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Bio-agronomic Evaluation of Linseed Genotypes

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Abstract: Five linseed (*Linum usitatissimum* L.) genotypes were evaluated for four years (1993-98) for seed yield. LS-49, 1.5-75, LS-73 and LS-29 demonstrated 24.82, 18.23, 29.92 and 3.09% higher mean yield compared to a commercial variety Chandni, during 1993-94 and 1994-95 at the research station. Mean yield of 11 trials conducted over different locations in Punjab during 1996-97 and 1997-98 showed the highest yield of LS-73 followed by LS-49, LS-75 and LS-29 compared to 677 Kg ha^{-1} of Chandni. In three of the 11 trials, LS-49 ranked first while all other genotypes each enjoyed first position in two trials, indicating considerable influence of location on genotypic performance. Ls-49 was the most stable genotype amongst five and it showed responsiveness to agronomic manipulation to obtain higher yield.

Key words: Linseed, evaluation, *Linum usitatissimum* L. stability analysis

Introduction

Linseed is an important oilseed crop keeping in view its multifarious industrial uses especially for the manufacture of high quality paper, instant drying inks, paints etc. Due to huge industrial demand of linseed in developed countries, it has great export potential. Agro-ecological conditions prevalent in the province are suitable for linseed cultivation. There is also great scope of genetic and non-genetic improvement as present yield levels are quite low.

Linseed breeding endeavour is a continuous process to evolve genetically better yield potential varieties than the prevalent ones. Kenaschuk (1976), Kenaschuk and Rashid (1994) and Vasile *et al.* (1994) concluded that new strains should be extensively evaluated for 3 to 4 years at the breeding station and over different environments to obtain broad picture of yield potential and consistency in yield over environments. Eberhart and Russell (1996) proposed a method for the evaluation of stability of genotypic yield across environment. Their techniques were used by Mahto (1995), Mahto *et al.* (1995) and Vasile *et al.* (1994) for determining linseed consistency in genotypic yield over wide ranging environment and they concluded that some genotypes were found better in some locations while others showed stable yield across locations. The objective of this research endeavour is to evaluate relative seed yield of five linseed genotypes during four years.

Materials and Methods

Four linseed genotypes namely; LS-29, LS-75, LS-73 and LS-49 were evaluated alongwith check variety Chandni (released during 1988) for four years (1994-98). During 1993-94 and 1994-95, experiment was planted at Faisalabad. The experiment was studied at 7 locations, during 1995-96 and 4 locations during 1998-97 in zonal trials conducted at various locations of the province. The experiment was planted following randomized complete block design with four replications. The plot size per entry was kept at 4 m × 1.8 m with inter-row distance of 30 cm and seed rate used was 5 kg ha^{-1}. Fertilizer was applied as basal dose of 60:60 kg ha^{-1} of N:P. Seed yield data was subjected to statistical analysis as outlined by Steel and Torrie (1980). Stability analysis was performed on seed yield of five genotypes over 11 environments using Eberhart and Russell model (1996) available in MSTAT package 4.C.

Results and Discussion

All four new strains out-yielded Chandni during both years (Table 1). However, one during 1993-94, and three during 1994-95 excelled Chandni significantly (p-5%). On the basis of two years mean yield, level of increase in yield in case of LS-49, LS-75 and LS-73 was 24.82,18.23 and 23.92% over Chandni, respectively (Table 1).

There was substantial differences in seed yield of five genotypes over 11 environments. The ranking of genotypes across environments changed considerably which is an indication of strong interplay of genotype x environment interaction. 18-49 ranked first in three environments while LS-73, LS-75, 15-29 and Chandni each were twice placed in top position (Table 2).

On the basis of mean yield of 11 environments, LS-73 yielded the highest followed by LS-75, LS-49 and LS-29 as compared to Chandni, registering 6.65, 5.61 and 5.47 and 0.74% higher yield over Chandni, respectively. These results also proved that efforts of linseed breeding programme in Punjab were successful in evolving new strains with at least 5% mean yield higher than Chandni. Several linseed breeders (Kenaschuk, 1976; Kenaschuk and Rashid, 1994; Mahto *et al.,* 1995) have reported that 5% or higher yield was sufficient to push a genotype as a new variety.

Table 1: Seed yield (Kg ha^{-1}) performance of four genotypes compared to Chandni during 199394 and 1994-95 at Oilseeds Research Institute Faisalabad

Varieties	PYT 1993-94	AYT 1994-95	Average	% increase over Chandni
LS-49	1292	1775	1534	24.82
LS-75	1144	1761	1453	18.23
LS-73	1094	1930	1513	23.92
LS-29	1100	1433	1267	3.09
Chandni	1064	1394	1229	
LSD (0.05)	133	247		

Ranking of genotypes and mean yield do not provide reliable measure of consistency in performance of genotypes across locations. Stability analysis of Eberhart and Russell (1966) was adopted by Mahto (1995), Mahto *et al*. (1995) and Mishra and Rai (1993), to collect information on the consistency of genotypic yield across

Table 2: Seed yield performance of four genotypes compared to Chandni over 11 environments in Punjab during 1996-97 and 1997-98

No. Environments	LS-49	LS-73	LS-75	LS-29	Chandni
		1996-97			
El Faisalabad	1597(4)	1740(3)	1830(2)	1838(1)	1525(4)
E2 Fateh Jang	572(1)	571(2)	429(5)	477(3)	476(4)
E3 Bahawalpur	198(4)	237(3)	316(1)	158(5)	277(2)
E4 Sahiwal	868(3)	827(5)	902(2)	848(4)	928(1)
E5 Khanpur	490(2)	443(3)	625(1)	237(5)	364(4)
E6 Karor	539(3)	384(5)	434(4)	656(1)	655(2)
E7 Bhakkar	206(3)	329(1)	247(2)	124(5)	173(4)
		1997-98			
E8 Faisalabad	1411(1)	1356(2)	1344(3)	1339(4)	1067(5)
E9 Bhakkar	1015(2)	1207(1)	801(5)	823(4)	935(3)
E10 Khanpur	396(1)	372(3)	368(4)	315(5)	395(2)
E11 Bahawalpur	561(4)	478(5)	569(3)	644(2)	656(1)
Mean	714(3)	722(1)	715(2)	682(4)	877(5)
% increase over Chandni	5.47	6.65	5.61	0.74	

Table 3: Stability Analysis Results of 5 Genotypes over 11 Environments Obtained Through Mstat 4.0 Package 4.c

	LS-75	LS-73	LS-49	Chandni	LS-29
Coefficient of correlation (r)	0.979	0.977	0.991	0.980	0.986
Coefficient of determination (r^2)	0.958	0.955	0.983	0.960	0.971
Regression line intercept (b_o)	0.617	-4.518	29.216	84.489	-109.803
Regression line slope (b)	1.016	1.035	0.975	0.845	1.128
Standard error of slope (SE)	0.071	0.075	0.043	0.058	0.065
Student's t-value (t)	0.233"	0.473	0.573	2.698	1.991
Probability	1.000	1.000	1.000	0.024	0.079
Deviation mean square (DMS) from regression	11026.88	12349.80	4070.705	7308.394	9220.053

appeared more stable while LS-75, LS-73, 15-29 less stable compared to Chandni.

Regression coefficient (b) of Chandni was significantly lower than unity indicating its more adaptability to poor environments (Table 3). b value of near unity in case of LS-75, LS-73 and LS-49 indicated their responsiveness to average environments. Above unity b value in case of LS-29 showed its responsiveness to favourable environments. Coefficient of determination (r^2) is a measure of prospects of agronomic manipulation to obtain higher yield (Mahto, 1995). Higher the value, better are the prospects to obtain high yield with good management. Therefore, the highest value of r^2 in case of LS-49 indicate that there is great scope to improve seed yield of LS-49 followed by LS-29 compared to Chandni with better agronomic manipulation. LS-49 not only possessed high seed yield potential but also high stability in yield, therefore, hold good promise as a future variety. Its involvement in future linseed breeding can result in further genetic improvement of seed yield potential.

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