

Evaluation and Genetical Studies of Yellow Seeded Germplasm of Linseed (*Linum usitatissimum* L.)

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Yellow seeded linseed (*Linum usitatissimum* L.) germplasm was evaluated for 10 agro-morphological and quality characters using two checks, namely Surabhi and KL-223 at Crop Research Farm, Nawabganj, CSAUA & T, Kanpur during *rabi* 2003-04 and 2004-05. Among 10 traits studied maximum variation was observed for branches per plant (9.85%) followed by seed yield per plant (7.44%). The least variability was observed for plant height (0.23%) followed by oil content (0.61%). Promising donors were identified for various economic traits which can be further use for future breeding programme. Genotype EC41583 was found to be one of the useful donor for branches/plant, capsules per plant and seed yield per plant. The genotype BSL-4 was observed to be good donor for oil content. The positive and significant values of correlation were observed for branches per plant, test weight and capsules per plant with seed yield per plant. Hence, selection for the highest values of these traits will be desirable to increase seed yield. The positive and significant correlation indicated that bold seeded types are having high oil content. Characterization of promising donors for high oil content was also studied.

Key words: Yellow seeded linseed, Agro-morphological traits, Coefficient of variations, Donor, Correlation

Linseed (*Linum usitatissimum* L.) is second largest oilseed crop of *rabi* after rapeseed-mustard grown in India. It has unique feature for its oil and fibre. Linseed is basically an industrial oilseed crop and its each and every part is endowed with commercial and medicinal properties. It is also unique that each part of linseed plant is commercially utilized either directly or after processing. At national level yield productivity of linseed is 403 kg/ha as against the world production of 851 kg/ha (2003-04). Thus, there is wide gap between India and World productivity which gives a pace for enhancement of production.

The present study was undertaken to study the variability among quantitative and qualitative traits of yellow seeded germplasm which have greater oil concentration than brown seeded (Saeidi and Rowland, 1999), available at Project Coordinating Unit (Linseed). This study also aimed to characterize the germplasm for certain useful agro-morphological traits. The identified accessions may prove to be an important genepool for different traits and may be exploited in the term of breeding programmes.

Material and Method

A total number of fifty yellow seeded elite germplasm of linseed were grown in 40 cm row to row space with row length of 3m, under augmented design with two checks i.e. Surabhi and KL-223, in three blocks at Crop Research Farm, Nawabganj, CSAUA&T, Kanpur during *rabi* 2003-

04 and 2004-05. These germplasm lines were evaluated for 10 traits including yield, its component and quality traits. The traits selected included branches per plant, capsules per plant, seeds per capsule, days to flowering (50%), days to maturity, test weight (g), plant height (cm), technical plant height (cm), seed yield per plant (g) and oil content (%). The observation each entry was based upon five randomly selected plants for all traits at appropriate stage of growth. The test weight was observed with weighing 1000 randomly selected seeds by electronic balance. Oil content was estimated from dry seed having less than 10 per cent moisture by NMR (MQO-07, USA), range of variation, mean, coefficient of variation, simple correlation coefficient were compiled using standard statistical methods (Gomez and Gomez, 1984).

Table 1. Variability in some agro-morphological traits in yellow seeded linseed

Characters	Range of variation	CV%	Mean value of checks	
			Surabhi	KL-223
Branches/plant	9-4	9.85	6.5	6.0
Capsules/plant	125-38	2.29	5.9	125
Seeds/capsule	9-6	6.95	8.0	8.0
Test weight (g)	9.4-4.49	0.65	4.49	7.05
Seed yield/plant (g)	8.72-2.14	7.44	2.89	7.61
50% flowering (Days)	135-55	0.68	102	92
Maturity days	157- 138	2.48	141	148
Plant height (cm)	110-51	0.23	58	58
Tech. plant height (cm)	71 -26	0.86	42	39
Oil content	46.21-31.97	0.61	37.15	40.57

Table 2. Promising cultures for different traits

Characters		Yellow seeded lines
Branches/plant	≥8	EC23269, EC322652, ECJ41583, NP(hyb)-47, Omega-2
Capsules/plant	≥90	EC41583, EC-588 A-388, Ajgan-1 1, NP(RR)- 405
Seeds/capsule	≥9	Poona-10, Omega- 1, NP(hyb)-47, LCK-9414, LCK-94II, EC322652
Test weight (g)	≥8	FRW-1, BSL-4, EC-568, A-388, KYS-15
Seed yield/plant (g)	≥7	KL-178, EC/41583, NP(hyb)-47, A-388, NP(RR)-60, KYS-15
50% flowering (Days)	≤83	NP(RR)-463, NP(RR)-405, EC/41662, EC41579, EC22781, KYS-15, CI-1574
Maturity days	≤141	GLC-1, NP(RR)-463, T-56, Ajgan-10, NP-125, Ajgan-11, EC41662
Plant height (cm)	≤60	KL-223, NP(RR)-463, EC23269, NP(RR)-405, EC41662, KYS-2
Technical plant height (cm)	≥60	LCK-9414, R-10, Poona-10, LCK-87311, L-23, Omega-2
Oil content	≥42	BSL-4, FRW-1, KYS-1, KYS-7, EC422781, EC22784, EC41579

Results and Discussion

The seeds of linseed are generally brown but some yellow colour seeds are also available in germplasm pool in limited number. Table 1 revealed great genetic variability in yellow seeded types particularly for the traits such as branches per plant, seeds per capsule and seed yield per plant as their coefficient of variations were observed to be high. Green and Marshall (1981) also observed variation in seed weight and oil content while studying diverse collection of 201 linseed and thirteen flax accessions. Among ten studied traits, maximum variability was observed for branches per plant (9.85%) followed by seed yield per plant (7.44%). However, least variability was observed for plant height (0.23%) followed by oil content (0.61%). Promising donors identified for various economic traits presented in Table

2 can be further used for further breeding programme. Genotype EC41583 was found to be one of the useful donor for branches per plant, capsules per plant as well as seed yield per plant. Genotypes BSL-4 and FRW-1 was found for higher test weight and oil content. Genotype A-388 was observed for higher number of capsule, 1000 seed weight and high yield per plant.

Correlation of metric traits (Table 3) revealed that seed yield had positive and significant correlation with capsules per plant, test weight and branches per plant. Pal *et al.* (2000) also observed positive correlation among these traits. Test weight had the positive and significant correlation with seed yield and oil content, thereby, revealing that bold seeded genotypes directly reflect seed yield and ultimately oil yield in positive direction. Technical plant height is major criteria for deciding double

Table 3. Correlation among the different traits of yellow seeded linseed

Characters	Branches/ plant	Capsules/ plant	Seeds/ capsule	Days to flowering	Days to maturity	Seed yield	Test weight	Oil content	Plant height	Technical plant height
Branches/plant	-	-	-	-	-	-	-	-	-	-
Capsules/plant	0.197	-	-	-	-	-	-	-	-	-
Seeds/capsule	-0.012	-0.181	-	-	-	-	-	-	-	-
Days to -flowering	0.199	-0.356*	0.149	-	-	-	-	-	-	-
Days to maturity	0.183	-0.023	0.151	0.302*	-	-	-	-	-	-
Seed yield	0.291*	0.500*	0.041	-0.158	-0.001	-	-	-	-	-
Test weight	-0.118	0.249	-0.112	-0.071	0.239	0.389*	-	-	-	-
Oil content	-0.100	0.119	0.058	-0.380*	-0.149	0.063	0.378*	-	-	-
Plant height	0.049	0.241	0.049	0.110	0.249	-0.131	0.236	0.006	-	-
Technical plant height	0.069	-0.323*	0.069	0.594*	0.370*	-0.184	0.007	-0.575*	0.309*	-

Table 4. Characterization of promising cultures of yellow seeded linseed having high oil content (> 42%)

Cultures name	Oil content	Branches/ plant	Capsules/ plant	Seeds/ capsule	Days to flowering	Days to maturity	Seed yield/ plant (g)	Test weight (g)	Plant height (cm)	Technical plant height (cm)
BSL-4	45.21	7.5	89	8.5	86.5	146	5.75	9.39	64.5	30.5
KYS-1	44.32	4.5	55	8.5	84	147	4.95	7.19	65.5	34.5
FRW-1	43.17	4.5	59	8.5	86.5	147	5.59	9.40	68.5	38.5
EC/41579	42.76	6.0	74	8.5	84	150	5.56	6.65	66.0	31.0
EC/22781	42.73	4.0	64	8.0	83	142	5.04	6.29	61.0	32.0
ECJ22784	42.53	5.5	84	8.5	89	147	5.39	6.65	65.0	33.0
KYS-7	42.47	6.0	54	6.5	89	153	4.57	7.47	67.5	37.5

Table 5. Characterization of promising cultures of yellow seeded linseed having high seed yield/plant (> 7 g)

Cultures name	Seed yield/plant (g)	Branches/plant	Capsules/plant	Seeds/capsule	Days to flowering	Days to maturity	Test weight (g)	Oil content	Plant height (cm)	Technical plant height (cm)
KL-178	8.72	7	91	7	91	144	6.635	38.30	71	50
NP(hyb)-47	7.59	8	75	9	104	150	6.335	38.46	68	41
A-388	7.31	6	102	7	101	152	8.305	38.03	72	51
NP(RR)-60	7.23	7	69	8	103	148	7.025	40.18	78.5	50

purpose linseed, observed positive and significant correlation with days to flowering, days to maturity and plant height indicated that taller the plants take more days to flower as well as to mature. Technical plant height had shown negative and significant correlation with the traits capsules per plant and oil content and also negative and poor association with seed yield which ultimately reflected that the technical plant height had poor number of capsules bearing branches resulted in poor seed yield. Plant height had the negative correlation with number of branches and capsules per plant (Pal *et al.*, 2000). Froment *et al.* (2000) also observed that seed yield of the fibre flax types were less than for industrial oil.

The oil content had less variation as its coefficient of variation was observed less (0.61%). The maximum oil content *Le*, 45.2% was observed in BSL-4. The promising yellow seeded types having more than 42% oil along with their agro-morphological traits were presented in Table 4. Similarly, promising donors like A-388, NP(Hyb)-47, NP(RR)-60 and KL-178 for seed yield among yellow seeded of linseed alongwith their agromorphological features are presented in Table 5, which can be exploited in future breeding programme

and yield improvement. High seed yield has been reported by selecting high seed number per plant and a medium 1000 seed weight (Hemker, 1989). These high seed yield and oil containing germplasm may be utilized for improving target yield.

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