

## A model to predict growth and yield of sunflower

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We have developed further a preliminary model (2) which simulates the growth, development and yield of sunflower cv. Hysun 30. The inputs needed are maximum and minimum daily temperatures, daily irradiance, plant population density, and date and latitude of sowing. The developmental phases of the crop (emergence, completion of floret initiation, first anthesis and physiological maturity) are calculated from daylength and temperature (1,6). Estimates of the areas of individual leaves are generated (5). These are modified by leaf N concentration at floret initiation and population density (affecting the rate of leaf expansion) and leaf position (affecting the duration and rate of leaf expansion). Leaf area per plant is also modified by temperature (affecting leaf number). The progress of leaf senescence in sunflower needs more investigation but in the model it starts at full anthesis with the rate being constant over time and scaled according to leaf N status and population density. The accumulation of shoot dry matter is derived as a function of incident radiation, canopy light interception and the efficiency of conversion of energy to dry matter. The latter is temperature dependent (7). The shoot dry weight at specific developmental stages is used to calculate yields: seed number per plant, amount of oil per seed, plant and crop area (3) (see table).

**Table Yields calculated from weather data-sets for Griffith, NSW showing comparison with actual yields (4,6) and variation with time of sowing.**

	Leaf Number	Seed Number	mg oil per seed	g oil per plant	g shoot DW during seed filling
Sown 20 Dec 1982	100 000 plants ha <sup>-1</sup>		Leaf N = 54 mg N g <sup>-1</sup> DW		
Calculated	31	1254	24.7	31.0	186
Observed	35	1414	20.4	29.0	180
Sown 21 Dec 1982	75 000 plants ha <sup>-1</sup>		Leaf N = 48 mg N g <sup>-1</sup> DW		
Calculated	31	1526	25.3	38.6	180
Observed	35	1531	23.5	35.9	180
Calculated output for sowing dates	100 000 plants ha <sup>-1</sup>		Leaf N = 40 mg N g <sup>-1</sup> DW		
15 Sept 1984	38	1477	26.3	38.8	186
13 Oct 1984	35	1190	29.7	35.3	179
10 Nov 1984	34	1159	27.9	32.4	137
22 Dec 1984	32	1016	25.3	25.7	147

Simulations have been conducted for a range of sowing dates at a number of sites. The model has pinpointed areas of research needed to improve the management and yield of sunflower. These include: changes in photosynthetic efficiency and light absorption over the development of the crop, determinants of the potential maximum floret number, nitrogen sufficiency tests and the factors governing the proportion of florets producing seeds.

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