Precision Irrigation: The New Cornell Orchard Irrigation Website

Terence Robinson and Alan Lakso
Department of Horticulture
Cornell University,
Geneva, NY 14456 USA

The ability to repeatedly produce high quality apples of the optimum economic size is critical to grower economic success. The two most important biological and management factors affecting fruit size are crop load and water stress. To repeatedly produce consistent crops of large fruit size requires precise control over crop load and tree water status.

Irrigation is essential to preventing water stress in dry summers and small fruit size. The apple market expects growers to deliver large size apples (150-200 gram fruits). Growers attempt to achieve this fruit size by properly reducing crop load with chemical thinners in the spring but if the summer turns out to be dry they will still not achieve the desired fruit size and crop value will be severely compromised. To precisely manage fruit size requires precision in chemical thinning and precision in irrigation. Until now the amount of irrigation needed by apple orchards has been estimated by experience or "feel" or by using imprecise models using crop coefficients. Over the last few years we have developed a computer model which uses weather variables to estimate, for both young, medium aged and old apple orchards, the amount of water needed each day or week. This model has been placed on the Cornell Climate Center website and allows growers and consultants to daily or weekly assess the need for apple orchard irrigation using local (on-farm NEWA) weather stations or regional weather stations (airports) to determine water needs. With automated electronic irrigation controls growers could precisely add the needed water each day based on the forecast for that day.

The website allows users to select a weather station close to their farm and then enter information on the spacing and age of the orchard. The model will then calculate and display the amount of water needed for that orchard for each of the last 7 days and for the upcoming 7 days based on the weather over the last 7 days (from the weather station data) and from forecasted weather data expected over the upcoming 7 days. The calculated water volume needed by the orchard is displayed in gallons/acre. If the number is negative the grower should add that amount of water to his orchard. If the number is positive it means that rainfall exceeded transpiration and more water is available than needed and no more water should be added. The website also allows a user to enter his own recorded rainfall since rainfall varies considerably within short distances and the weather station data may not represent the actual rainfall at the farm.

The website will allow more precise management of tree water status in both wet and dry year. It will require the grower or his consultant to regularly use the model on the website and then regularly adjust water added to the orchard via irrigation. In the early season orchard managers will need to adjust water supplied each week but from mid June until the end of August it will require adjustments of water supply twice per week. With more precise water management growers will be able to more consistently achieve the optimum economic fruit size for each variety.

NEWA Apple ET Model

Weather Station: Williamson (Demarree)

Select Date: 07/08/2012

Continue

Map | Results | Help

Apple ET Model for Williamson (Demarree)

Change green tip date or tree density and click "Calculate" to recalculate results. Changing "Age of Orchard" will automatically recalculate table.

Green tip date	In row spacing	Between row spacing	Trees per acre	Age of orchard	Water balance
3/18/2012	3 feet	12 feet	1210	Mature	

Apple Evapotranspiration Model Results

Date	Model ET (liters/tree)	Orchard ET (liters/tree)	Orchard ET (gallons/acre)	Rainfall (inches)	Available Rainfall (gallons/acre)	Water Balance (gallons/acre)
Jul 1	24.07	10.3	3294	0.00	0	-3294
Jul 2	31.92	13.66	4368	0.00	0	-4368
Jul 3	20.25	8.67	2771	0.00	0	-2771
Jul 4	34.99	14.98	4788	0.00	0	-4788
Jul 5	30.88	13.22	4226	0.00	0	-4226
Jul 6	33.82	14.48	4628	0.00	0	-4628
Jul 7	15.19	6.5	2079	0.20	3802	1723
Jul 8	30.33	12.98	4150	0.00	0	-4150
Jul 9	33.01	14.13	4517	0.00	0	-4517
Jul 10	31.96	13.68	4373	0.02	380	-3993
Jul 11	35.32	15.12	4833	0.00	0	-4833
Jul 12	29.31	12.55	4011	0.00	0	-4011
Jul 13	28.90	12.37	3955	0.00	0	-3955
Jul 14	31.48	13.48	4308	0.00	0	-4308

You can enter your own rainfall amounts and click "Calculate" to recalculate the water balance.

NEWA

Powered by ACIS Northeast Regional Climate Center

Fig. 1. Website of irrigation model with sample data from Williamson during the summer of 2012.

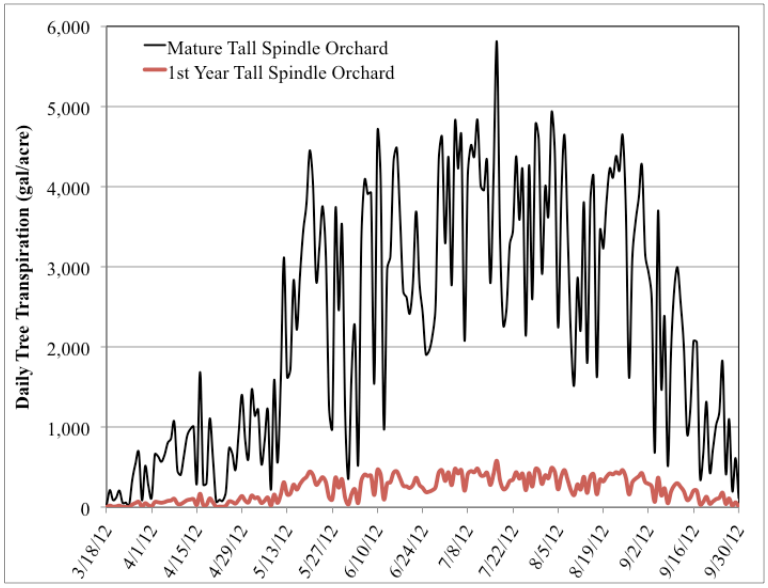

Fig. 2. Daily transpiration of a mature or a newly planted Tall Spindle Orchard in Williamson NY in 2012.

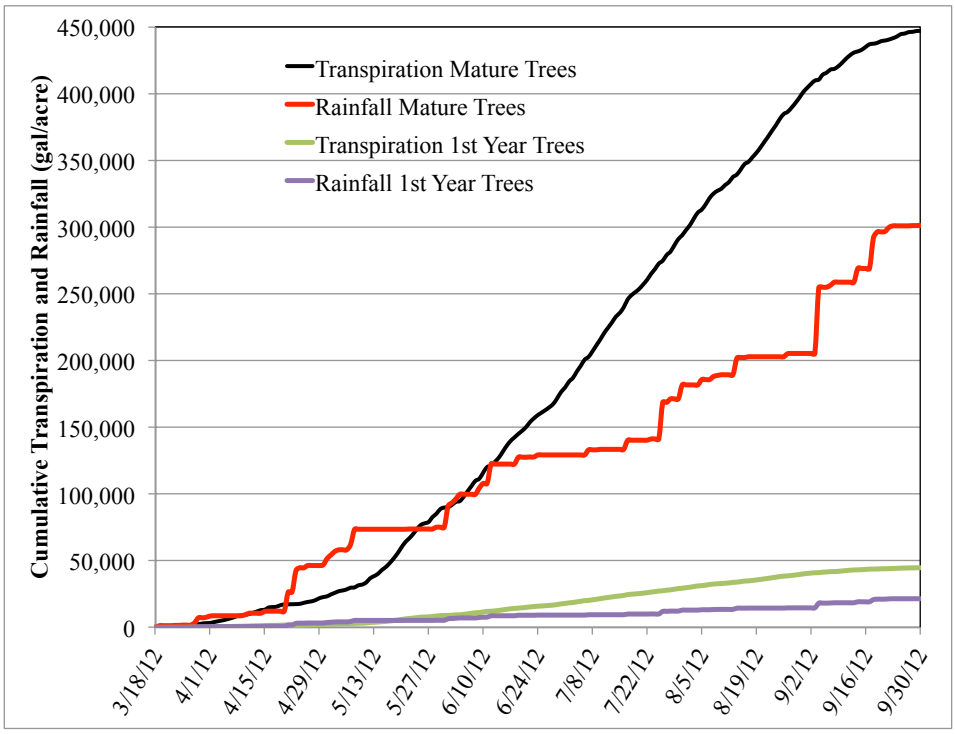

Fig. 3. Cumulative transpiration and rainfall in 2012 of a mature or a newly planted Tall Spindle Orchard in Williamson NY.

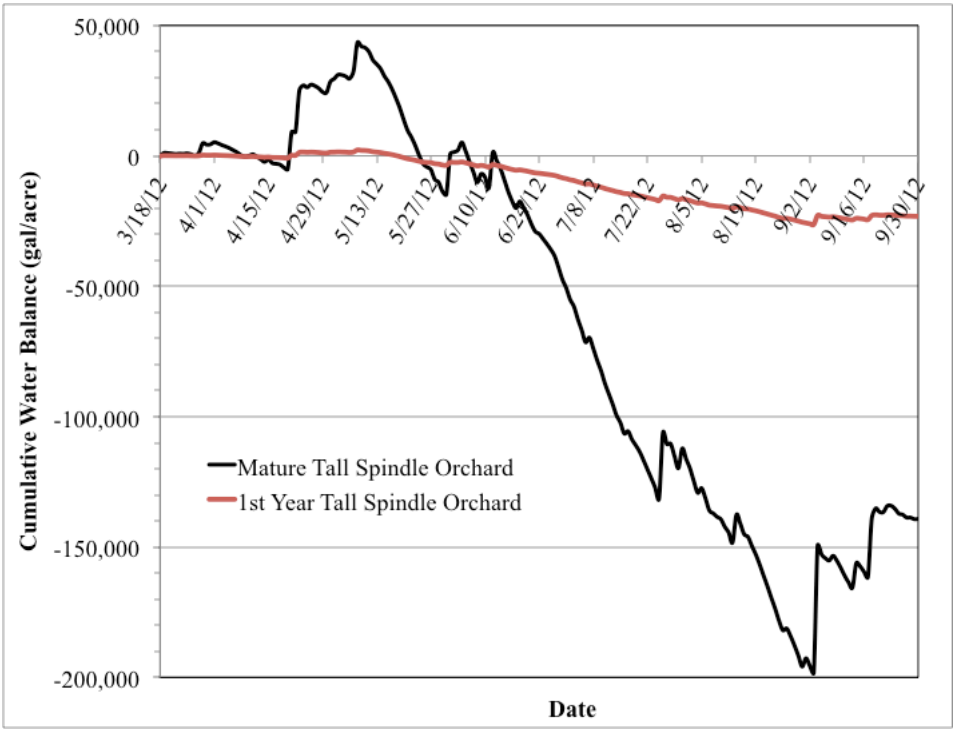

Fig. 4. Cumulative water deficits of a mature or a newly planted Tall Spindle Orchard in Williamson NY in 2012.