

## Crop evapotranspiration and soil water depletion of dryland sunflowers

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Approximately 60% of the sunflower crop is grown in environments where survival and productivity are dependent on stored water supplemented by rainfall. In the deep, friable soils of the Wimmera they provide a useful opportunity for those seasons when unusually high autumn/winter rainfall prevents the sowing of cereals. It is not possible, however, with the cultivars presently available, to realise the full yield potential from summer crops sown in a winter rainfall environment. Early-maturing varieties, which are better adapted to high temperatures and limited water availability, are necessary. Apart from empirical testing, it should be possible to attain this goal through a better understanding of the factors affecting the water use efficiency of sunflowers under such conditions.

### Methods

Sunflower cultivar Sunfola 68/2 was sown in a friable clay and thinned to 34,000 plants per hectare. Soil and plant moisture status were measured regularly to monitor soil water depletion during growth and the water use efficiency of grain production.

### Results and Discussion

In three different crops it was found that a soil moisture reserve, capable of providing 63-80% of the evapotranspiration (ET), was essential for successful growth and yield. The total crop water requirement ranged between 320 and 400 mm, with grain filling being increasingly dependent on moisture reserves at depth in the soil. Yield was restricted by the available water supply in all three crops. Since late sowing increased the proportion used by anthesis it both increased the stress and caused it to occur earlier in the growth cycle. Accordingly, unless rainfall supplements alleviate water stress during the grain-filling period, late sowings in regions with high evaporative demands will result in markedly lower yields.

The level of total soil moisture (780-880 mm/1800 mm) was near field capacity at sowing and losses during growth ranged from 200 to 260 mm. Plants were unable to extract moisture from the soil when the water potential dropped below -1500 to -1700 KPa. Thus, sunflowers can only be reliably grown in friable grey clays if there is 250 mm available water in an effective rooting depth of 1.8 m and more than 100 mm of summer rain.

Characteristic	Crop 1	Crop 2	Crop 3
Sowing time	26/9/74	6/11/74	8/11/75
Evapotranspiration (ET) (mm)	400	320	320
% ET from soil moisture (gm)	64	80	63
% available SM used by anthesis	65	64	78
% ET from sowing to anthesis	68	65	68
Transpiration ratio	3413	2726	1910
Oil yield (kg/ha)	504	536	712 +

+ Increased yield due to post-anthesis rainfall.