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## Satellites aid irrigation on fruit farms

In future farmers will have to produce more with less, especially when it comes to fresh water supplies. We take a closer look at how an online tool called FruitLook is helping farmers to better manage their “open-air factories”.

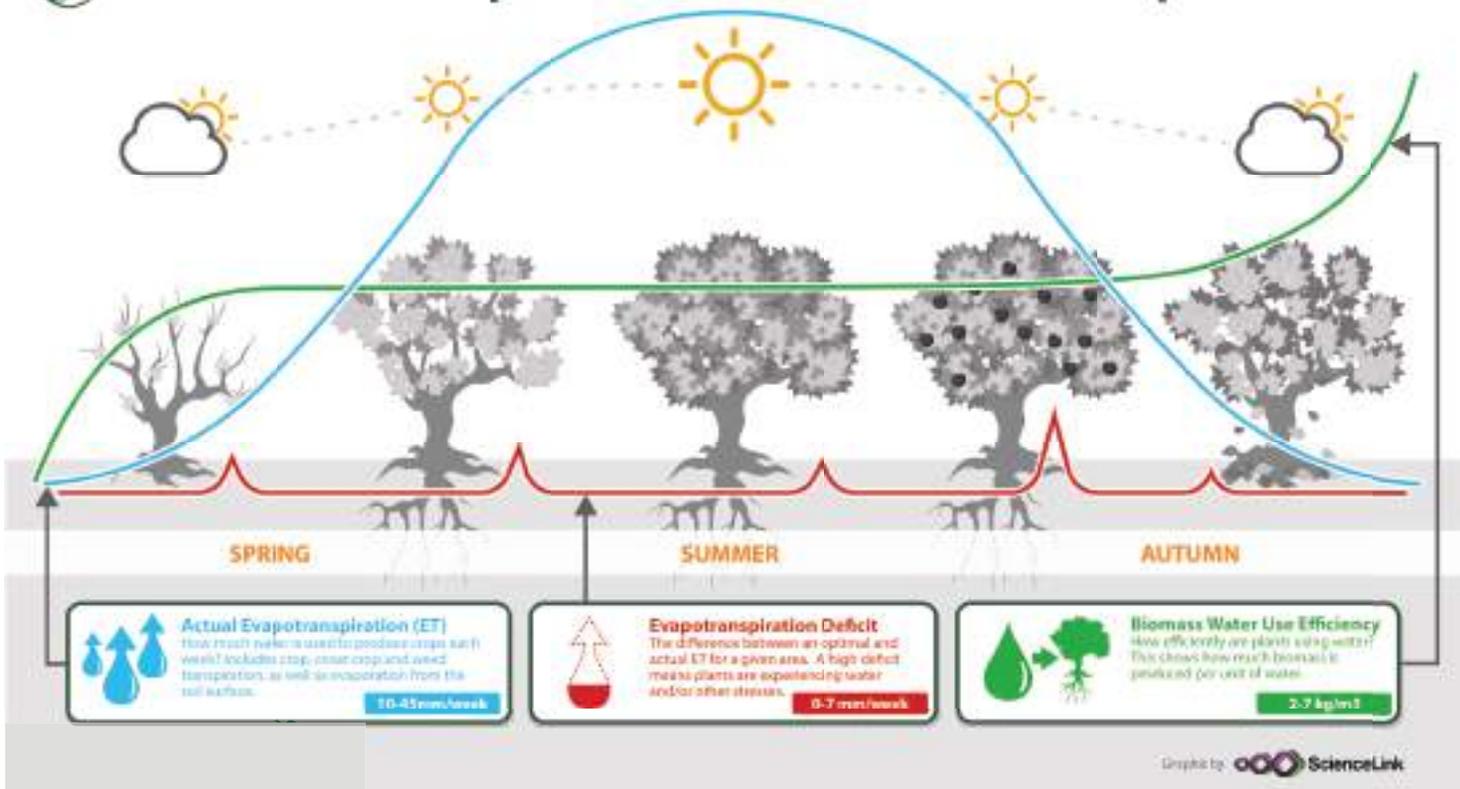
*“Cameras mounted on satellites capture characteristics of the crop which cannot be seen by the naked eye, providing farming intelligence normally not available to the farmer.”*

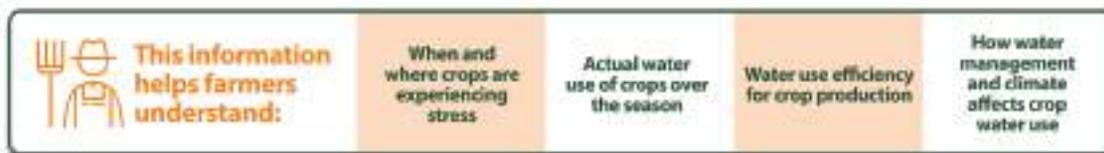
It has been a really dry summer in many parts of the country, mostly due to El Niño causing a serious drought. Many fruit producers are still counting the cost of related water stress during critical phases of crop development. The need to use reliable information tools and best practices to enhance producers' ability to inform farming decisions, is clear. Luckily, becoming a “water smart” farmer is already possible with FruitLook, says André Roux of the Western Cape Department of Agriculture. FruitLook helps producers to understand how their crops respond as part of the bigger water cycle of their region. By knowing more about the transfer of moisture from the

earth to the atmosphere producers are better placed to efficiently manage their farms. Many producers are using this online tool to provide insights into water use on their farms, helping them to become more resource efficient.

Almost half of the producers using FruitLook have indicated they have cut their water use with a tenth. One in every ten says they are now using almost a third (30%) less water than before. The majority have also indicated it is very useful in the detection of over- or under-irrigation, with over half of them highlighting that it could be used to detect irrigation problems (for example pipe leaks).

### fruitlook.co.za helps farmers understand their crops' water use





But how does it work? “Basically, FruitLook employs the latest satellite technology to help farmers manage crop productivity, growth and water use more precisely,” explains Dr Caren Jarman. She is an independent researcher and Research Associate at the Centre for Geographical Analysis at Stellenbosch University.

This cutting edge data service provides remote sensing derived data products to the deciduous fruit producers in the Western Cape, currently free of cost. “Cameras mounted on satellites capture characteristics of the crop which cannot be seen by the naked eye, providing farming intelligence normally not available to the farmer. It can help producers to better understand how their crops use water and how much is needed where,” Dr Jarman says.

The satellites can, for instance, tell you how well your crop is growing, how much water it is using and also how effectively it is doing that. This allows for a more targeted approach to irrigation with farmers able to monitor their water use. “It is a system then enables you to identify farm specific areas with weak growth or even pinpoint the particular area in your orchard or vineyard with water shortages,” Dr Jarman says.

FruitLook integrates the latest in remote sensing technologies by satellite with weather data and complex algorithms and offers three water-related datasets. These relate to actual evapotranspiration, evapotranspiration deficit and biomass water use efficiency in orchards and vineyards. Data about the evapo-transpiration deficit, for instance, can give clues whether plants are under-watered or stressed in some way (see graphic on page 78). This helps to take some of the guesswork out of farming and could save producers lots of money, especially on irrigation costs.

Many users say this tool has proven useful to analyse the “bigger picture”, especially when it comes to their water needs.

Farmers know that irrigation schedules and

probes have their limitations and that you need to adjust your “recipe” according to specific conditions, including plant development and stress factors. This is where FruitLook has often proven useful to check irrigation system performance, says soil scientist Nelius Kapp. Kapp, director of Soil2Root Technologies, has been using FruitLook for several years. He, for example, looks at its data on biomass production along with its datasets on evapotranspiration deficit (an indicator of water stress in plants) to unravel what is happening in a problem area.

Anton Müller, Kromco's technical advisor, considers FruitLook especially useful to detect irrigation issues, for the placement of soil moisture probes, the detection of drainage problems and to evaluate just how efficient irrigation regimes were during a “post-mortem” of the season. “FruitLook also helps clarify what the effect is of irrigation scheduling on crop growth,” he adds.

Both under- and over-irrigation have a negative impact on water use efficiency and yield, thus it is important that users understand and improve on both. “FruitLook allows growers to see where in the orchard trees have been over- or under- irrigated. This information helps farmers understand the actual crop water use over the season, water efficiency on their farms and fields and how crops respond to changes in irrigation and climate. Thanks to FruitLook producers also have farm-specific data compiled over past growing seasons that can act as a reference point. I find that very useful,” Müller says.

Some farms in the Grabouw region have, for example, been able to reduce their early-season water use with up to 30%. This was done using FruitLook in combination with soil moisture probes.

Sometimes issues related to irrigation in an orchard are first noticed thanks to unusual changes flagged by FruitLook's growth data. Müller gave an example of a 5 ha apple orchard in the region that developed a real problem with red spider mite infestation late January:



**"Why was the pear yield so low this year?"**

*-Nelius Kapp, Soil2Root Technologies*



A pear farmer's low yields in 2013 led to a loss in income. Nelius Kapp helped the farmer identify the problem using FruitLook.

FruitLook data showed that **biomass production** was lower during December, a crucial time for pear development. What caused the drop?



**Evapotranspiration deficit**



The **evapotranspiration deficit** was very high over the same period. Taken together, the FruitLook data suggests the pear orchard experienced water stress at this crucial growth stage.



Additional calculations for crop water requirements showed that the existing drip irrigation system could not provide enough water in high-demand periods. Nelius advised the farmer to invest in a microsprinkler system that would provide adequate water in future.



FruitLook growth and water use data helped Nelius Kapp and the pear farmer to identify and resolve the cause of a low crop yield, thereby preventing an unnecessary loss of income for the farmer.

"The evapotranspiration deficit data showed clearly that the trees were under stress during early January. Considering integrated pest management on the farm, the problem was resolved by biological control after it was decided to adjust water scheduling, rather than spray en masse. Adjusting water management helped reduce stress in the orchard. The pest issue at hand was an irrigation issue."

Jaco Engelbrecht, a viticulturist from Boland Cellar, has had similar experiences. He often also considers FruitLook's evapotranspiration data. Engelbrecht uses it to identify event-based problems within the vineyards. "FruitLook helps us to adjust our management practices when the plants need it the most," he says. "We adjust our irrigation accordingly to avoid spikes or drops in biomass production."

Kapp often employs FruitLook's biomass data in conjunction with its moisture parameters. He also uses it in conjunction with information from soil profiles to decide where to for instance place soil moisture probes. "FruitLook is useful to identify areas that are experiencing evapotranspiration deficits, but it won't tell you the reason. Sometimes there are other reasons why this dataset would for instance show changes in your orchard. This could be because of the wind, pests or atmospheric stresses like a heat wave. Relying on a satellite image alone will not necessarily give you the answer. You still have to interpret the data." The data must be assessed given unique block, farm and regional conditions, he emphasises.

The real value of FruitLook, Kapp believes, emerges when used in collaboration with soil moisture probe data, information from weather stations and hands-on investigations on the ground. "FruitLook not only helps you understand the current season, but also to look back at conditions in the seasons. To interpret decisions around water scheduling you have to think farm specific and integrate all your measurements and observations," he says. (See graphics on page 80 for some practical examples from Kapp.)

Len van der Merwe, who manages the Ratelfontein Boerdery near Villiersdorp, agrees. He has been using FruitLook for about two

years to inform farm management decisions. "FruitLook offers me the opportunity to look back over the season and to assess some of the irrigation decisions we made. I access the data weekly and adjust scheduling accordingly, along with soil moisture probe readings." The probes give detailed information over time and the depth of soil and the other provides a picture of the entire orchard.

He considers FruitLook as a "handy" tool to use in pursuit of more precision type agriculture. It is also valuable when trying to calibrate irrigation scheduling and helps to visualise trends in soil drying. "FruitLook offers a nice way to check if what you have been doing last week and earlier in the season are having the desired results. Our farms have different soil conditions. We have to consider factors like slopes and drainage to make sense of why one section grows slower or dries out quicker. It has proven useful to compare different areas with each other."

FruitLook reflects farm specific and regional conditions. And therein lies the beauty of using this kind of remote sensing tool that can look back in time and space. "A better picture emerges of what is happening on the whole farm when you integrate this with your existing farming practices," Müller concludes.

Visit  
[www.fruitlook.co.za](http://www.fruitlook.co.za)  
or contact the project  
team at  
[info@fruitlook.co.za](mailto:info@fruitlook.co.za)  
for information.

## DID YOU KNOW?

- Eight percent of South Africa's landscapes provide more than half of its fresh water.
- Two-thirds (66%) of all water consumption countrywide is by farmers.
- Water issues are compounded by the fact that demand outstrips supply in many parts of the country.
- In the Western Cape, 43% of the available water resources are used for irrigation.
- Fruit crops need between 7 000 m<sup>3</sup> and 11 000 m<sup>3</sup> water per hectare, depending on the type of crop and locality.
- Approximately 240 6000 ha is under irrigation in the Western Cape. This includes 186 400 ha under fruit crops and 8 000 ha under vegetable crops.
- Rain-fed agriculture is also considered important in the province. About 468 000 ha dryland grain crops (like wheat, canola and barley) are annually planted in the Western Cape. Another 400 000 ha lucerne is produced on dryland and with irrigation.
- Last year's drought caused an estimated loss in wheat production of about 200 000 ton.
- FruitLook measures evapotranspiration (the sum of evaporation and plant transpiration from the surface to the atmosphere) in mm per week.
- 1 mm evapotranspiration per day is the same as 10 m<sup>3</sup> per hectare per day.
- 1 litre evaporation per second per hectare is the same as 8 640 mm per day.

SOURCE: FRUITLOOK, WWF-SA, DAFF, FAO.