.9% and 104.9%).

The estimation of heterosis for yield under irrigated condition ranged from 26.54 to 66.88% over mid-parent and from -37.55 to 57.94% over better parent. Under rainfed condition, heterosis percentage for seed yield ranged from -8.94 to 104.88% over mid-parent and -9.43 to 101.06% over better parent. The heterotic response obtained from varietal crosses by other workers (Galkin, 1973; Chandra, 1978; Patil and Chopde, 1983 and Verma and Sinha, 1993) ranged from 10.0% to 89.8%. The maximum record of heterotic response in varietal crosses of 89.9% over better parent has been reported by Patil and Chopde (1983). In the present study, the average yield heterosis was 29.30% and 40.06% over mid-parent and 12.99% and 34.24% over better parent under irrigated and rainfed conditions, respectively.

Out of 42 crosses studied under two environments, 20 crosses under irrigated and 27 crosses under rainfed conditions gave highly significant positive heterotic effect for seed yield over mid-parent and 11 crosses under irrigated and 20 crosses under rainfed condition showed significantly high positive heterotic effect over better parent (Table 1). Singh *et al.* (1983) studied seven yield components in 21 F_1 hybrids and observed heterosis for yield over the better parent in 18 crosses. Chandra (1978) reported the highest heterosis for seed yield (57%) with respect to better parent. Patil and Chopde (1983) reported highest heterosis, with respect to the better parent, of 89.8% for seed yield.

R-7 x BS-2, LMH-350 x BS-2 and SPS-30-5 x BS-2 under irrigated situation and DPL-20 x T-397, BAULK-1 x T-397, BAULK-1 x LS-2 and MS-4 x LS-2 under rainfed situation may be considered as the best crosses as they expressed high values for both relative heterosis and heterobeltiosis (Table I). It was revealed that for the selection of germplasm or crosses for evolving high

Table 1. Heterotic effects (relative heterosis - HMP and heterobetiosis - HBP) for different characters in linseed under irrigated (I) and rainfed (R) conditions

Characters	Plant height				Primary branches/plant				Secondary branches/plant				Days to first flowering			
	HMP		HBP		HMP		HBP		HMP		HBP		HMP		HBP	
Crosses	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
1 1x15																
2 1x16																
3 1x17																
4 2x15																
5 2x16																
6 2x17																
7 3x15																
8 3x16																
9 3x17																
10 4x15																
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38 13x16																
39 13x17																
40 14x15																
41 14x16																
42 14x17																
Average	6.79	5.15	.3.48	-0.48	3.77	2.30	-9.16	-13.16	11.41	12.05	3.47	-0.06	-1.01	-2.37	-0.30	-0.54
SEm (I)	3.52	3.54	4.09	0.88	0.78	1.02	0.90	4.13	4.99	4.77	3.76	2.03	4.25	2.35	4.91	1.00
CD(0.05)	6.97	7.01	8.06	8.10	1.74	1.54	2.02	1.78	8.82	9.88	9.44	11.40	4.02	8.41	4.65	9.72

Table 1 (contd.)

Characters	Days to maturity				No. of capsules per plant				No. of seeds / capsule				Seed yield / plant			
	HMP		HBP		HMP		HBP		HMP		HBP		HMP		HBP	
Crosses	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
1 1x15																
2 1x16																
3 1x17																
4 2x15																
5 2x16																
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22 8x15																
23 8x16																
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25 9x15																
26* 9x16																
27 9x17																
28 10x15																
29 10x16																
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31 11x15																
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34 12x15																
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36 12x17																
37 13x15																
38 * 13x16																
39 13x17																
40 14x15																
41 * 14x16																
42 14x17																
Average	0.13	0.1	0.12	6.61" *	13.66	18.38	2.17	6.52	-2.76	-3.91	-3.83	-5.81	29.30	40.96	12.99	34.24
SEm (I)	1.06	1.15	1.23	34.22	27.38	39.52	30.50	6.35	0.42	0.41	0.49	1.00	0.62	1.15	1 0.72	-
CD(0.05)	1.98	2.10	2.28	2.43	67.75	54.01	78.25	60.39	0.69	6.63	6.81	6.97	1.98	1.23	2.28	1.42

*, ** - Significant at 5 per cent and 1 per cent levels respectively (*, ** are negative values)

Lines = 1. NP (RR 9), 2. Kangra, 3. DPL-20, 4. R-7, 5. LMH-350, 6. LMH-328, 7. LC-51, 8. LC-54, 9. SPS-30-5, 10. RAULP-2, 11. MP-485, 12. MS-4, 13. BAULK-1 and 14. NP-5; Tester - 15. T 397, 16. LS-2 and 17. BS-2

yielding varieties for irrigated condition and T-397 and LS-2 for rainfed situations. BS-2 **may** be used as the tester parent

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