International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(4): 2909-2912

Received: 18-05-2020
Accepted: 21-06-2020

PC Yadav
Department of Genetics and Plant Breeding, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

RK Yadav
Department of Genetics and Plant Breeding, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Vishawanath
Department of Genetics and Plant Breeding, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Laxmi Prajapati
Department of Genetics and Plant Breeding, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Corresponding Author:
PC Yadav
Department of Genetics and Plant Breeding, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Stability analysis over environments in linseed (*Linum usitatissimum* L.) varieties

PC Yadav, RK Yadav, Vishawanath and Laxmi Prajapati

DOI: https://doi.org/ 10.22271/chemi.2020.v8.i4ai.10085

Abstract
A field experiment was conducted during Rabi season of 2015-16. To study the stability analysis of yield and its component traits in 20 genotypes of linseed i.e.; NPHY-29, NP-121, NPRR-271, NPRR-402, RL-28-1, AHUDERA-170, NPHY-39, NPRR-28, NPHY-38, POLF-6, LCK-87312, RR-76, No-356, No-8, L-53, SJKO-05, No-3, 141No18 X RR-9, LMHS-397 and SJKO-55 will be grown in randomized block design with three replications at three different locations (Kanpur, Mainpuri and Mauranipur). The observations were recorded on some biological characters, viz.; 1000-seed weight (g), seed yield per plant (g), oil content (%), protein content (%), palmitic acid, stearic acid, oleic acid, linoleic acid and linolenic acid. In the present study of material SJKO-05 for 1000-seed weight (g), seed yield per plant (g) and protein content (%) were found to be stable because b_1 was near to unity, S^2_{di} was not significant and mean values were more than population mean which was desirable. NP121 and NPRR 271 for palmitic acid, stearic acid, oleic acid and linolenic acid were found to be stable because b_1 was near to unity, S^2_{di} was not significant and mean values were less than population mean which was desirable.

Keywords: Linum usitatissimum, G X E interaction, Selection, Stability.

Introduction
Linseed (*Linum usitatissimum* L.) is a diploid (2n =30, genome size ~370 Mb) self-pollinated annual oilseed plant. It grown for both seed and fibre. Recently medical researchers have found linseed as best herbal source of carbohydrates, Omega-3 and Omega-6 fatty acids, which have beneficial effect on human metabolism. The seed of linseed is a very rich source of nutrients, which contain oil (40%), protein (26%), fibre (14%), mucilage (12%), water (9%), minerals (4%), potassium (0.74%), phosphorous (0.70%), magnesium (0.38%), calcium (0.21%), sulphur (0.21%), along with sodium, chlorine, iron, zinc and copper in traces. Lignan (1.90-6.16 mg/g) is also found in the seed. The oil contains different fatty acids like linolenic (omega-3) 53.21%, linoleic (omega-6) 17%, oleic 18.51%, stearic 4.42% and palmitic 4-6%. Linseed is the richest source of omega-3 fatty acid and it contains almost twice as much as of omega-3 in fish oil. The ratio of omega-3 and omega-6 present in linseed is about 4:1, so this is a best herbal source of omega-3 for improvement in human metabolism. World over, linseed is an important crop grown over 27.29 lakh ha with production of 25.20 lakh tons and average productivity of 923 kg/ ha, while national production of 1.525 lakh tons is from 3.38 lakh ha area with low productivity of 473 kg/ha. As far as productivity is concerned, Indian average yield (473 kg/ha) is far below the productivity of UK (1500 kg/ha), Germany (1429 kg/ha), Canada (1538 kg/ha), USA (1076 kg/ha) and China (1000 kg/ha). India is an important linseed producer, which contributes about 11.82% to world acreage producing about 7% of world production. Anonymous (2015) [1].

Materials and Methods
Basic material of present investigation comprising 20 pure lines of linseed i.e. NPHY-29, NP-121, NPRR271, NPRR-402, RL-28-1, ADHUERA-170, NPHY-39, NPRR-28, NPHY-38, POLF-6, LCK-87312, RR-76, No-8, L-53, SJKO-05, No-3, 141No18XRR-9, LMHS-397 and SJKO-55 were grown in randomized block design with three replications at three different locations viz. Kanpur, Mainpuri and Mauranipur during Rabi 2015-16. Oil content was determined by Soxhlet method A.O.A.C 1975. There were analysed separately for their oil content and fatty acid composition. The data were reported about stability by Eberhart and

Russell model of three replications. Methyl esters were prepared by the method of Luddy *et al.* (1968) [4].

Results and Discussion

The stability analysis (Table 1) revealed highly significant differences among the genotype for all the characters except seed yield per plant and stearic acid. Seed yield per plant (g), protein content (%) and stearic acid for environment. Similar result has been reported by Yadav *et al.* (2000-2014) [5, 6, 7]. 1000-seed weight (g), protein content (%), palmitic acid, stearic acid, linoleic acid and linolenic acid for (E+GXE). Protein content (%) and stearic acid for E(Linear). 1000-seed weight (g), seed yield per plant (g), oil content (%), protein content (%), palmitic acid, stearic acid, oleic acid and linolenic acid for GXE (Linear). 1000-Seed weight (g), seed yield per plant (g), oil content (%), oleic acid, linoleic acid and linolenic acid for pooled deviation. Indicating substantial amount of genetic diversity in the material, such as observations were advocated by Eberhart and Russell model (1966) [3] in their findings. Adaptability studies (Table-2) in linseed to considerable amount of G X E linear component emphasized genotypes deviating from regression line of unit slope could be identified. Accordingly, three kinds of linear component viz., b = 1, b > 1 and b < 1 < 0 had been generally observed in all the characters. In the present study four genotypes namely, NPHY 29, NPRR 271, NPHY 38 and SJOK 05 for 1000-seed weight (g), Five genotypes namely, POLF 10, L-53, 141NO18XRR9, LMHS-5 and SJKO 55 for seed yield per plant (g), Six genotypes namely RL-28-1, NPRR 28, POLF 10, L-53, NO 3 and LMHS-5 for oil content (%), Four genotypes namely, NP 121, NPHY 38, RR 76 and SJKO 55 for protein content (%), Seven genotypes namely, NP121, NPRR 271, NPRR 402, NPHY 38, RR 76, 141NO18XRR9 and LMHS-5 for palmitic acid, Two genotypes namely, NPHY 29 and NPRR 271 for stearic acid, Twelve genotypes namely, NPHY 29. NPRR271, NPRR 402, NPHY 39, NPHY 38, POLF 10, NO 356, L-53, SJKO 05, NO141NO18XRR9 and SJKO 55 for oleic acid. All genotypes for linoleic acid showed significant regression coefficient (b_1). Deviation from non-linear regression (s^2_{di}) was significant in none of the genotypes and Nine genotypes namely, NPHY 29, NP 121, RL-28-1, AHUDERA 170, NPHY 39, POLF 10, NO 356, and LMHS-5 for linolenic acid were to be stable because b_1 was near to unity, S^2_{di} was not significant and mean values were less than population mean which was desirable. Such observation were reported by Alem and Dessalegn (2014) [9]; Temesgen *et al.* (2014) [10]; Vishnuvardhan and Rao (2014) [11] and Yadav *et al*, (2014) [7].

Table 1: Analysis of variance of stability for some biological characters in 20 parents in linseed (*Linum usitatissimum* L.).

Source of variation	d.f.	1000- seed weight (g)	Seed yield/plant	Oil content (%)	Protein content (%)	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid	Linolenic acid
Genotype	19	0.48**	0.80	5.03**	0.70*	41.26**	1.96	157.53**	121.56**	242.05**
Environment	2	0.91**	13.39	6.85**	0.33	6.70**	0.43	31.43**	8.22*	17.82**
G x E	38	0.09	0.53	0.46	0.37	0.53	1.83	0.64	2.80	1.41
E + G x E	40	0.14	1.17**	0.78*	0.36	0.84	1.76	2.18**	3.07	2.23
E (Linear)	1	1.83**	26.79***	13.71**	0.66	13.41**	0.86	62.87**	16.45**	35.64**
G x E (Linear)	19	0.12	0.66	0.58	0.48	0.16	1.47	0.48	3.87*	0.83
Pooled deviation	20	0.07	0.38	0.32	0.24*	0.85***	2.08***	0.76	1.63	1.89
Pooled error	114	0.10	0.33	0.59	0.12	0.09	0.009	0.57	1.35	1.26

Table 2: Estimates of stability parameters based on three environments for some biological characters in linseed (*Linum usitatissimum* L.).

Genotype	1000-Seed weight (g)			Seed yield per plant (g)			Oil content (%)		
	$\bar{x}$	b_i	$\bar{x}$	b_i	S^2d_i	S^2d_i	$\bar{x}$	b_i	S^2d_i
NPHY 29	7.05	0.95	36.29	0.66	-0.45	-0.104	5.83	0.28	-0.27
NP 121	7.05	2.48	35.90	0.47	0.68	-0.031	4.90	0.95	-0.002
NPRR 271	6.94	1.07	36.62	1.71	0.10	-0.102	5.29	1.01	0.49
NPRR 402	7.04	2.21**	34.44	0.42	0.26	-0.104	5.66	1.37	-0.11
RL-28-1	6.38	0.69	37.21	1.00	-0.55	-0.102	4.61	0.50	-0.18
AHUDERA 170	6.53	1.15	36.72	2.13**	-0.57	-0.101	4.71	-0.50	0.08
NPHY 39	6.39	-0.005	36.55	1.30	0.33	-0.64**	4.97	1.08	-0.33
NPRR 28	7.04	2.21**	37.04	1.53	-0.50	-0.104	5.21	1.04	0.62
NPHY 38	8.14	1.28	34.40	-0.52*	-0.579	-0.001	4.75	0.005	0.13
POLF 10	7.05	1.74	37.07	0.87	-0.574	0.044	6.08	1.27	-0.15
LCK 87312	6.71	-0.38	36.73	1.19	-0.44	0.016	5.71	0.87	0.52
RR 76	7.32	2.98	36.05	1.04	-0.55	0.037	4.96	0.84	1.00*
NO 356	6.64	0.41	38.04	3.78	0.79	-0.100	5.57	0.27	-0.20
NO 8	6.94	2.71	36.73	0.43	-0.34	-0.054	5.86	2.18	-0.28
L-53	6.62	0.63	40.00	0.70	-0.54	-0.096	6.05	1.41	-0.027
SJKO 05	6.91	1.34	36.87	-0.40	-0.55	-0.095	5.20	0.34	0.025
NO 3	6.59	-0.20	39.06	1.41	-0.33	-0.082	6.23	2.26	-0.19
141NO18XRR9	6.36	-0.11*	36.32	0.60	-0.57	-0.104	5.93	1.60*	-0.33
LMHS-5	6.76	-1.32	37.99	1.29	-0.11	-0.099	5.30	1.55	0.27
SJKO 55	6.95	0.13	37.01	0.32	-0.53	-0.009	6.06	1.58	0.01
Population Mean	6.87			5.44			36.85		
SE Bi	0.19			0.53			0.68		
SE Mean	0.89			0.43			0.40		

Table 3: contd.

Genotype	Protein content (%)			Palmitic acid			Stearic acid		
	x^-	b_i	x^-	b_i	S^2d_i	S^2d_i	x^-	b_i	S^2d_i
NPHY 29	15.68	5.07	3.93	-1.17	0.022	-0.11	6.39	0.74*	-0.10
NP 121	16.15	0.57	3.11	-0.88	0.223**	0.0005	10.48	0.94	0.11
NPRR 271	15.58	4.93	4.15	-1.32	0.075**	0.45*	17.72	1.83*	-0.09
NPRR 402	16.71	-3.92	1.90	1.10	0.074**	-0.11	15.03	0.79	0.23
RL-28-1	15.37	1.35	4.18	4.41	17.62**	0.48*	8.21	1.25	0.58*
AHUDERA 170	16.22	5.30	2.23	0.62	0.31**	-0.10	7.85	0.95	0.18
NPHY 39	16.27	-0.12	3.36	-4.32	0.26**	-0.05	6.16	1.00	0.03
NPRR 28	16.08	2.42**	3.80	-1.50	2.14**	-0.12	14.31	0.15	5.42**
NPHY 38	16.98	1.87	4.27	-2.06	1.56**	0.34	9.04	1.48	-0.03
POLF 10	16.01	-0.87	4.02	8.98	3.09**	0.35	7.34	1.39	0.85**
LCK 87312	16.04	-2.99	3.33	-1.49	0.02*	0.002	3.54	0.56	-0.01
RR 76	16.24	1.18	2.56	9.63	2.71**	0.30	7.62	1.25	0.74**
NO 356	15.41	10.79	4.07	-11.24	0.29**	0.46*	8.25	0.31	1.24**
NO 8	16.22	2.26	4.40	7.38*	-0.008	-0.09	6.39	0.48	-0.07
L-53	14.79	1.44	4.63	2.31	2.38**	-0.02	4.72	1.04	1.14**
SJKO 05	16.32	-3.60*	4.34	2.42	2.57**	-0.12	4.21	2.23	3.42**
NO 3	15.78	1.33	4.50	6.34	0.10**	0.42*	5.99	0.98	0.18
141NO18XRR9	16.03	-0.10	4.17	6.18	0.73**	-0.10	7.34	0.66	0.61**
LMHS-5	16.04	-6.15	3.46	6.19	1.04**	0.53*	11.65	0.77	0.59**
SJKO 55	16.32	-0.78	4.93	-11.61	6.20**	-0.11	6.55	1.11	0.05
Population Mean	16.01			8.44			3.77		
SE Bi	2.70			1.13			6.94		
SE Mean	0.35			0.65			1.02		

Table 4: contd.

Genotype	Oleic acid			Linoleic acid		Linolenic acid			
	x^-	b_i	x^-	b_i	S^2d_i	S^2d_i	x^-	b_i	S^2d_i
NPHY 29	23.16	0.66	58.79	0.78	-1.22	-0.54	7.71	0.69	-0.91
NP 121	9.40	0.89	65.25	1.05	-1.12	-0.50	11.73	1.02	-1.17
NPRR 271	21.04	1.29*	41.72	1.48	-0.35	-0.56	15.34	2.36	-1.22
NPRR 402	26.38	0.90	36.63	1.23	-0.95	-0.44	20.85	-0.68	3.74
RL-28-1	18.37	1.11	57.26	1.08	-1.22	-0.53	12.62	3.03	1.73
AHUDERA 170	12.55	2.30	64.93	1.44	-0.84	2.80*	12.41	1.68	2.22
NPHY 39	23.03	0.72*	57.78	1.20	-0.88	-0.56	9.64	1.91	-0.52
NPRR 28	5.07	0.92	39.71	0.98	-1.22	-0.54	36.86	-0.35	-1.21
NPHY 38	25.32	0.71	43.84	1.03	-1.10	-0.55	17.51	2.69	-0.37
POLF 10	21.29	1.01	55.81	0.95	-1.22	-0.54	12.44	-2.40	8.60**
LCK 87312	10.81	1.18	71.17	1.78	32.32**	9.86***	11.14	-0.70	4.25*
RR 76	19.34	1.03	59.04	0.96	-1.21	-0.39	11.39	-1.13	-1.11
NO 356	20.81	1.01	57.82	1.06	-1.22	0.11	8.67	2.83*	-1.33
NO 8	23.19	0.15	48.90	2.15	-0.84	-0.55	17.12	-3.87	0.96
L-53	24.49	1.26	54.09	-0.46	-0.80	-0.54	11.92	2.69**	-1.34
SJKO 05	30.27	0.92	47.91	1.15	-1.02	-0.55	13.51	2.74	-1.16
NO 3	32.57	1.00	48.52	1.22	-1.258	-0.51	8.26	-0.17	-1.33
141NO18XRR9	29.42	1.05	49.30	1.02	-1.251	-0.45	9.14	0.26	-134
LMHS-5	13.34	0.88	58.63	-1.02	-0.64	-0.48	12.84	1.96	-1.29
SJKO 55	23.09	0.90	50.56	0.85	-1.25	-0.49	14.85	5.43*	-1.33
Population Mean	20.65			13.80		53.38			
SE Bi	0.49			1.41		0.97			
SE Mean	0.61			0.90		1.03			

References

1. Anonymous. Food and Agriculture organization of the United Nation. FAO Statistics, 2014-15. (www.faostat.org.com).
2. Anonymous. methods of analysis, 12th edition, Association of official analytical chemists, Washington, D.C, 1975.
3. Eberhart SA, Russell WA. Stability parameters for comparing varieties. Crop Sci. 1966; 6:36-40.
4. Luddy EF, Barforad RA, Berbs SF, Magidman P. J Amer Oil Chem Soc. 1968; 65:549.
5. Yadav RK, Singh PK, Gupta RR. Phenotypic stability for yield and quality attributes in linseed (*Linum usitatissimum* L.). Crop Res. 2000; 19(2):301-304.
6. Yadav RK. Association studies over locations in linseed (*linum usitatissimum* L.) Prog. Agic. 2001; 1(1):11-15.
7. Yadav RK, Yadav AK, Shweta Singh L, Verma PN. Stability analysis in linseed (*Linum usitatissimum*) varieties. Indian Journal of Agricultural Science. 2014; 84(7):883-886.
8. Jinks JL, Perkins JM, Breeze EI. A general method of detecting dominance and epistatic variation for metric

traits II. Application to inbred lines. *Heredity*. 1969; 24:45-57.
9. Alem C, Dessalegn T. Study on genotype x environment interaction of seed yield, oil content, fatty acid profile and stability analysis of yield related trait in linseed (*Linum usitatissimum*L.). International Journal of Plant Breeding and Genetics. 2014; 8(2):66-73.
10. Temesgen A, Mammo K, Lule D. Genotype by environment interaction (G x E) and grain yield stability analysis of Ethiopian linseed and Niger seed varieties. Journal of Applied Bioscience. 2014; 80:7093-7101.
11. Vishnuvardhan KM, Rao SS. Stability analysis for yield and its attributing characters in linseed (*Linum usitatissimum* L.). International Journal of Plant, Animal and Environmental Sciences. 2014; 4(2):408-412.
12. Tewari N, Singh N Shweta. Selection parameters for seed yield and its components in linseed (*Linum usitatissimum* L.). Current Advances in Agricultural Sciences. 2012; 4 (2):149-151.