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Dates of sowing and varieties for the management of root-rot wilt complex of linseed (*Linum usitatissimum*)*

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Linseed or flax (*Linum usitatissimum* L.) is an important oil and quality fibre-bearing crop of sub-tropical and temperate regions. India grows this crop on about 3.53 lakh ha producing 1.48 lakh tonnes of seed. It represents 21.4 and 10.14% of the global linseed acrage and production respectively. A number of diseases (Kolte and Fitt 1997), however, act as yield limiting factors for the crop. Consequent upon continuous cropping of linseed in same marginalized fields, year after year, soil becomes sick with root-rot (*Rhizoactonia* spp, *Pythium* spp, *Fusarium* spp) and wilt [*Fusarium oxysporum* Schlecht.ex Fr. f. sp. *lini* (Bolley) Snyder and Hanson] pathogens resulting in partial to total yield loss due to these diseases (Kolte and Fitt 1997, Sharma *et al.* 2002). Seed treatments (Singh *et al.* 2005) manage only early root rots and wilt and varieties tend to loose their resistance due to variation in the pathogen population. Investigations were, therefore, undertaken to identify dates of sowing and varieties capable of reducing disease severity and giving higher seed yield. Further investigations were carried out to select resistance donors against root rot-wilt complex, out of recently developed genotypes, for use in future resistance breeding programmes.

Field experiments were conducted at the experiment station of the university at Kumarganj (26°47' N, 82°12' E 113 m above mean sea level), Faizabad, Uttar Pradesh during 2005–06 and 2006–07 following recommended agronomic practices. Trials were conducted in a root-rot wilt sick plot of 20 years' standing. Experiment on dates of sowing was conducted during 2005–06 and 2006–07 in a randomized block design having 4 m×3 m plot size, 25 cm×10 cm plant spacing with four replications, had 15, 25 October; 5, 15, 25 November and 5 December as treatment and susceptible 'Chambal' linseed as test variety. The varietal trial too, was sown under similar design and dimentions on 20 October during 2005–06 and 2006–07. It had commercial varieties 'Jawahar 23', 'Jeevan', 'Kiran', 'Padmini', 'R 552', 'Surabhi', 'Type 397' and susceptible 'Chambal' as treatments. Disease severity was recorded as per cent mortality and yield in kg/ha. Trial for identifying resistance donors having eight released and 272 recently bred linseed genotypes was sown on 15 October during 2005 and 2006 in single rows of 3 m length in augmented design at 30 cm×10 cm plant spacing, interspersed with susceptible 'Chambal' and resistant 'Ayogi' varieties after every 5 and 10 rows, respectively. The set was replicated twice. Genotypes were classified into different susceptibility groups using following 0–5 rating scale (genotypes those with mortality percentage of 0, highly resistant (HR); up to 5, resistant (R); 5–15 moderately resistant (MR); 15–30, moderately susceptible (MS); 30–50 susceptible and above 50, highly susceptible (HS).

Disease severity was high during 2005–06 and 2006–07, it being severer during second year under all the dates of sowing except 15 October. Gradual reduction in severity was noted for every succeeding date, ranging between 70.45 and 67% for the first date (15 October) and 6.83 and 16.98% for the last date of first and second years, respectively. This happens because of lowering of temperatures on later dates which are unfavourable for infection with the root-rot and wilt pathogens. Differences between the dates of sowing were statistically significant in 2006–07. In 2005–06 there was no difference in disease severity for 5 November and 15 November and 25 November and 5 December sown. Higher average yield of 605.10 kg/ha was recorded in 15 November sown, followed by 550.00 kg in 5 November sown one. Lowest average yields of 284.72 and 290.74 kg/ha were recorded for 5 December and 15 October sown crop, respectively (Table 1). Lowest yields for the first (15 October) and last (5 December) dates were recorded because of the highest disease intensity in case of former and extremely narrow crop duration for the latter. Crop sown under root rot-wilt free conditions has been noted to yield highest under

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5 November sowing, followed by 15 November (Singh and Singh 2004). Thus, 15 November seems to be an ideal date for sowing under root rot-wilt infested conditions. However, to spread the field operations over a reasonably longer period of time, period from 5 November to 15 November seems to be reasonably good as yields obtained under these two dates are statistically at a par.

Root rot-wilt severity was high during both the crop seasons, susceptible 'Chambal' linseed expressing highest severities of 70.70 and 80.17% during 2005–06 and 2006–07, respectively. 'Padmini' linseed expressed higher disease severity (5.3%) in the first year in comparison to second (3.17%), though variation in annual disease intensities of individual varieties was very narrow (Table 2). Based on highest disease severities, out of both the years, varieties 'Jeevan' and 'Padmini' were noted resistant, and 'Jawahar 23', 'Kiran', 'Type 397', 'R 552' and 'Surabhi' moderately resistant. 'Jeevan' showed least (3.75%) susceptibility and 'Surabhi' highest (12.18%). 'Jeevan' gave highest average yield of 1118.05 kg/ha, followed by 'Surabhi' at 1102.77, 'Padmini' 1081.94 and 'Type 397' 1073.88 kg/ha. In the year of lower disease severity (2005–06), the moderately susceptible variety 'Surabhi' yielded highest at 1 055.55 kg/ha, followed by the resistant 'Jeevan' and 'Padmini' which yielded 977.78 and 922.22 kg/ha, respectively. 'Surabhi' also gave highest yield of 12.88 kg for every percentage of disease reduced, followed by 'Jeevan' at 11.76 kg, 'Type 397' at 11.72 kg and 'Padmini' at 11.46 kg, indicating their higher genetic yield potential under root rot-wilt free condition. Recent studies of similar nature from other centers are lacking, though a number of older studies with then prevalent varieties are available.

Out of 280 linseed genotypes evaluated, none was found highly resistant, ie root rot-wilt free. Ten genotypes, namely 'NP 19', 'NPRR 271', 'No. 294', 'LC 2221', 'LMS 154-03', LMS 166-03', 'RLC 94', 'SLS 56', 'Ayogi' and 'LMS 129 1', were noted resistant, 15, namely, 'JLS 9' 'PKDL 46', 'BAU 2K-21', 'NL 97', 'NL 165', 'RLC 92', 'SLS 63', 'NP 72R', 'NP 109', 'NPRR 93', 'NP 21', 'NP 115', 'NP 116', 'LCK 8222', and 'SLS 50' were moderately resistant, and 26, namely, 'NP 26', 'RR 5 K', 'NP 47', 'NPPR 182M', 'NPRR 422', 'KL 215', 'SLS 66', 'JLT 62', 'JLT 111', 'RLC 89', 'RLC 1011', 'Pusa 3', 'JLT 118', 'KL 214', 'LCK 4012', 'NL 126', 'PKDL 43', 'PKDL 44', 'PKDL 45', 'SLS 59', 'SLS 60', 'J 23-1', 'LC 54', 'NP 104', 'NPHY 25', and 'NPRR 190' were moderately susceptible. Thirtytwo genotypes were susceptible and 197 highly susceptible. Resistant and moderately resistant genotypes can be utilized

Table 1 Effect of date of sowing on root-rot wilt severity and seed yield in 'Chambal' linseed

Date of sowing	Disease severity (%)			Seed yield (kg/ha)		
	2005–06	2006–07	Mean	2005–06	2006–07	Mean
15 October	70.45(57.11)	67.00(55.03)	68.73(56.07)	237.04	344.44	290.74
25 October	53.60(47.06)	60.25(50.93)	56.93(49.00)	407.41	405.44	406.43
5 November	31.98(34.42)	41.25(39.98)	36.62(37.20)	533.33	566.67	50.00
15 November	25.25(30.08)	30.70(33.59)	27.98(31.84)	607.41	602.78	605.10
25 November	11.88(20.07)	25.41(30.19)	18.65(25.13)	407.41	413.89	410.65
5 December	6.83(15.03)	16.98(24.26)	11.91(19.65)	300.00	269.44	284.72
SEm±	2.38	1.16		77.71	42.47	
CD (P = 0.05)	5.30	2.58		110.53	94.62	

Table 2 Evaluation of commercial linseed varieties against root-rot wilt and its effect on seed yield

Variety	Disease severity (%)				Seed yield (kg/ha)			
	2005–06	2006–07	Mean	Reduction over check	2005–06	2006–07	Mean	Per unit disease reduced
'Jawahar 23'	4.08(12.65)	6.43(14.65)	5.25(13.65)	93.04	894.44	904.17	899.30	9.66
'Jeevan'	3.50(10.74)	4.00(11.54)	3.75(11.14)	95.03	977.78	1258.33	1 118.05	11.76
'Kiran'	5.9(14.06)	7.17(15.56)	6.53(14.81)	91.34	755.56	937.50	846.53	9.27
'Padmini'	5.3(13.31)	3.17(10.31)	4.23(11.81)	94.39	922.22	1241.67	1 081.94	11.46
'R 552'	8.6(17.01)	10.00(19.54	9.30(18.27)	91.65	827.78	883.33	855.55	9.34
'Surabhi'	9.5(17.92)	12.18(20.44)	10.84(19.18)	85.63	1055.55	1150.00	1 102.77	12.88
'Type 397'	5.00(12.92)	7.67(16.11)	6.33(14.51)	91.61	914.44	1233.33	1 073.88	11.72
'Chambal'	70.70(57.20)	80.17(63.58)	75.43(60.39)		300.00	262.50	281.25	
SEm±	1.11	1.97			73.79	53.82		
CD (P = 0.05)	3.08	5.47			204.76	149.35		

in future resistance breeding programmes and these along with moderately susceptible genotypes further evaluated for their agronomic characters with a view to release some of them as cultivars. In view of the national gene pool having poor resistance base against the disease (Singh *et al.* 2006), present findings carry great significance for stabilizing linseed industry in the country.

SUMMARY

Sowing linseed (*Linum usitatissimum* L.), between 5 and 15 November in root rot-wilt sick fields results in lower disease severity and higher seed yield. 'Jeevan' and 'Padmini' linseed varieties proved resistant and 'Jawahar 23', 'Kiran', 'Type 397', 'R 552' and 'Surabhi' moderately resistant. However, 'Jeevan' gave highest average yield of 1118.05 kg/ha, followed by 'Surabhi' with 1102. 77 and 'Padmini' 1081.94. In the year of lower disease pressure 'Surabhi' yielded highest at 1055.55 kg/ha, followed by 'Jeevan' (977.78 kg/ha) and 'Padmini' (922.22 kg/ha). Ten genotypes, namely, 'NP 19', 'NPRR 271', 'No. 294', 'LC 2221', 'LMS 154-03', 'LMS 166-03', 'RLC 94', 'SLS 56', 'Ayogi' and 'LMS 129-1'showed resistance to root rot-wilt complex .

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REFERENCES

Kolte S J and Fitt B D L. 1997. *Diseases of Linseed and Fibre Flax*, 247 pp. Shipra Publications, Delhi.

Sharma R C, Singh B P, Thakur M P and Verma K P. 2002. Chemical management of linseed wilt caused by *Fusarium oxysporum* f. sp. *lini*. *Annals of Plant Protection Sciences* **10** (2): 290–1.

Singh J, Singh K, Prakash O and Bajpeyi M. 2006. Seed colour not a diagnostic character for disease resistance in linseed (*Linum usitatissimum*). *Indian Phytopathology* **59** (2): 180–4.

Singh J, Souarmma V and Kerkhi S A. 2005. Effect of seed treatment for control of linseed wilt. *Annals of Plant Protection Sciences* **13** (2): 507–8.

Singh R B and Singh R N. 2004. Occurrence and management of Alternaria blight of linseed. *Plant Disease Research* **19**(2): 120–4.