

WATER AND AGRICULTURE

Beyond the farm gate: FruitLook unlocks bigger picture

Rising input costs, increased competition for water and recent weather woes are compelling producers to improve their water use efficiency in terms of agricultural yield per amount of water consumed. Jorisna Bonthuys looks at how an online service called FruitLook is strategically placed to support local fruit and wine producers on their journey towards more efficient water use.



Changing farming conditions due to climatic shifts are already a reality.

Globally, the year 2016 was the hottest year ever recorded, surpassing the exceptionally high temperatures of 2015. During this period South Africa experienced one of its worse droughts in decades, putting a strain on producers and consumers alike.

South Africa, like the rest of southern Africa, is expected to be vulnerable to food insecurity, water scarcity and climate change over the coming decades. The agricultural sector is the biggest consumer of water and therefore most vulnerable to the expected change in weather patterns caused by climate change.

Water availability is set to be the single biggest factor in limiting agriculture production. Already water issues are compounded by the fact that demand outstrips supply in many parts of the country.

“Alternative sources of water will have to be found, and we need to reuse what limited water sources we have as much as possible. The optimum utilisation of existing water resources is key to agricultural development and growth, with the associated jobs it creates,” says André Roux. Roux recently retired as Director for Sustainable Resource Management in the Western Cape’s Department of Agriculture.

In the Western Cape – the heart of the country's fruit and wine production region – strict water restrictions are in place due to severe water shortages caused by insufficient winter rainfall over the last few years.

In August 2017 many of the dams in the province had reported levels drastically lower than levels recorded at the same time during previous years (44% in August 2016 compared with 18% in August this year). Without additional rainfall in the coming months, producers are up for a challenging production season.

Unfortunately, these droughts might not be isolated events. Climate models predict a gradual to rapid change in climatic conditions and an increased likelihood of extreme weather conditions like hail, flooding and prolonged droughts in the Western Cape. The picture does not look the same everywhere, but the direction of change is clear.

This is forcing managers and irrigators to re-evaluate their strategies for growth in the local agricultural sector. There is an increasing need to improve the efficiency of resource use to mitigate impacts of climate change, says Roux. Farmers will need to produce 'more crop per drop'.

Space technology supports farmers

The face of natural resource management is changing with satellites and remote sensing playing an increasing role to inform decision making on farms, says Dr Caren Jarman. She is an independent researcher and research associate at the Centre for Geographical Analysis at Stellenbosch University. "Irrigation and proper water management can play a major role in enhancing water productivity and food security in our region," Jarman believes.

This is where FruitLook, supported by a Dutch company called eLEAF, has proven especially useful to many local fruit and wine producers.

It uses satellite-derived information to help farmers decide about optimal timing, extent and location of inputs such as water and fertiliser. It is thereby helping to take some of the guesswork out of irrigation.

This is possible thanks to its ability to collate relevant information that is not always visible to the naked eye (for instance of surface temperatures and plants that experience stress). By doing so, FruitLook provides weekly overview maps describing growth, water and mineral content on a 20x20m pixel basis for almost every production block in the Western Cape. Producers and consultants alike use this data to determine the placement of soil moisture probes, detect drainage problems and evaluate irrigation efficiency post-seasonal.

Currently, Fruitlook is only available to fruit and wine producers in the Western Cape. The area covered by the satellites it employs now roughly stretches from Lutzville and Vredendal (in the north) to the Hemel and Aarde Valley (in the south) and Montagu and Bonnievale (in the east). During the 2017/18 season, the area will be further expanded eastwards all the way to the eastern boundary of the province, to include for the first time the Langkloof area as well as the grazing areas of the

dairy industry in the Tsitsikama area and the hops producing areas near George. This means all major agricultural areas in the Western Cape will be covered by FruitLook's from next season onwards.

The system, subsidised by the Western Cape Department of Agriculture, give local farmers access to high-end data products at no cost. By doing so, the agricultural sector is supported to become more resilient to climate change by empowering farmers to make better-informed decisions on resource management and especially the use of water for irrigation.

More about FruitLook

- Fruitlook is an online tool that helps farmers improve yield and save resources by providing weekly data maps describing crop growth, water use and mineral content.
- It integrates satellite data with geographical data and weather information in complex models and produces user-friendly, farm-specific data maps.
- It is helping fruit and wine farmers in the Western Cape optimise water use and improve productivity by enabling enhanced management of resources.
- FruitLook provided data on 182 600 ha of fruit crops and 5.7 million ha in total during the 2016/17 season. Approximately 34 860 ha of current data was used by farmers as well as 29 550 ha of historical data for comparative purposes.
- The service includes data maps on, among others, biomass production, actual evapotranspiration, evapotranspiration deficit, biomass water use efficiency and nitrogen contents.
- It allows a grower to see where an orchard or vineyard has received sufficient or insufficient irrigation.
- Almost half of the producers using it indicated they have cut their water use with a tenth. One in every ten producers says they are using almost a third (30%) less water than before.

Source: SA Fruit Journal, Fruitlook.

Applying FruitLook in farming

Many producers find Fruitlook a valuable tool, especially when it is integrated with other technologies. 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 the previous season. Kromco is one of the largest deciduous fruit packing facilities in the Western Cape and many of the growers in the Elgin and Grabouw region that supply to them, now employ this technology.

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, Müller indicated. Sometimes issues related to irrigation in an

orchard are also first noticed thanks to unusual changes flagged by FruitLook's growth data.

Others like Karen Cluver, the manager of the fruit section of the De Rust farm near Grabouw, uses FruitLook's parameters for biomass production, water use efficiency and evaporation deficit to identify any emerging problems, including non-efficient growth in blocks throughout the season. Using biomass and water use parameters have enabled them to use about 20% less water than before. Says Cluver, "The data allows us to re-evaluate the growth of our crops and how much or how little water we are giving." Growth differences in a vineyard or block are, for instance, often linked to soil differences, related to water and growth.

FruitLook's data is not only useful in season but also to look back on a season to see how producers fared from a management perspective. It allows a grower to see where an orchard or area of an orchard has been over- or under irrigated, Jarmain points out. "The technology offers producers the opportunity to save water, but also to manage their orchards or vineyards within the required norms to optimise production."

The biomass production parameter has also been used by for early disease detection in orchards and vineyards and the effective treatment of only the affected areas, that resulted in significant cost savings in the disease treatment.

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 says.

Beyond the farm gate

Although satellite products have been around for decades, producers and consultants alike now have free and timeous access via the Internet to products that would have been too expensive before. "Big data" and remote sensing can help a great deal to help make agriculture more water efficient in future, researchers believe

In the case of FruitLook, the application of remote sensing is aimed at providing farmers with the right information to help them increase their water use efficiency (providing the correct amount of water at the right time).

The data behind FruitLook can also be useful beyond the farm gate, explains Jarmain. It is already used for regional analysis (including research into yield prediction) and water resource management (including drought detection, water audits and water footprinting).

Remote sensing is applied in various ways. Some local researchers are mapping irrigated areas with it and doing research on the water footprint of crops. Others are interested in river discharge, improving efficient water use on farms or identifying just how much of our precious water resources are currently being used by water thirsty alien invasive plants and trees. Collective efforts are also under way to gain a better



understanding of what this means for water availability in future. Heaps of data get collected in the process that needs to be interpreted.

Dr Jarman is, for instance, involved in a research project on behalf of the Water Research Commission (WRC) performed by the University of Stellenbosch to determine the actual area under irrigation and the volume of water required annually for this. FruitLook's data is used to calibrate models that are being developed to estimate actual crop water use across the country. She is also involved in a research project on how Fruitlook can be used to make yield projections. The researchers are looking at phenological as well as yield data. They use statistical analysis and machine learning to discover relationships between remote sensing data and yield data, to model future yield.

Meanwhile, various national strategies have been developed to cope with current and future water crises in South Africa. How does FruitLook fit into these regional and nationwide strategies to deal with water and environmental challenges? It provides valuable information on actual crop water use of the previous week of the selected crop, orchard or vineyard.

Roux explains, "This can guide the irrigators to optimise the water use in the current week. Water savings of more than 10% are quite common for the users of the FruitLook data and saving water also result in electricity and fertiliser savings. Reduced irrigation water runoff reduces or eliminates the pollution of our rivers and streams with fertiliser enriched water, which has a tremendous positive impact on the environment."

Roux believes the optimal use of the limited irrigation water available this summer season (due to the drought) will be crucial for farmers to produce a quality crop given the water restrictions in place. "FruitLook's data will significantly contribute towards an increase in agricultural water use efficiency. This all starts by assisting irrigators to manage their limited water resources in the upcoming irrigation season."

Farming for the future: SA's water realities

- South Africa is one of the 30 driest countries in the world, with an annual average rainfall of less than 490 mm, a significantly lower amount than the world annual average of 814 mm.
- More than 80% of the country is hyper-arid to semi-arid. The rainfall climate of South Africa varies considerably across the country.
- Eight percent of South Africa's land provides more than half of our run-off and freshwater resources.
- About two-thirds (63%) of all water consumption countrywide is by farmers who are its biggest direct users.
- Based on current usage trends, South Africa is expected to face a water deficit of 17% by 2030, and this shortage will only be worsened by climate change.
- Demand for water is increasing rapidly due to population growth, development initiatives, extreme weather events, climate change and pollution.
- In the Western Cape, 43% of the available water resources are used for irrigation. Fruit crops have a nett irrigation requirement of between 7 000 m³ and 11 000 m³, depending on the type of crop and where it is grown.
- One millimetre evapotranspiration per day is the same as 10 m³ per hectare per day.

Sources: WWF-SA, Fruitlook.

