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.
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.