Effect of changing nitrogen supply on growth, nitrogen accumulation and seed characteristics of sunflower

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Applying N fertiliser frequently in irrigation water is becoming an important technique in irrigated row crop husbandry. N fertiliser is expensive, so it is important that growers schedule applications to give the best returns from their fertiliser costs. There is little published information either on the requirements of irrigated sunflowers or on the optimum timing of N application during crop growth. We are studying the effects of a range of constant and changed N supplies on plant growth, the partitioning of N between plant parts, and especially on floret development, seed filling and seed yield. *We* report some preliminary results of our work.

Methods

Plants of Hysun 30 were grown under glass in 8-litre pots of sand and received a complete nutrient solution with the following ppm nitrate-N, 7, 35, 84 or 168, so that each plant was given 1.2, 8.7, 21 or 42 mg N daily. The prevailing daylength was extended to 16 hours with incandescent lamps. Immediately after floret initiation some plants were changed to different N supplies (see Table). All plants were grown to maturity.

Results and Discussion

Plants were smaller, accumulated less N and yielded less oil at constant low supply than at constant high N supply (in italics, in Table). At low N plants produced fewer and smaller leaves so that leaf area was 8% of high N leaf area; this would severely curtail photosynthesis. More importantly, low supply drastically reduced the number of florets initiated (ie. potential seeds) and resulted in an 8-fold reduction in the number of sound seeds per plant. By contrast, low N supply did not change the timing of floret initiation, anthesis or seed maturity.

Changing the N supply at the end of floret initiation (44 days after sowing) did not affect leaf or floret number because these had been determined already. Plant dry weight and N accumulation responded to changes in N supply (see Table), but the magnitude of the response was determined partly by the previous N supply.

Response of sunflower to constant and changed N supply

ppm N supply before	g plant dry weight				mg plant nitrogen				g seed oil per plant			
	ppm N supply after floret initiation											
	7	35	84	168	7	35	84	168	7	35	84	168
7	*7.6*	17.4	17.2	22.3	*95*	347	389	551	*0.93*	2.60	2.08	2.54
35	25.0	*39.4*	36.3	-	292	*581*	804	-	2.90	*4.40*	4.44	-
84	22.9	61.4	*84.3*	-	243	895	*1340*	-	2.74	6.48	*9.80*	-
168	34.9	57.7	-	*92.2*	297	796	-	*1539*	3.54	6.85	-	*12.05*

The major determinant of oil yield per plant is seed number, with seed weight also important. Changes in later N supply affected seed abortion and seed weight. Seed N levels rose with increasing N supply (2-3% dry weight). However, when low N plants (7 ppm) received 84 or 168 ppm N the level of seed N increased to 4%. Changing the N supply just before anthesis gave similar responses to those outlined above.

Adequate N supply before floret initiation is important in establishing plants with large leaf and floret numbers that can respond to N applied during the phase of rapid growth and N acquisition between floret initiation and anthesis. Later adequate N supply can lessen seed abortion and increase seed size. These indications for scheduling N applications will be tested in the field.