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Response of late-planted linseed (*Linum usitatissimum*) varieties to nitrogen levels under rainfed conditions

M.P. DUBEY

Regional Agricultural Research Station, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Sagar, Madhya Pradesh 470 002

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ABSTRACT

A field experiment was conducted during the winter season of 1997–98 and 1998–99 at Sagar, Madhya Pradesh, on clay soils, to find out the most suitable variety and economical nitrogen dose for sustainable grain yield and economics of lineseed (*Linum usitatissimum* L.) under rained condition. The field trial was laid out in split-plot design, comprising 5 varieties ['SLS 21', 'SLS 9', 'SLS 7', 'RLC 29' ('Sheetal') and 'T 397'] as main and 4 nitrogen levels (30, 40, 50 and 60 kg/ha) in subtreatment plots, replicated thrice. 'RLC 29' ('Sheetal') recorded significantly higher values of almost all the growth and yield parameters, grain yield (q/ha) and economics over other varieties except plant height (cm), seeds/ capsule and harvest index (%) in pooled data. Though higher dose of 60 kg N/ha produced significantly higher growth as well as sink parameters, 1,000-seed weight (g), grain yield (q/ha) and economics revealed possibility of saving 10 kg N/ha. Interaction study, however, showed that different growth and sink parameters were influenced significantly by N levels irrespective of varieties, but 'RLC 29' revealed higher both growth and yield attributes including grain yield which gave good economics and proved most economical variety for late planting, especially after soybean and gave 57.51, 11.69, 14.44 and 22.53% more grain yield than 'SLS 21', 'SLS 9', 'SLS 7' and 'T 397' respectively. Further, 9.03 and 27.07% more grain yield was noted with 50 kg N/ha over 40 and 30 kg N/ha respectively.

Key words : Response, Late planted, Linseed varieties, Nitrogen, Rainfed conditions

Introduction of high-yielding varieties is also playing a vital role in increasing crop yield under crop production system. Rastogi (1994) and Jain *et al.* (1995) reported the significance of the high-yielding, improved varieties of linseed (*Linum usitatissimum* L.) over older or local ones to enhance the production. The fertilizers which are the non-renewable and costly input also plays very significant role in crop production. Therefore, fertilizers need more attention to reduce their doses particularly

nitrogenous fertilizers which are rapidly lost or leached in field condition during crop period. Pandey and Chatterjee (1995), Sharma and Hunsigi (1996 a, b) and Sarode *et al.* (1997) also reported the positive effect of N on grain as well as oil production. The information on the response of late-sown linseed varieties to nitrogen doses under rainfed condition (especially after soybean) of Sagar region of Vindhyan Plateau of Madhya Pradesh is still lacking. Hence an effort was made to generate the information for increasing linseed production in this tract.

MATERIALS AND METHODS

The field study was conducted during winter season of 1997–98 and 1998–99 at Regional Agricultural Research Station, Sagar, Madhya Pradesh, on clay soils, neutral in reaction (pH 7.02), low in organic carbon (0.36%) and medium in available nitrogen (349), phosphorus (12) and potassium (157 kg/ha) respectively. The treatments comprised 5 linseed varieties ['SLS 21', 'SLS 9', 'SLS 7', 'RLC 29' ('Sheetal') and 'T 397 (NC)'] considered in main plot treatments, while 4 nitrogen doses (30, 40, 50 and 60 kg/ha) were studied under sub-plot treatment with 3 replications. Sowing of the trial was done during the second and first week of December after soybean in both the respective years in lines at 30 cm apart using 30 kg seed/ha. The seeds were well treated with Thiram @ 3 g/kg seed before sowing. A uniform dose of 20 kg P_2O_5 and 0 kg K_2O/ha was applied in all treatment plots before sowing 2 cm below the seeds as basal application, while N was given as per treatment basal at sowing. At maturity, various growth as well as yield attributes were recorded by selecting 5 plants in each treatment plot randomly and subjected to statistical and for interpreting the results by comparing various treatments.

RESULTS AND DISCUSSION

Growth and yield parameters

Growth and sink parameters were affected significantly by different varieties and N levels alone and their interactions. Amongst different varieties, 'RLC 29' ('Sheetal') recorded significantly higher plant population, dry-plant biomass, branches, capsule number and their weight, seed yield/plant and 1,000-seed weight (g) except plant height ('T 397'), seeds/capsule ('SLS 21, 'SLS 7' and 'T 397') and harvest index ('SLS 7' and 'SLS 9'). A growth and yield attributes increased with the increase with the increase in N level. However, 60 kg N/ha produced significantly higher growth and sink parameters, but 1,000-seed weight revealed the saving of 10 kg N/ha. Interaction of varieties × N levels revealed that the combination of 'RLC 29' ('Sheetal') coupled with 60 kg N/ha produced significantly higher dry plant biomass (g) and capsules/plant. The combined effect of N was found significant only during first year of experimentation, while it was not true in next year as well as in pooled data.

Crop biomass, grain and straw yields

'RLC 29' ('Sheetal') gave significantly higher crop biomass, grain and straw yields. Higher values of these parameters in 'RLC 29' ('Sheetal') may probably be due to su-

Table 1. Growth and yield attributes of linseed as influenced by varieties and nitrogen levels (pooled data for 2 years)

Treatment	Plant population (No./plot) at 45 days*	Biomass (g/plant)	Plant height (cm)	Branches/ plant	Capsules/ plant	Capsule weight (g/plant)	Seeds/ capsule	Seed yield (g/plant)	1,000-seed weight (g)
Variety									
'SLS 21'	705	10.58	54.90	3.07	50.25	4.51	8.46	2.92	7.34
'SLS 9'	855	10.03	50.64	3.72	71.45	5.28	7.54	3.69	7.87
'SLS 7'	814	12.56	49.46	3.88	86.42	6.46	8.42	4.41	7.23
'RLC 29' ('Sheetal')	982	15.23	50.98	4.82	92.93	8.26	8.05	5.86	8.57
'T 397'	858	10.84	56.77	3.66	57.98	5.35	8.22	3.67	7.12
CD (P=0.05)	27	0.52	1.37	0.33	2.48	0.44	0.29	0.32	0.42
Nitrogen (kg/ha)									
30	844	9.85	51.24	3.53	58.98	5.00	7.97	3.38	7.30
40	840	11.11	52.49	3.59	70.15	5.81	7.90	3.99	7.51
50	849	12.62	52.81	3.96	77.19	6.35	8.38	4.39	7.69
60	838	13.82	53.66	4.23	80.90	6.72	8.20	4.71	7.95
CD (P=0.05)	NS	0.46	1.22	0.29	2.22	0.40	0.26	0.28	0.38
CD (P=0.05) for interaction of V × N	NS	1.03	NS	NS	4.96	NS	0.59	NS	NS

*Days after sowing

Table 2. Crop biomass, grain yield, harvest index and economics of linseed as influenced by varieties and nitrogen levels (pooled data for 2 years)

Treatment	Crop biomass (q/ha)	Grain yield (q/ha)			Harvest index (%)	Straw yield (q/ha)	Gross monetary returns (Rs/ha)	Net monetary returns (Rs/ha)	Benefit: cost ratio
		1997–98	1998–99	Pooled					
Variety									
'SLS 21'	15.60	7.65	1.81	4.73	25.65	10.88	6,723	849	1.09
'SLS 9'	19.58	9.67	3.67	6.67	3394	12.89	9,518	3,349	1.54
'SLS 7'	18.89	9.06	3.79	6.51	34.40	12.46	9,185	3,016	1.49
'RLC 29' ('Sheetal')	23.44	8.80	5.87	7.45	31.35	16.11	10,570	4,401	1.71
'T 397'	18.51	8.08	3.74	6.08	31.00	12.64	8,461	2,292	1.37
CD (P=0.05)	0.42	0.25	0.18	0.32	1.30	0.45	231	234	0.04
Nitrogen (kg/ha)									
30	17.21	7.39	3.25	5.32	30.20	11.89	7,616	1,803	1.26
40	18.39	7.97	3.93	6.20	32.22	12.49	8,468	2,340	1.38
50	19.46	9.52	3.99	6.76	33.88	12.70	9,660	3,454	1.56
60	21.76	9.73	4.02	6.87	31.17	14.91	9,822	3,528	1.56
CD (P=0.05)	0.38	0.22	0.16	0.28	1.17	0.40	206	209	0.03
CD for interaction of V × N P=0.05	0.84	0.50	NS	NS	2.61	0.90	462	468	0.07

*Days after sowing

periority in growth and yield attributes. These findings are in conformity with the results reported by Rastogi (1994) and Jain *et al.* (1995), as they reported the advantages of improved linseed varieties over older or local ones. Both 60 and 50 kg N/ha were found statistically at par with each other, indicating the saving of 10 kg N/ha in terms of grain production (6.76 q/ha) and gave 9.03 and 27.07% higher grain yield compared with 40 and 30 kg N/ha respectively. These findings confirmed the views of Pandey and Chatterjee (1995), Sharma and Hunsigi (1996 a, b) and Sarode *et al.* (1997). Interaction of V × N indicated that 'RLC 29' ('Sheetal') could be grown successfully with applying 50 kg N/ha after soybean with *paleva* under rainfed condition of Sagar region of Vindhyan Plateau of the state.

Economics

'RLC 29' ('Sheetal') fetched maximum gross as well as net monetary returns and proved the most profitable variety. Similarly, 50 kg N/ha was found equally effective to 60 kg N/ha and calculated good gross and net monetary returns and proved economical N level for rainfed linseed (1.54 : 1.00). Interaction also revealed that the cultivation of 'RLC 29' ('Sheetal') coupled with 50 kg N/ha under rainfed condition after soybean may be taken successfully.

Thus, present study indicated that 'RLC 29' ('Sheetal') could be grown successfully by applying 50 kg N/ha as basal at sowing time for sustainable grain yield and good economics under rainfed condition of Sagar region of Vindhyan Plateau of Madhya Pradesh on soybean fallows even under late-sown conditions up to the second week of December. This variety ('RLC 29') possessing short-duration maturity and synchronous flowering habit which escaped from major disease and pest complex than that of other medium to long-duration linseed varieties like 'SLS 21' and 'T 397'.

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