Smart farmers

Background *2 Jul 2020* 1 comment

Overcoming drought with new technology

Precision farming technology is helping Western Cape farmers deal with drought and climate change.

The Western Cape province in South Africa is known for its horticulture – deciduous and citrus fruit, berries, vineyards, and vegetables. It also produces livestock, meat and dairy, and field crops like wheat, barley, and canola.

Increasing need for irrigation

All need water – and lots of it. Climate change forecasts for the Western Cape suggest warming of 1.5°C to 3°C by around 2050. While the need for irrigation increases, the restocking of existing water sources becomes more unsure. Simply put, farmers need to produce “more crop per drop”.

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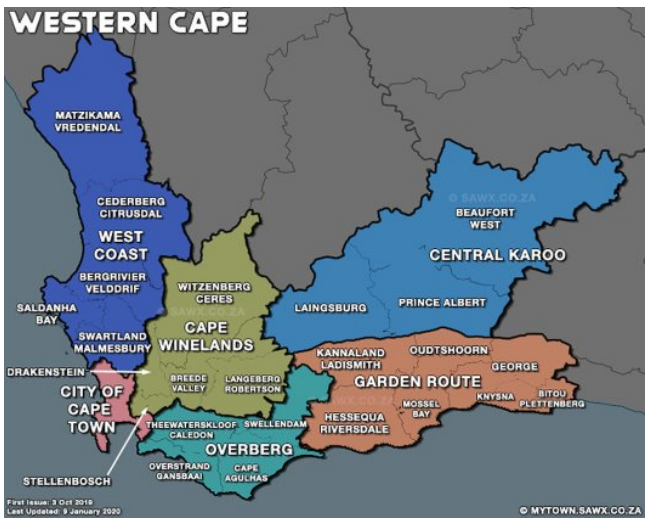

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Dam levels decreasing

Since 2013 dam levels have slowly been decreasing with three years of gravely deficient rainfall from 2015 to 2017. The period was regarded as the driest three-year period in more than 80 years, and 2017 was the region’s driest year since 1933 – a ‘one in 400-year’ event.

The Western Cape Department of Agriculture launched a service called FruitLook to deciduous fruit and grape farmers in the Western Cape. FruitLook was developed by a Dutch company, eLeaf, and is supported in South African by the company Blue North.

Satellite data

The portal provides weekly information on crop growth, evapotranspiration deficits and crop nitrogen status for irrigation blocks in orchards and vineyards. Using satellite data, FruitLook delivers quantitative, spatial information on water, vegetation, and climate. The data assists farmers in understanding better the effects of their water use and crop management decisions.

This, in turn, reduces costs by saving on inputs. Currently, the FruitLook services are offered free of charge to the farming community. FruitLook is an invaluable tool for farmers that had nothing else in place to be water efficient and climate-smart.

Precision farming practices can get farmers through tough times

The consulting company, Agrimotion, worked together with fruit farmers in the Western Cape to use precision farming to survive the worst drought in eighty years. According to CEO, Coenrad Fraenkel, Agrimotion used the concept of water budgeting to help farmers manage their water quotas and available water in their dams throughout the drought. A drone with a camera took high-resolution contour images of dams to measure the precise capacity of dams and how much water was available for use.

Requirements for effective irrigation scheduling

The three minimum requirements for effective irrigation scheduling was used to determine how much water would be needed in the orchards. The three basics are:

1. A weather station to monitor seven days in advance what the weather demand will be;
2. A flow meter to precisely capture the amount of water that reaches each orchard;
3. Soil observations with the help of a soil auger or soil moisture (capacitance) probes in the root zone to monitor that the soil moisture was ideal during critical phenological stages and to a depth of 80cm.

Avoiding deep drainage

Regulated deficit irrigation (RDI) principles were used to ensure optimal soil moisture during the different growth stages of the crop. Probes were closely monitored to make sure that deep drainage (water passing 80cm) was avoided. The soil moisture readings were determined with soil moisture probes or physical feeling/evaluation of the soil where possible. By knowing how much water was available and how much was needed, irrigation priorities could be set.

Orchards were classified into five categories, and the water budget allocated the available water according to each category. The easiest way to do this is to divide profit per cubic meter of water applied and rank orchards from highest to lowest. Orchards are nocked off from the bottom of the list until the water usage from the previous season matches the available water supplies.

Orchards were classified into five categories and managed accordingly.

Money-spinners: These are the crops or varieties with high income potential such as clementine. These orchards received 100% of their water requirement.
Commodity-crops: These crops are sold as commodities and do not fetch the same high prices as the money spinners, for example oranges. They were pruned back to bare a lower crop and require only about 60% of their original water requirement. Less leaves on a tree means that it has a lower water requirement.
Marginal orchards: These trees were pruned back completely, and top worked with better cultivars for future higher income potential. Their water requirement was taken right down to about 20% of the original requirement, just to keep them alive.

Orchards-earmarked-for-replacement: These were taken out immediately, and **Young orchards** were given the minimum water required to keep them in good condition.

Soil Moisture Probes for precision irrigation

Soil moisture probes measure plant-available water as a function of soil volumetric water content as it relates to matric potential (the strength of the bond between a soil particle and a water molecule). Each soil type, crop and variety have different irrigation needs which means that placing the probes in the most representative locations is paramount to using the data they generate correctly to make the right irrigation decisions.

With the latest probe technology, farmers are able to allocate the exact amount of water needed to conserve water for later in the season when it is needed. Any sensor used for irrigation purposes needs to help the grower answer two questions: when to irrigate and how much. ‘When’ relates to the starting soil moisture before irrigation and what RDI principle is being followed. ‘How much’ relates to the soil’s texture and how deep the water infiltrates when it is applied.

Take out alien plants that compete for water

Good water conservation practices included chopping up alien plants to be used for mulching in orchards. Farmers that could afford the outlay erected net structures to conserve plant moisture. These practices assisted in keeping soil moisture from evaporating as fast in the uncovered conditions. Converting blocks from micro-irrigation to drip irrigation also helped to increase on water use efficiency drastically.

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A net structure erected over a young citrus orchard. Photo - Agrimotion

Soil and water chemistry changes in times of drought

Water quality deteriorates as dam levels go down and boreholes start to run dry. Soil chemistry needs to be carefully managed since deep drainage (leaching) is being limited, salts are being added to the soil through poor quality water and rainfall is limited. Frequent soil sampling and testing to determine the change in salt content must continue even after the drought to protect the yield capacity in the first year after the drought.

Sharing of information is vital for the community to pull through

Collaboration within a farming community helps so that all parties get as much water as possible. The water budget can be done on a macro scale to benefit the whole community. In the Western Cape, the Grabouw farmers were able to put water back into the Bosteenbrasdam to be used by the city of Cape Town.

Sharing information between industry parties ended up benefiting everybody. Agrimotion, for example, trained farmers for free on the farmers days to share in the water budgeting

principles and effective scheduling techniques.

Incentives for better water management

Imagine a system where farmers get rewarded with more water for better water management. Unfortunately, the South African regional Waterboard do not have the sophisticated systems to do just this. However, smarter water use such as the precision water budgeting, effective irrigation scheduling techniques and investing in drip irrigation as described above leads to higher profits per litre of water used. More Crop per Drop, so to say.

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