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Performance of linseed genotypes for seed yield and stability analysis

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Abstract
Sixty diverse genotypes used to study their stable performance over three environmental conditions *viz.*, sowing date October, 31, November, 15 and November 30, respectively for seed yield and its attributing characters. Significant genotypes, environment and environment (linear) were observed for all the characters. Env. + (G x Env.) and linear component of G x E interaction were also significant for all the characters except tillers per plant, branches per plant, seeds per capsules, oil content and seed yield. The genotypes NDGL-124 was found stable for branches per plant, capsules per plant, seeds per capsule, 1000-seed weight and seed yield, NDGL-143 showed stable performance for days to maturity, tillers per plant, seeds per capsules and biological yield. NDGL-127 found stable for branches per plant, capsule per plant, 1000-seed weight and seed yield.

Keywords: Stability, linseed, G x E interaction

Introduction
Linseed is one of the oldest *rabi* crop and mainly cultivated for its oil. The low yield of linseed is characterized mainly due to varying environments and further lack of response to better conditions and the instability in yield of linseed due to environments are also great concern. Stability in performance is most desirable character of a genotype to be released as a variety for wider adoption. So information about stability of linseed genotypes prior to their recommendation for cultivation is very necessary. Keeping this point in view the present investigation was carried out on 60 diverse linseed genotypes for stability analysis.

Material and Methods
The present investigation was conducted during *rabi* season of 2007-08 and 2008-09 at crop research farm of Post Graduate College Ghazipur (U.P.). The experimental material comprised 60 diverse linseed genotypes which were grown under three environment condition *viz* E_1 (Sowing date October, 31) E_2(Sowing date November, 15) and E_3 (Sowing date November, 30). The experiment was raised in randomized block design with three replications at each environment with single row of 3 M length. The row to row distance was kept 45 cm and plant to plant distance was 5 cm respectively. Recommended cultural practices were followed. The observations were recorded on days to 50% flowering, days to maturity, plant height, tillers per plant, branches per plant, capsules per plant, seeds per capsules, 1000-seed weight, biological yield, harvest index, oil content and seed yield per plant. The analysis of variance was done based on the formula suggested by Panse and Sukhatme (1976) [2]. For stability analysis the data were analysed based on the formula suggested by Eberhart and Russell (1966) [1].

Results and discussion
The analysis of variance (Table1) indicated the mean square due to genotypes, environments and environment (linear) were highly significant for all the characters under study. It revealed that there was considerable variation present amongst genotypes as well as environments. The genotypes x environment were significant for plant height, capsules per plant, 1000- seed weight and harvest index indicating the genotypes interact strongly with the environments. The significant G x E interaction also indicating the genotypes were suitable for applying stability parameters. Genotypes x environment (linear) and Env. + (G x Env.) Were significant for all the characters except tillers per plant, branches per plant, seeds per capsule, oil content and seed yield per plant. It revealed the varied response of genotypes to changing environments. Similar results have been reported by Vishnuvardhan and Rao (2014) [6],

Yadav *et al.* (2014) [9], Khan *et al.* (2008) [10] and Patil *et al.* (2001) [7]. The pooled deviation were significant for capsules per plant, harvest index and oil content.

The genotypes were categorized into various groups on the basis of mean, regression coefficient and deviation from regression coefficient. The genotypes having high mean, unit regression (b_i=1) and deviation from regression (S^2d_i=0) and average stability. Further the genotypes with high mean, b_i>1 and S^2d_i=0 are considered more responsive for favourable environment, whereas the genotypes with high mean, b_i<1 and S^2d_i=0 or expected to equal to exceed average mean performance is suitable under unfavourable environments. Michaels and Stanley (1991) [8] founded that well adopted variety had regression coefficient approaching zero (0) for most of the yield components. The stability parameters for days to 50% flowering (Table 2) the genotypes NDGL-101, NDGL-93, NDGL-96, NDGL-88 and NDGL-107 were stable for a wide range of environment. The genotypes NDGL-113, NDGL-143, NDGL-148 and NDGL-102 were found stable with minimum days to maturity. NDGL-97, NDGL-102 and NDGL-137 were stable for plant height, NDGL-143, NDGL-98, NDGL-125 and NDGL-137 were stable for tillers per plant, NDGL-128, NDGL-124, NDGL-193, NDGL-126, NDGL-127, NDGL-131 and NDGL-100 were found stable for branches per plant. NDGL-35, NDGL-118, NDGL-119, NDGL-138, NDGL-127, NDGL-114, NDGL-124, NDGL-129 and NDGL-84 were stable for capsules per plant. NDGL-126, NDGL-124, NDGL-143, NDGL-84, NDGL-44, NDGL-123, NDGL-97, NDGL-104, NDGL-117, NDGL-130, NDGL-140, NDGL-85 and NDGL-108 were stable for seeds per capsules. NDGL-109, NDGL-141, NDGL-142, NDGL-87, NDGL-98, NDGL-86 and NDGL-127 were stable for 1000-seed weight. NDGL-35, NDGL-119, NDGL-101, NDGL-93, NDGL-124, NDGL-87, NDGL-90, NDGL-118, NDGL-97, NDGL-143, NDGL-147, NDGL-113 and NDGL-130, were stable for biological yield. NDGL-115, NDGL-86, NDGL-114, NDGL-129, NDGL-106, NDGL-99, NDGL-125 and NDGL-30 were stable for harvest index. NDGL-93, NDGL-122, NDGL-121, NDGL-92 and NDGL-84 were stable for oil content. NDGL-115, NDGL-93, NDGL-119, NDGL-127, NDGL-141, NDGL-30, NDGL-118, NDGL-129 and NDGL-124 were stable for seed yield. The phenotypic stability in linseed has been investigated by many workers Verma and Mahato (1994) [4], Khan *et al*. (2008) [10], Yadav *et al*. (2014) [9], Cherinet alem and Tadesse Dessaleng (2014) [5], Vishnuvardhan and Rao (2014) [6] and Rai *et al*. (2014) [3].

Table 1: Analysis of variance (ANOVA) for stability parameters (mean sum of squares) for different traits in linseed (Eber hart & Russell 1966).

Source of variation	d.f.	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of Tillers / plant	No. of Branches / plant	No. of Capsule / plant	No. of Seed / capsule	1000-seed weight(g)	Biological yield(g)	Harvest index (%)	Oil content (%)	Seed yield/ plant (g)
Genotypes	59	130.14**	16.88**	357.87**	9.15*	3.69*	4204.06**	5.13*	9.44*	166.29**	177.09**	1419**	7.27*
Environment	2	1639.69**	4239.09**	1216.34**	11.41**	25.31**	3062.66**	3.58*	5.41*	83.52**	105.37**	28.21**	13.02**
G x E	118	1.04	1.897	3.72*	0.76	0.45	12.90**	0.02	3.96*	1.52	2.87*	2.49	0.197
Env.+ (G. x Env.)	120	28.36**	72.52**	23.93**	0.94	0.86	63.73**	0.08	3.98*	2.88*	4.58*	2.92	0.41
E (linear)	1	8201.26**	21195.34**	6083.60**	57.09**	126.57**	15313.77**	17.89**	27.05**	417.57**	526.78**	142.05**	65.11**
G x E (linear)	59	1.84	2.23*	6.00*	0.12	1.47	25.39**	0.03	16.46**	2.44*	3.49*	1.47	0.10
Pooled dev.	60	0.82	1.78	3.09*	0.91	0.19	9.61*	0.02	0.82	1.26	2.67*	2.69*	0.22
Pooled error	354	0.734	2.99	4.27	2.28	0.07	17.44	0.11	11.86	0.45	0.83	0.73	0.55

*Significant of 5 % level of significance.

** Significant of 1 % level of significance.

Table 2: Estimates of stability parameters for different characters in linseed

S. No.	Characters→ Genotypes ↓	1. Days to 50% flowering			2. Days to maturity			3. Plant height (c.m.)			4. No. of Tillers/plant		
		$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di
1	NDGL-93	62.9	0.83**	0.09	123.61	0.84	11.91**	68.96	0.80**	4.82	7.63	0.96	0.19
2	NDGL-92	73.78	0.99**	0.08	123.41	0.84	12.22**	46.55	0.73**	0.24	5.53	3.21*	4.43
3	NDGL-91	79.88	1.07**	0.11	125.31	0.85	14.27**	52.85	0.82**	0.24	5.56	0.79	0.17
4	NDGL-121	71.73	0.96**	0.13	123.35	0.83	11.93**	62.32	0.98**	0.39	5.6	0.65	0.09
5	NDGL-122	66.6	0.88**	0.09	123.67	0.81	8.73**	62.59	1.03**	2.67	4.41	0.49	0.05
6	NDGL-123	73.29	0.88**	3.44**	122.05	0.84	12.15**	63.14	0.99**	0.43	7.11	0.87	0.16
7	NDGL-84	72.05	0.93**	0.2	122.36	0.91	54.37**	69.26	1.09**	0.45	5.63	0.64	0.12
8	NDGL-104	73.26	0.98**	0.08	124.48	0.85	12.40**	35.25	1.14**	3.52	5.79	0.52	0.1
9	NDGL-103	81.04	1.08**	0.18	126.03	0.86	12.88**	81.11	1.29**	1.64	7.32	1.11	0.1
10	NDGL-101	62.66	0.83**	0.21	121.62	1.01	0.54	60.28	0.95**	0.37	6.46	1.05	0.06
11	NDGL-102	75.61	1.02**	0.13	120.97	1.01	0.55	83.15	1.30**	0.63	6.95	1.02	0.07
12	NDGL-135	65.82	0.86**	0.1	121.92	1.02	0.59	65.79	1.04**	0.52	6.28	1.02	0.07
13	NDGL-116	67.3	0.70**	6.36**	122.02	1.05	0.7	61.35	0.96**	0.32	7.32	1.13	0.12
14	NDGL-87	68.81	0.92**	0.12	122.84	1.02	0.67	63.15	0.9**	0.45	4.67	0.74	0.04
15	NDGL-90	75.56	0.98**	0.98	124.12	1.04	0.53	67.35	1.05**	0.4	7.07	1.15	0.09
16	NDGL-117	77.33	1.02**	0.2	123.95	1.03	0.61	70.05	1.08**	0.42	7.13	1.11	0.14
17	NDGL-118	78.17	1.05**	0.12	123.82	0.92	5.81**	59.25	1.42**	225	7.1	1.07	0.1
18	NDGL-119	80.1	1.05**	0.32	124.1	1.03	0.68	62.69	0.97**	0.42	7.29	1.14	0.07
19	NDGL-115	74.62	1.00**	0.2	124.43	1.03	0.6	57.9	0.89**	0.24	5.95	0.91	0.08
20	NDGL-108	71.72	0.95**	0.11	123.35	1.01	1.86	60.49	0.94**	0.38	6.55	0.98	0.11
21	NDGL-107	70.08	0.93**	0.14	122.78	1.03	0.6	69.23	1.04**	0.59	5.79	0.87	0.06
22	NDGL-106	69.05	0.92**	0.08	122.88	1.04	2.77	56.42	0.87**	0.28	6.42	1.08	0.09
23	NDGL-105	79.11	1.06**	0.13	123.04	1.03	0.71	54.55	-0.37	108.44	4.97	0.82	0.06
24	NDGL-120	76	1.02**	0.11	122.48	0.98	10.28**	67.29	1.04**	4.58	6.3	0.93	0.12
25	NDGL-85	76.08	1.02**	0.08	122.95	1.02	0.87	59.73	0.89**	0.76	7.1	0.99	0.12
26	NDGL-95	71.11	0.94**	0.16	124.3	1.03	0.66	65.69	1.03**	0.42	5.39	0.85	0.07
27	NDGL-96	67.14	0.89**	0.12	123.61	1.03	0.55	70.59	1.08**	0.36	5.33	0.87	0.16
28	NDGL-130	76.67	1.03**	0.08	123.99	1.03	0.58	67.55	1.01**	0.52	5.97	1.06	0.1
29	NDGL-128	68.47	1.11**	36.15**	119.12	1.31	189.65**	62.85	0.46**	293.56	11.4	0.34	207.32*
30	NDGL-129	73.65	0.97**	0.22	122.72	1.01	0.62	58.93	0.91**	0.39	5.63	0.95	0.05
31	NDGL-124	76.8	1.03**	0.19	124.4	0.98	9.15**	61.64	1.36**	19.62*	7.22	1.08	0.06
32	NDGL-125	75.13	0.99**	0.22	122.17	1.02	0.7	68.94	1.06**	0.37	8.88	1.32	0.1
33	NDGL-144	72.4	0.97**	0.21	121.45	1.04	0.54	59.85	0.93**	0.36	5.3	0.67	0.07
34	NDGL-88	68.75	0.81**	1.27	121.96	1.01	0.52	62.17	0.78**	4.61	5.33	0.82	0.06
35	NDGL-97	80.09	1.06**	0.13	125.01	1.04	0.62	85.21	1.33**	0.78	6.61	1.06	0.07
36	NDGL-86	73.26	1.03**	1.2	124.62	1.04	0.56	64.36	0.99**	0.4	4.92	0.82	0.13
37	NDGL-99	76.95	1.53**	47.19**	123.09	1.02	0.33	69.2	1.13**	5.25	6.06	0.98	0.11
38	NDGL-100	74.99	1.00**	0.19	121.01	1.11	9.58**	70.01	1.09**	0.45	6.06	0.9	0.07
39	NDGL-143	75.51	1.00**	0.29	120.64	0.98	1.99	59.24	0.92**	0.45	9.16	1.41	0.12
40	NDGL-131	72.53	0.97**	0.25	121.18	1.01	0.49	49.24	0.77**	0.22	7.17	1.15	0.15
41	NDGL-132	74.86	1.00**	0.22	125.03	1.04	0.53	68.34	1.07**	0.36	6.07	0.9	0.05
42	NDGL-133	80.05	1.08**	0.1	122.35	1.02	0.64	57.53	0.90**	0.4	7.1	1.1	0.7
43	NDGL-126	75.91	1.00**	0.18	123.93	1.04	2.51	60.02	0.80**	13.98*	6.68	1.01	0.48
44	NDGL-127	80.23	1.06**	0.13	125.05	1.05	0.51	57.08	0.91**	0.44	5.94	0.86	0.06
45	NDGL-137	82.92	1.11**	0.11	122.1	0.98	8.62**	82.85	1.13**	0.67	8.6	1.45	0.61
46	NDGL-138	77.73	1.06**	0.59	122.4	1.01	0.34	60.49	0.93**	0.35	7.35	0.84	0.18
47	NDGL-139	76.66	1.02**	0.1	120.5	1	0.73	66.26	1.03**	0.35	5.66	0.75	0.06
48	NDGL-142	77.68	1.04**	0.09	125.71	1.04	0.54	66.63	1.02**	1.19	6.59	0.95	0.1
49	NDGL-141	81.19	1.24**	4.74**	122.49	1.02	0.65	67.11	1.04**	0.55	5.95	0.87	0.06
50	NDGL-140	75.86	1.01**	0.14	121.15	1.01	0.57	81.54	1.27**	0.58	6.06	0.88	0.06
51	Parvati-9-	72.93	0.97**	0.15	121.11	1.01	0.57	75.1	1.18**	0.5	5.12	0.85	0.08
52	NDGL-148	73.91	1.20**	70.54**	120.73	1.01	0.64	74.82	1.18**	0.69	7.44	1.07	0.08
53	NDGL-147	79.87	1.06**	0.11	123.68	1.02	0.55	74.6	1.15**	0.51	7.51	1.17	0.13
54	NDGL-109	76.07	1.03**	0.27	126.57	1.05	0.47	63.65	1.03**	1.3	6.99	1.06	0.09
55	NDGL-110	74.38	1.00**	0.31	120.11	0.99	2.03	68.5	1.07**	0.39	5.39	0.93	0.05
56	NDGL-114	75.65	1.01**	0.1	121.72	1.05	9.34**	67.36	1.07**	1.43	7.56	1.08	0.21
57	NDGL-113	70.27	0.93**	0.09	119.54	0.99	0.54	65.6	1.02**	0.38	7.96	1.24	0.1
58	NDGL-30	79.67	1.09**	0.53	124.78	1.05	0.94	65.82	1.02**	0.47	6.06	0.9	0.05
59	NDGL-98	78.87	0.75**	14.50**	124.25	1.04	0.78	66.93	1.06**	0.55	9.1	1.45	0.17
60	NDGL-35	81.86	1.09**	0.11	126.4	1.05	0.83	60.73	1.18**	30.74*	7.26	1.13	0.11
Population mean		74.54 ± 0.40			123.07 ± 0.60			65.29 ± 0.79			6.58 ± 0.43		
SE bi		0.077			0.71			0.17			0.98		

S. No.	Characters→ Genotypes ↓	5. No. of Branches/plant			6. No. of Capsules/plant			7. No. of Seeds/capsule			8. 1000-seed weight (g)		
		$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di
1	NDGL-93	4.54	-0.17	0.43	185.29	2.00**	61.83**	6.65	0.80**	0.02	6	0.24	0.08
2	NDGL-92	4.43	-0.23	0.73	85.73	0.76**	1.24	6.21	0.63**	0.04	6.95	0.31*	0.39
3	NDGL-91	3.37	-0.16	0.34	101.12	1.03**	0.81	7.7	1.17**	0	4.86	0.17	0.04
4	NDGL-121	4.59	-0.2	0.45	111.32	1.00**	197.27**	7.34	1.28**	0.05	5.23	0.11	0.04
5	NDGL-122	3.25	-0.16	0.17	77.65	0.81**	0.29	7.75	0.96**	0.05	5.56	0.41*	0.13
6	NDGL-123	3.45	-0.15	0.21	111.46	1.10**	1.04	8.36	1.09**	0.03	5.02	0.19	0.03
7	NDGL-84	3.91	-0.18	0.27	115.74	1.10**	1.17	8.58	1.28**	0.01	4.84	0.05	0.02
8	NDGL-104	4.56	-0.18	0.51	114.21	1.12**	0.87	8.26	1.08**	0.06	4.82	0.21	0.04
9	NDGL-103	4.52	-0.18	0.29	100.11	1.03**	0.72	7.7	0.89**	0.03	6.41	0.23	0.05
10	NDGL-101	3.97	1.39**	0.1	64.23	0.56**	1.11	7.34	0.88**	0.04	5.79	0.24	0.04
11	NDGL-102	4.88	1.15**	0.01	87.61	0.86**	5.5	5.49	0.74**	0	5.75	0.27*	0.05
12	NDGL-135	3.66	1.54**	0.13	65.98	0.64**	0.62	7.39	0.61**	0.55	4.92	0.16	0.06
13	NDGL-116	4.43	1.65**	0.15	91.45	0.95**	1.56	7.6	1.16**	0.03	5.51	0.17	0.03
14	NDGL-87	4.61	-0.16	0.52	79.22	0.83**	0.29	6.18	0.91**	0.03	7.91	0.33*	0.13
15	NDGL-90	3.76	1.96**	0.39	113.62	1.15**	1.01	6.04	1.08**	0.04	6.06	0.03	0.14
16	NDGL-117	3.74	1.97**	0.45	103.44	1.03**	1.41	8.26	1.23**	0.01	4.88	0.18	0.02
17	NDGL-118	4.34	1.55**	0.17	140.7	1.42**	1.62	6.39	1.11**	0.06	6.14	-0.11	0.12
18	NDGL-119	3.98	2.00**	0.32	130.25	1.66**	1.99	7.47	1.17**	0.04	5.58	0.21	0.08
19	NDGL-115	3.42	1.44**	0.43	111.24	1.09**	2.03	6.5	0.96**	0.05	5.86	0.24	0.03
20	NDGL-108	4.02	1.31**	2.22*	56.07	0.73**	77.49**	8.02	1.06**	0.02	5.76	0.29	0.09
21	NDGL-107	3.51	1.31**	0.15	84.07	0.80**	0.54	7.58	1.19**	0.02	5.53	0.32*	0.04
22	NDGL-106	3.37	1.74**	0.33	90.15	0.77**	1.4	6.86	0.98**	0.02	6.45	0.37*	0.07
23	NDGL-105	6.72	-1.08	27.24**	83.74	1.07**	28.64**	6.24	0.91**	0.01	6.99	0.30*	0.07
24	NDGL-120	4.15	1.17**	0.04	64.69	0.65**	0.22	7.07	0.87**	0.01	6.17	0.26	0.05
25	NDGL-85	4.34	1.65**	0.2	102.81	1.03**	0.68	8.05	1.21**	0.08	4.7	0.25	0.04
26	NDGL-95	3.65	1.03**	0.76	69.26	0.69**	0.32	8.44	1.17**	0	6	0.2	0.09
27	NDGL-96	4.09	0.66**	0.14	97.88	1.02**	0.47	6.45	0.96**	0.03	6.39	0.27*	0.06
28	NDGL-130	3.68	1.21**	0.07	74.46	0.80**	0.25	8.26	1.05**	0.02	5.21	0.19	0.16
29	NDGL-128	6.45	1.06**	0.33	117.88	2.03**	1022.21*	7.54	1.14**	0.62**	11.2	46.95	187.92*
30	NDGL-129	4.42	0.52	0.07	117.86	1.21**	0.9	7.57	1.10**	0.01	6.14	0.33*	0.08
31	NDGL-124	5.8	0.79*	0.4	119.32	1.23**	0.79	9.27	1.31**	0.01	4.87	0.23	0.04
32	NDGL-125	4.84	2.40**	0.36	107.84	1.12**	0.78	7.7	1.12**	0.02	4.99	0.16	0.02
33	NDGL-144	3.65	0.99**	0.02	70.9	0.71**	0.36	6.53	1.07**	0.03	6.95	0.33*	0.06
34	NDGL-88	3.55	1.02**	0.02	83.67	0.89**	0.31	7.46	0.93**	0	5.77	0.27*	0.06
35	NDGL-97	4.82	0.92**	0.02	103.87	1.05**	0.62	8.36	1.10**	0.02	6.86	0.35*	0.07
36	NDGL-86	4.26	0.35	0.11	42.7	0.44*	0.09	7.57	1.00**	0.01	7.16	0.30*	0.08
37	NDGL-99	4.73	0.63*	0.06	79.28	0.78**	0.85	5.98	1.05**	0.02	6.53	0.28*	0.05
38	NDGL-100	4.85	0.62*	0.11	99.15	0.93**	1.44	6.43	0.81**	0.01	6.63	0.25	0.04
39	NDGL-143	5.3	2.28**	0.42	113.65	0.88**	845.78**	9.01	1.12**	0.04	6.36	0.23	0.07
40	NDGL-131	5.11	1.09**	0	80.62	00.81**	0.39	5.88	0.96**	0.02	6.81	0.33*	0.07
41	NDGL-132	4.09	1.13**	0.05	77.45	0.73**	0.4	6.72	2.22**	1.22**	6.62	0.42*	0.8
42	NDGL-133	4.23	1.68**	0.23	86.29	0.81**	1	6.36	0.89**	0.02	6.78	0.52*	1.43
43	NDGL-126	5.28	0.64**	0.11	96.86	1.07**	8.13	10.03	1.04**	0.09	4.86	0.09	0.28
44	NDGL-127	5.35	0.21	0.25	124.43	1.22**	1.3	6.73	1.01**	0.02	7.02	0.79*	0.45
45	NDGL-137	4.94	1.83**	0.2	97.99	1.00**	0.65	7.27	1.05**	0.02	5.09	-2.1	0.92
46	NDGL-138	5.07	1.47**	0.1	129.99	1.32**	1.38	7.88	-0.32	0.59**	4.53	0.16	0.03
47	NDGL-139	3.81	1.08**	0.02	85.54	0.82**	0.66	7.53	0.76**	0.03	4.67	0.19	0.04
48	NDGL-142	5.38	0.58	0.11	74.48	0.69**	0.6	6.86	0.78**	0.02	8.46	0.42*	0.16
49	NDGL-141	6.62	0.59	1.38**	91.48	0.90**	0.63	6.9	0.93**	0.12	8.71	0.44*	0.12
50	NDGL-140	3.43	1.61**	0.37	81.19	0.73**	18.24	8.18	1.06**	0.01	5.42	0.19	0.03
51	Parvati-9-	3.59	0.85**	0.04	92.84	0.90**	1.04	6.01	0.74**	0.01	5.88	0.29*	0.07
52	NDGL-148	4.55	1.71**	0.15	80.59	0.80**	0.43	6.75	0.94**	0.02	4.76	0.17	0.03
53	NDGL-147	4.35	1.85**	0.2	107.71	1.10**	0.66	6.79	0.93**	0.01	6.03	0.35*	0.08
54	NDGL-109	4.11	1.72**	0.22	64.86	0.68**	0.18	6.33	0.88**	0.01	9.22	0.40*	0.12
55	NDGL-110	3.84	0.80**	0.01	99.73	0.98**	0.77	7.12	0.94**	0.01	5.3	0.22	0.04
56	NDGL-114	4.65	1.71**	0.12	123.83	1.24**	0.94	7.63	1.15**	0.05	5.05	0.30*	0.06
57	NDGL-113	3.91	2.59**	0.77	91.28	0.97**	0.45	7.29	0.69**	0.08	5.93	0.25	0.11
58	NDGL-30	4.87	0.59	0.09	121.1	1.23**	1	8.33	1.10**	0.04	5.32	0.34*	0.18
59	NDGL-98	4.88	2.47**	0.64	113.88	1.12**	0.68	5.71	0.53**	0.12	7.66	0.31*	0.08
60	NDGL-35	4.73	1.53**	1.36**	175.8	1.92**	1.18	7.41	1.55**	0.57**	4.27	0.14	0.03
Population mean		4.41 ± 0.19			98.29 ± 0.14			7.29 ± 0.66			6.05 ± 0.40		
SE bi		0.3			0.19			0.27			0.13		

S. No.	Characters→ Genotypes ↓	9. Biological yield(g)			10. Harvest Index(%)			11. Oil content(%)			12. Seed yield(g)		
		$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di	$\bar{X}$	bi	S^2di
1	NDGL-93	25.29	1.38**	0.1	28.9	1.04	0.77	91.53	0.48**	1.08	7.26	1.65*	0.16
2	NDGL-92	10.44	1.37**	7.41**	35.98	1.43*	76.17**	40.83	0.1	2.57	3.69	0.58	0.04
3	NDGL-91	16.86	0.93**	0.06	22.55	0.96	0.2	39.4	0.12*	2.37*	3.81	0.55	0.02
4	NDGL-121	19.05	1.13**	0.23	22.42	0.26	7.5	41.21	0.29**	0.4	4.23	0.88	0.38
5	NDGL-122	16.83	0.94**	0.03	19.85	0.95	0.49	41.64	0.58**	0.23	3.36	0.90*	0
6	NDGL-123	22.14	1.22**	0.11	21.1	0.79	0.29	30.74	0.11	1.24	4.63	1.08*	0.02
7	NDGL-84	13.61	0.7	0.13	35.28	1.07	1.03	40.79	1.31**	1.84	4.81	1.03*	0.01
8	NDGL-104	12.67	0.74	0.17	35.87	1.51**	2.57*	38.55	0.81**	22.97*	4.55	1.08*	0.01
9	NDGL-103	28.82	2.81**	172.84**	17.6	0.54	31.57**	35.12	0.63**	4.11*	4.95	1.01*	0.02
10	NDGL-101	26.33	1.45**	0.15	10.35	0.32	0.37	41.62	1.38**	6.29*	2.73	0.54	0.02
11	NDGL-102	21	1.14**	0.42	13.15	0.42	0.15	40.93	2.31**	19.29*	2.77	0.6	0.01
12	NDGL-135	9.93	0.75	6.14**	24.51	1.24*	48.14	42.5	2.09**	6.61*	2.4	0.43	0.08
13	NDGL-116	17.14	0.39	57.60**	23.02	1.82**	63.05**	35.2	0.56**	5.97*	3.84	0.54	0.02
14	NDGL-87	23.69	2.13**	4.32	16.39	0.23	3.41	38.81	1.25**	12.01*	3.88	0.55	0.02
15	NDGL-90	23.55	2.13**	4.04	17.71	0.4	6.12	40.98	1.40**	6.34*	4.17	1.22*	0.11
16	NDGL-117	17.9	1.02*	0.27	23.3	0.91	0.13	40.26	1.50**	3.16*	4.19	1.02*	0.01
17	NDGL-118	23.03	1.13*	0.04	23.96	1.18*	3.75	41.52	1.41**	6.17*	5.54	1.52*	0.2
18	NDGL-119	27.21	1.55**	1.43	24.57	0.99	0.95	37.16	0.64**	14.40*	6.7	1.65*	0.04
19	NDGL-115	12.9	0.72	0.57	32.87	1.56**	6.97	37.35	0.73**	9.60*	9.25	1.01*	0.04
20	NDGL-108	13.64	0.74	0	18.98	1.17*	6.85	40.16	0.87**	2.97*	2.6	0.76	0.11
21	NDGL-107	12.07	1.03*	7.59*	29.51	0.46	53.68**	42.14	1.73**	2.90*	3.53	0.89*	0
22	NDGL-106	14.05	0.42	0.03	28.39	1.51**	0.63	38.19	0.43**	9.01*	4	0.89*	0
23	NDGL-105	13.66	0.76	0.1	27.09	1.08	0.08	41.24	4.06**	37.40*	3.71	0.89*	0.01
24	NDGL-120	11.68	0.66	0.01	24.14	0.83	0.28	38.02	0.63**	9.20*	2.82	0.63	0.01
25	NDGL-85	14.69	0.81	0.23	25.96	1.40*	5.05**	40.95	1.12**	6.04*	3.89	1.00*	0
26	NDGL-95	15.96	0.46	1.44	21.98	1.36*	3.78*	41.6	0.58**	8.90*	3.51	0.88	0.01
27	NDGL-96	18.95	1.04*	0.11	21.3	0.9	0.8	90.26	0.73**	9.29*	4.04	0.56	0.03
28	NDGL-130	13.67	0.73	0.04	23.44	1.16*	1.9	37.35	0.32**	6.76*	3.21	0.79	0.06
29	NDGL-128	17.36	1.34**	7.22*	25.3	1.15*	44.68**	41.27	0.82**	58.52*	5.95	0.39	41.68**
30	NDGL-129	17.81	0.98	0.12	30.76	1.33*	0.36	39.52	0.04	8.95*	5.5	1.37*	0.01
31	NDGL-124	24.24	1.32**	0.09	22.2	0.56	0.17	37.35	0.80**	12.92*	5.4	1.33*	0.01
32	NDGL-125	14.71	0.79	0.06	28.17	1.13*	0.18	41.92	1.17**	28.96*	4.15	0.98*	0
33	NDGL-144	12.59	0.68	0.09	25.51	1.27*	0.41	40.13	0.57**	4.67*	3.22	0.82	0.01
34	NDGL-88	15.72	0.87	0.1	22.89	0.97	0.19	40.86	1.33**	6.71*	3.61	0.85	0.01
35	NDGL-97	22.19	1.27**	0.07	25.65	1.06	0.42	37.75	0.05	8.36*	5.96	1.47*	0.04
36	NDGL-86	7.37	0.4	0	31.42	1.28*	0.14	37.68	1.22**	8.90*	2.32	0.56	0
37	NDGL-99	11.59	0.63	0.02	26.67	1.18*	0.26	37.64	1.21**	11.59*	3.1	0.78	0.01
38	NDGL-100	17.87	0.97	0.07	23.66	0.84	0.24	10.17	1.35**	2.60*	4.24	0.98*	0.01
39	NDGL-143	22..12	1.22**	0.1	20.39	0.35	44.69*	41.21	1.04**	17.89*	6.51	0.96*	2.74*
40	NDGL-131	15.79	0.86	0.04	20.34	0.8	0.79	41.6	0.85**	2.57*	3.23	0.8	0.02
41	NDGL-132	15.72	0.85	0.28	21.95	2.81**	8.59*	37.14	0.71**	14.09*	3.47	1.34*	0.13
42	NDGL-133	12.65	0.7	0.03	25.43	1.78**	2.30*	35.65	0.69**	13.86*	3.74	1.03*	0.31
43	NDGL-126	16.86	0.93	0.05	27.97	0.86	5.34*	40.24	0.30**	14.52*	4.73	1.04*	0.16
44	NDGL-127	17.9	0.98	0.08	32.63	1.81**	7.28*	38.64	0.87**	30.13*	5.89	1.51*	0.3
45	NDGL-137	15.78	0.86	0.06	22.99	1.01	59.74**	40.24	1.41**	6.22*	3.65	1.06*	1.54
46	NDGL-138	15.8	0.86	0.05	29.98	0.97	0.65	40.19	1.49**	6.86*	4.74	1.02*	0.04
47	NDGL-139	10.2	0.46	4.79*	29.87	2.78**	39.69**	38.51	0.61**	20.28*	3.01	0.64	0.01
48	NDGL-142	16.83	0.9	0.04	25.7	0.89	0.12	40.26	1.02**	6.47*	4.34	0.96*	0
49	NDGL-141	21.08	1.15	0.09	26.08	1.01	1.6	38.19	0.81**	7.38*	5.51	1.36*	0.09
50	NDGL-140	10.54	0.59	0.03	34.15	1.36*	5.34*	40.97	1.79**	11.78*	3.6	0.8	0.07
51	Parvati-9-	15.49	0.46	0.95	20.74	0.76	0.17	41.27	2.17**	18.81*	3.29	0.78	0
52	NDGL-148	10.05	0.3	5.01*	26.07	2.36**	20.48**	38.01	1.03**	8.43*	2.59	0.63	0
53	NDGL-147	22.13	1.22**	0.13	19.92	0.84	0.12	40.17	2.90**	15.46*	4.43	1.06*	0.02
54	NDGL-109	21.07	1.15*	0.08	18.53	0.73	0.23	41.5	1.72**	14.86*	3.91	0.92*	0.02
55	NDGL-110	15.8	0.86	0.05	23.92	0.9	0.51	40.77	1.55**	20.64*	3.77	0.90*	0
56	NDGL-114	15.79	0.83	0.03	30.21	1.29*	0.44	37.3	1.75**	7.34*	4.78	1.17*	0
57	NDGL-113	20.11	1.10*	0.01	19.65	0.91	0.15	37.53	1.60**	12.63*	3.97	1.03*	0.02
58	NDGL-30	21.07	1.13*	0.09	25.73	1.30*	1.07	35.64	0.87**	3.59*	5.44	1.45*	0.01
59	NDGL-98	17.93	0.99	0.06	27.74	0.96	2.67*	39.38	0.51**	6.89*	4.98	1.06*	0.09
60	NDGL-35	34.54	3.59**	17.80**	15.47	0.3	38.20**	40.2	1.61**	15.48*	5.34	1.98*	3.19*
Population mean		17.41 ± 0.50			24.85 ± 0.73			39.83 ± 0.73			4.19 ± 0.20		
SE bi		0.43			0.55			0.1			0.44		

*Significant of 5 % level of significance.
** Significant of 1 % level of significance.

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