Effects of relief or onset of nitrogen stress on yield components of linseed

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The recent development of edible-oil linseed (1) is likely to stimulate considerable expansion in linseed production. The highest yields can be expected from irrigated linseed supplied with split applications of N fertilizer. N fertilizer is expensive, so it is important to schedule applications to give the best returns per unit N cost. This requires knowledge of the yield penalty incurred if the crop becomes N-deficient, and the yield recovery that can be expected if N is applied to a N-deficient crop. We are studying the effects of both the onset and relief of N stress at various stages of crop development. We report some preliminary results.

Methods

Linseed cv. Glenelg was grown in sand culture in a glasshouse and received a complete nutrient solution with either 35 (stressed) or 210 (unstressed) ppm nitrate-N. The N supplies of some plants were changed from either 35 to 210 or from 210 to 35 ppm at the following growth stages and days after sowing

(DAS); (1) start of floral initiation on main tiller (34 DAS), (2) flower buds just visible on main tiller (48 DAS), and (3) end of first flowering flush on main tiller (74 DAS). All plants were grown to maturity.

Results and discussion

Number of capsules per plant was the yield component most sensitive to N stress. Plants which received a constant low N supply had only a quarter of the capsules of plants on the high N supply, and this was reflected in their seed and oil yields (Table 1). N stress also reduced the number of tillers per plant, but had no effect on the number of seeds per capsule or on single seed wt. Seed oil % was slightly higher in N-stressed plants.

Table 1. Response of linseed yield components to relief or onset of N stress

Yield component	N supply (ppm)								L.S.D. (5%)
	Constant		Changed						
	35	210	35 to 210 at DAS			210 to 35 at DAS			
			34	48	74	34	48	74	
Tillers/plant	4.2	7.2	7.1	8.4	6.9	4.2	4.6	5.9	0.6
Capsules/plant	128	534	527	532	446	145	181	350	39
Seeds/capsule	6.8	7.2	7.2	7.5	7.0	7.8	8.2	7.5	0.5
g seed/plant	5.6	26.1	25.8	27.3	21.0	7.7	9.8	17.1	4.7
wt/seed (mg)	6.5	6.8	6.8	6.8	6.7	6.8	6.6	6.5	0.3
Seed oil %	41.8	40.5	39.9	40.6	40.6	42.0	42.2	41.2	0.6
g oil/plant	2.4	10.6	10.3	11.1	8.5	3.2	4.1	7.1	1.0

Relief of N stress up to the flower bud visible stage (48 DAS) allowed full recovery of tiller and capsule production, so that yields were similar to the constant high-N plants (Table 1). If the relief of N stress was delayed until the end of flowering on the main tiller, then there was a 25% yield penalty as a result of reduced capsule production. Despite this, linseed can respond reasonably well to the late relief of N stress, because its semi-indeterminate growth habit allows the rapid production of new tillers and fruiting branches. Linseed is, however, fairly sensitive to the onset of N stress, even as late as the end of flowering (Table 1).

In practical terms, mild N deficiency during the early development of linseed is not nearly as detrimental to yield as it is with a determinate crop such as sunflower, because of the capacity of linseed to quickly

increase capsule production in response to relief of N deficiency. However, it is important that the N supply is adequate at flowering, because of the limited reserves of plant N available for redistribution to developing capsules.

1. Green, A.G. 1986. Can. *J.* Plant Sci. 66: 499-503.