Apple Size and Irrigation Management

Consistent apple size is important to maintaining market share and farm profitability. Monitoring fruit growth and soil moisture together can improve irrigation decision making and help growers achieve fruit size targets set by the market and thus packing sheds. The information presented in this article illustrates the plant growth responses to soil moisture and how this impacts on commercial apple production.

Fruit size is directly related to expansion of fruit cells. In turn cell expansion rate is highly sensitive to the various prevailing environmental conditions. Soil water is the major environmental variable which affects cell expansion. This is noticable as fruit size, leaf area and plant height. Figure 1 illustrates how soil water affects cell expansion and photosynthesis.

At the full point both cell expansion and photosynthesis proceed at their maximum rate. In other words, there is adequate soil water to support these plant activities. As the soil dries out, the cell expansion rate is quickly affected but photosynthesis continues at close to its maximum rate. The result of this is that fruit size, leaf size and node length are reduced but cell reproduction and dry matter accumulation continue unaffected.

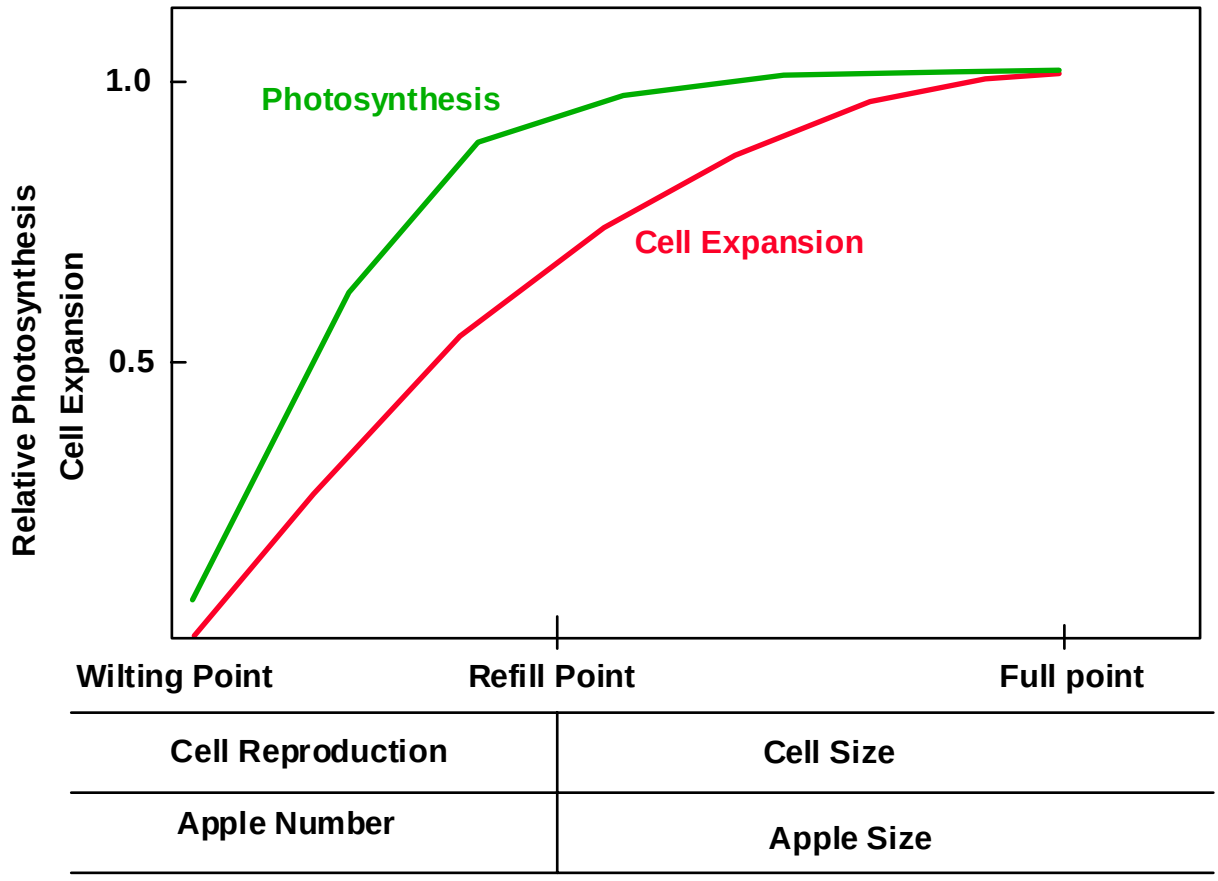

Figure 1. Soil Water Content as it Affects Plant Growth and Yield.

The refill point is defined as the water content below which the plant can no longer meet the evaporative demand. At this point leaf stomates close, wilting becomes evident and photosynthesis declines. When soil water content falls below the refill point photosynthesis declines even further. If the soil water content is maintained near the full point and/or soil physical conditions are excellent then high fruit growth rates can occur. If soil water content remains near the refill point and/or poor soil physical conditions are present it will be difficult to obtain high fruit growth rates and hence to satisfy market requirements for fruit size.

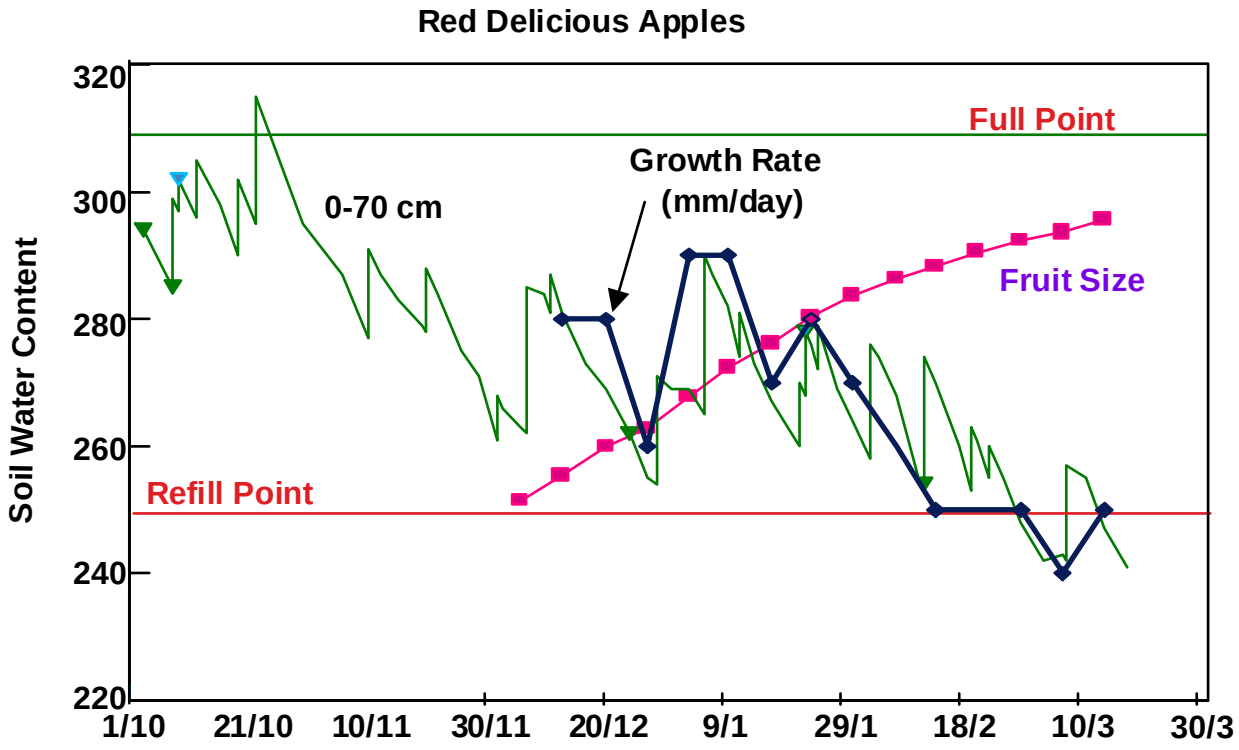

Figure 2. Soil Water Content and Apple Size

The close relationship between soil moisture content and fruit growth rate for Red.

Delicious apples grown at Batlow, NSW is clear in Figure 2. Soil water and fruit growth data were collected on a twice weekly basis using a neutron probe and fruit size measurement of 15 apples. The measurements were graphed using “the PROBE” software. There was 60 mm water availability between the Full and Refill point through the 70 cm deep root zone. Soil water content in this root zone declined throughout the season despite irrigation and rainfall. Monitoring showed soil water content to be close to the refill point from late January onwards. Fruit growth rate fluctuated in response to the level of soil water content throughout the season. The highest fruit growth rates were in early January when soil moisture was highest and lowest in February when soil moisture was often close to the refill point. Fruit sizing slowed as the fruit growth rate slowed because soil moisture was close to the refill point.

South African apple growers have been using this important relationship. These growers constantly compare the actual fruit size with the ideal size required by their apple cooperatives at different stages of the season. (Figure 3). This provides the basis for irrigation scheduling decisions. The amount of water applied is based on the dependence of fruit growth rate on appropriate soil water content in the root zone.

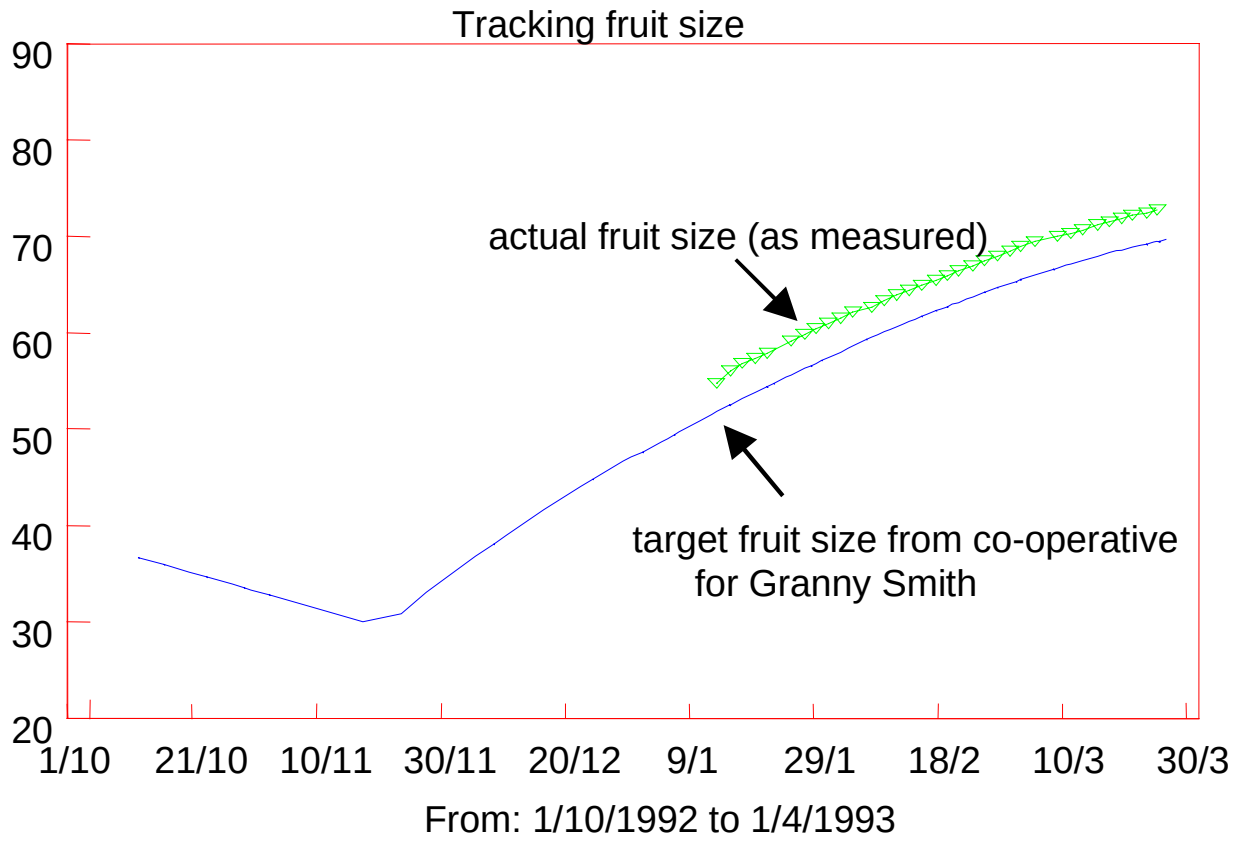

Figure 3. Tracking fruit size - actual fruit size and co-operative shed target fruit size

The actual fruit size was measured from the crop and recorded in the “the PROBE” software together with the root zone soil water content and daily water use. The co-operative target line was based on target sizes supplied by the buyers and entered just once in a ‘look-up’ table - it can then be displayed on a time graph for any apple crop at any time.

Systematic observations of fruit size and soil moisture as well as responsive management are key to high yielding and consistent apple production. Modern soil moisture instrumentation and software are valuable tools to objectively quantify these observations enabling progressive improvement toward crop production goals and hence farm profitability.

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