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Evaluation of improved management technologies and linseed (*Linum usitatissimum*) cultivars in salt-affected soils under rainfed condition

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ABSTRACT

Eight and twelve on farm trials were conducted during the winter (*rabi*) season of 2001–2002 and 2002–2003, respectively, to evaluate the improved management technologies and promising linseed (*Linum usistatissimum* L.) cultivars in salt-affected soils under rainfed condition. Improved management technologies consisting of line or seed drill sowing, application of FYM @ 2 tonnes/ha a month before sowing and use of straw mulch after sowing proved superior to traditional practices adopted by the farmers. 'Padmini' variety followed by 'Sweta' and vice-versa proved superior to 'Bijuri Local' with improved management technology in comparison to farmers' practices. 'Padmini' having markedly higher dry matter, number of branches and capsules/plant with dwarf plants utilized soil moisture more efficiently under rainfed condition and showed better tolerance to salts compared to 'Sweta' and 'Bijuri Local'.

Key words : Improved practices, Linseed cultivars, Salt-affected soils, Rainfed

Productivity (385 kg/ha) of linseed in the country is far below the potential yield of 1,026 kg/ha (Malik and Kerkhi, 2003). It is usually grown under stress conditions like marginal, sub-marginal and neglected lands with poor management practices. More than 7 million ha lands are still not properly utilized by the farmers in the country due to salt accumulation in upper layers. The yield loss due to salts is about 25–100% (Chauhan *et al.,* 2003). Linseed crop having high salt-tolerance potential and being hardier (Dubey *et al.,* 2003) can play vital role in increasing the area, production and productivity by introducing the improved management technologies in salt-affected soils under rainfed condition. Therefore, present study was undertaken to evaluate the management practices and linseed cultivars in salt-affected soils under rainfed condition on the cultivars' fields.

MATERIALS AND METHODS

On farm trials were conducted at 20 farmers' fields, i.e. 8 during winter (*rabi*) 2001–02 and 12 during 2002–03 of Ghatampur Tehsil in Kanpur district in the salt-affected soils under rainfed condition. Soil samples of the fields were analysed before sowing. The analysed soil had pH 8.2–9.2, exchangeable sodium 2.75–11.50 meq/100 g, organic carbon 0.26–0.63%, available phosphorus 9–18.5 kg/ha and potassium 210–430 kg/ha. The trials were laid out in split-plot design considering each farmer as the replication. The treatments comprised 2 management technologies (improved and prevailing farmers practices) in main plots and 3 cultivars, viz. 'Sweta', 'Padmini' and 'Bijuri Local', in sub-plots. The recommended practices consisted of line or seed drill sowing; application of 2 tonnes FYM/ha about a month before sowing and use of straw mulch after sowing, while no FYM and mulch was used in the crop sown by broadcast as farmers' practice. The crop was sown in bigger-size plots (300 m^2) keeping row-to-row distance of 25 cm with a seed rate of 30 kg/ha. Seeds were treated with Thiram @ 2.5 g/kg to control pre- and post-emergence seedling blight diseases. The recommended dose of fertilizers, i.e. 40 kg N and 40 kg P_2O_5/ha, was applied uniformly. A total of 719.3 and 838.9 mm precipitation was received in 43 and 37 rainy days from June 2001 to May 2002 and June 2002 to May 2003 respectively.

RESULTS AND DISCUSSION

Management technologies

Improved management technologies (line or seed drill sowing, application of FYM @ 2 tonnes/ha about a month before sowing and use of straw mulch after sowing) improved the germination, final plant stand, dry matter, branches and capsules/plant significantly, the increase being 10.2, 85.3, 2.7, 26.0 and 110.3% over the traditional practices followed by the farmers, respectively, in the re-

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Table 1. Growth, yield attributes, yield and salt content of linseed (data pooled over 2001–2002 and 2002–2003)

Management	'Sweta'	'Padmini'	'Bijuri Local'	Mean	CD (P=0.05)	
			Germination (%)			
Improved management	76.45	74.30	65.31	72.02	C	1.80
Farmers, practice	71.90	68.93	55.21	65.34	M	1.54
Mean	74.17	71.61	60.26		C× M	2.57
			Final plant stand/m²			
Improved management	51.50	75.55	42.49	56.51	C	1.37
Farmers, practice	32.06	40.18	19.24	30.49	M	1.47
Mean	41.78	57.86	30.86		C× M	1.94
			Plant height (cm)			
Improved management	62.18	40.95	47.29	50.14	C	1.20
Farmers, practice	50.80	33.93	35.97	40.23	M	1.00
Mean	56.49	37.41	41.63		C× M	1.68
			Dry matter/plant (g)			
Improved management	8.77	9.77	7.79	8.77	C	1.42
Farmers, practice	7.22	9.28	9.14	8.54	M	1.09
Mean	7.99	9.52	8.46		C× M	2.00
			Branches/plant			
Improved management	6.78	8.96	5.86	7.20	C	0.19
Farmers, practice	5.79	6.53	4.81	5.71	M	0.19
Mean	6.29	7.75	5.33		C× M	0.27
			Capsules/plant			
Improved management	104.30	148.04	55.61	102.65	C	3.05
Farmers, practice	60.46	56.50	29.43	48.80	M	4.29
Mean	82.38	102.27	42.52		C× M	4.31
			Seeds/capsule			
Improved management	7.40	7.05	6.24	6.90	C	0.33
Farmers, practice	7.17	7.13	6.15	6.82	M	0.26
Mean	7.29	7.09	6.20		C× M	NS
			1,000-seed weight (g)			
Improved management	8.39	8.28	7.99	8.19	C	0.17
Farmers, practice	8.27	8.27	7.99	8.17	M	NS
Mean	8.33	8.27	7.99		C × M	NS
			Oil content (%)			
Improved management	36.36	39.23	35.72	37.11	C	0.27
Farmers, practice	36.38	38.85	35.60	36.94	M	0.23
Mean	36.37	39.04	35.66		C × M	NS
			Seed yield (q/ha)			
Improved management	7.94	8.65	4.43	7.01	C	0.36
Farmers, practice	5.11	5.56	3.13	4.60	M	0.41
Mean	6.53	7.10	3.78		C×M	0.51
			Na : K ratio at seedling			
Improved management	0.097	0.087	0.171	0.118	C	0.008
Farmers, practice	0.155	0.122	0.181	0.153	M	0.011
Mean	0.126	0.105	0.176		C × M	0.011
			Na: K ratio at 50% flowering			
Improved management	0.080	0.071	0.092	0.081	C	0.008
Farmers, practice	0.102	0.081	0.123	0.102	M	0.008
Mean	0.091	0.076	0.108		C × M	0.012
			Na : Ca ratio at 50% flowering			
Improved management	0.062	0.067	0.069	0.066	C	0.004
Farmers, practice	0.073	0.078	0.096	0.082	M	0.006
Mean	0.068	0.072	0.083		C × M	0.005

C, Cultivars; M, management

sults pooled over 2001–02 and 2002–03 (Table 1). As a result, the increase in seed yield (52.4%) owing to improved technologies was also significant in the pooled data compared to farmers' practices. Since the branches and capsules/plant were higher with improved practices, these practices could not be helpful in increasing seeds/capsule over the farmers' practices, as the differences were not significant. No marked variations due to improved and farmers' practices were observed in the 1,000 seed weight. The plant height was greater with improved management practices, while no marked differences were noticed in oil content though these were found significant which confirmed the superiority of improved technologies over farmers' practices.

Data pooled over 2001–2002 and 2002–2003 revealed (Table 1) that Na : K and Na : Ca ratios in plants grown with improved management technologies was lower than farmers' practices at the selected stages (seedling and 50% flowering). Line or seed drill sowing, application of FYM @ 2 tonnes/ha about a month before sowing and use of straw mulch after sowing improved the soil conditions favourably for better growth and development of the crop from sowing to maturity. As a result the plants grown with these improved practices had lesser Na : K and Na : Ca ratios than traditional practices of the farmers.

Performance of cultivars

Germination of 'Sweta' was higher (74.17%) than 'Padmini' (71.61%) and 'Bijuri Local' (60.26%), but as a result of better survival of plants in salt-affected soils under rainfed condition, 'Padmini' had higher final plant stand (57.86 plants/m^2) than (Sweta (41.78 plants/m^2) and 'Bijuri Local' (30.86 plants/m^2). 'Padmini' also had more branches and capsules/plant and also yielded higher (7.10 q/ha) than both the remaining cultivars, while dry matter/plant of 'Padmini' followed by 'Bijuri Local' was higher than 'Sweta'. Sweta being at par with 'Padmini' produced more seeds/capsule and 1,000-seed weight than 'Bijuri Local'. 'Padmini' having markedly higher dry matter, branches and capsules/plant with dwarf plants utilized soil moisture more efficiently under rainfed condition and showed better tolerance to salts compared to 'Sweta' and 'Bijuri Local'. These findings support the work of Kumar (2002) and Kumar (2002).

Interaction effect

The interaction between management technologies and cultivars was observed significant in germination, final plant stand, plant height, dry matter/plant, branches/plant, capsules/plant, seed yield and salt content ratio in plants (Table 1). On the basis of these observations, 'Padmini' followed by 'Sweta' and vice-versa proved superior to 'Bijuri Local' with improved management technologies in comparison to farmers' practices. Salt content ratio (Na:K ratio at seedling and 50% flowering and Na:Ca ratio at 50% flowering) in plants of 'Padmini' followed by 'Sweta' was lower with improved technologies than farmers' practices. These results are in conformity of the findings based on main effects described above earlier.

The results indicated superiority of improved management technologies which consist of line or seed drill sowing, application of FYM @ 2 tonnes/ha a month before sowing and use of straw mulch after sowing, over traditional practices so far adopted by the farmers in salt-affected soils under rainfed condition. 'Padmini' having markedly higher dry matter, branches and capsules/plant with dwarf plants utilized soil moisture more efficiently under rainfed condition and showed better tolerance to salts than 'Sweta' and 'Bijuri Local'.

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