

Poor irrigation scheduling is the largest cause of wasting water and often results in environmental damage.

The scientific community developed the concepts of scheduling based on evaporation using crop factors determined by laboratory experiments. There is still a significant proportion of the scientific community convinced that evaporation based scheduling provides a complete solution to the scheduling problem.

The development of soil moisture sensing technologies provided an alternative school of thought thinking that scheduling could be based on soil moisture data to predict when and how much water to apply.

The reality is that neither technique has provided little more than a partial solution. Around the world, including Australia, most practical growers have expressed their dissatisfaction with these approaches by relying on a hands on approach, essentially a combination of inspecting the plants and gut feel.

It is widely held view in the scientific community that poor scheduling is simply a failure to educate growers coupled with reluctance of the growing community to adopt a more science based approach. There is fierce opposition to the view that the scientific approach has failed.

Nevertheless both methods are essentially flawed.

The evaporation approach falls down because crop factors measured under laboratory conditions bear little relationship with crop factors in the field.

The soil moisture monitoring approach fails because moisture sensors only measure the moisture over a relatively small volume of the soil, water does not magically move through the soil to create a uniform moisture content, there is very wide variation in moisture level which is dynamic as the plant extracts water.

No irrigation system applied the water uniformly and even if it did the plant extracts water non uniformly starting with the upper zone and progressively working downwards as the soil dries.

This complex three dimensional dynamic situation cannot be monitored by an economically reasonable number of sensors.

Growers may not understand these limitations in scientific terms but they clearly understand that neither system is giving the answers they need to manage their crops, so they rely on their instinct and experience. Some growers may use one or even both of the so called scientific methods, but only as useful guide to back up to their experience.

There is no doubt that a significant gap exists between the practical grower community and the scientific community, each side blaming the other for not

appreciating their respective positions. There is clearly a need for a new type of technology which provides growers with a practical system but with a firmer scientific basis.

If we examine the process used by the smarter growers it is obvious that there is a process which is much more sophisticated than appears at first sight. These smart growers are continuously observing a whole range of factors, how much water they apply, the weather, the condition of the plants and are continuously refining the amount of water they apply; they are adopting a natural self learning or adaptive approach.

This may not be scientific in the classic sense, it is more akin to the adaptive skill human develop for highly complex tasks which we take for granted but are technically very sophisticated, walking is a good example. It is a self learning process which humans are naturally very good at and technology is generally very bad at.

The process can be nevertheless be emulated in computer software using closed loop feed back technology. To mimic the way humans think, commonly called self learning software.

It works by determining the amount of water used by the plants using a predictor corrector scheme. Once the water consumption is known, a genuine 'field crop factor' is known and scheduling becomes an almost trivial matter.

Essentially the process is to estimate a field crop factor, (typically based on what has been used in the past). This is then used in conventional evaporation based scheduling software to predict how much water to apply. Soil moisture is read before and after every irrigation. If the crop factor is correct there will be no change in moisture content from one irrigation to the next.

Typically the soil moisture will change increase or decrease over time giving an error factor which can be used to mathematically adjust the crop factor.

This involves using sophisticated mathematical techniques but this is quite transparently to the user who will only see an adjusted 'field' crop factor.

This 'field crop factor' is developed over a number of irrigations, when conditions change eg the plant grows or the season changes this field crop factor is automatically corrected.