

SEBINASI DZIKITI

A life committed to growth through agriculture

*Agrometeorologist
Dr Sebinasi Dzikiti reflects
on an award-winning career
that saw him help improve
water productivity of South
Africa's most valuable crops.*

Article by Petro Kotzé.

Growing up in Zimbabwe, then referred to as the breadbasket of southern Africa, Sebinasi Dzikiti knew one clear path would help him contribute to his country's economy: agriculture. However, as a student of physical sciences, he says he needed to enter this field through a side door.

Though he didn't know it then, his mission would lead to a celebrated career spanning across the borders of his birthplace. And after three decades, he has won international acclaim for his work to help farmers squeeze the most output from high-value commercial crops with the least amount of water – fueling economic growth for both farmers and the countries they operate in.

His road has been one of commitment, passion, and constant work, rewarded with long-term support from funders and mentors. But, in the beginning, it took a serendipitous nudge in the right direction.

Early career in Zimbabwe

Dzikiti graduated with a BSc Honours in Physics from the University of Zimbabwe in 1996. However, after his MSc in Agricultural Meteorology, also at the University of Zimbabwe, the young scientist couldn't find employment. After being hired as a research assistant, he applied for his PhD in Applied Biological Sciences. The decision was partly motivated by funding for the Agricultural Meteorology programme from a consortium of Flemish universities, including Ghent University in Belgium. This also offered the way into agriculture that he was looking for.

Dzikiti tackled the course with fervour. To develop his research topic, he recalls taking a taxi to travel to a citrus farm located almost 40 kilometres outside of Harare, "to see if I could do some work for them..." Zimbabwe, like South Africa, also faces serious water shortages, so he reckoned that a career in agricultural water management would see him play a role in the agricultural sector. At the time, he was interested in testing a new irrigation technique called partial root zone drying (PRD), which had just been developed in Australia, but had not yet been tested in citrus orchards. PRD is a form of deficit irrigation, he explains,

that entails supplying water to part of the plant's root zone while keeping the other part dry. In this way, the plant is tricked into thinking it is stressed by producing root-generated stress hormones from the dry side, which causes partial stomatal closure, thereby reducing plant water use without compromising yield, as the plant still gets sufficient water from the irrigated side.

The farmer was immediately interested and introduced the budding researcher to Citrus Research International (CRI), which supervised, evaluated, and co-funded the study. This set the wheels in motion for Dzikiti's collaboration with CRI staff in the Department of Horticultural Science at Stellenbosch University (SU), while he was registered for his PhD in the Laboratory of Plant Ecology at Ghent University in Belgium.

Continuing the work in South Africa

After completing his PhD in September 2007, Dzikiti moved to the Department of Horticultural Science for a postdoctoral research position in June 2008. The position, which was a collaboration between SU and another Belgian University (Katholieke Universiteit, Leuven), focused on developing advanced plant-water relations monitoring techniques that integrate in situ and hyperspectral remote sensing technologies. In 2010, he moved to the Council for Scientific and Industrial Research (CSIR) as a senior researcher in the Hydro Sciences Research Group, under the mentorship of prominent South African scientist and hydrology expert, Dr Mark Gush, now with the Royal Horticultural Society in the UK.

There, he stepped into research aligned with his original motivation for switching to agriculture, working in areas that contribute to the country's economy.

As in many water-scarce countries, there is increasing competition among sectors of the South African economy for water resources. Irrigated agriculture, in particular, is under pressure to use water efficiently, as the sector is estimated to account for approximately 60% of available surface water. The fruit tree industry is highly dependent on irrigation (about 90%) and must improve water-use efficiency as water stress increases, without compromising fruit quality, size, yield and profits.

Over the years, the WRC, in collaboration with fruit industry

partners, has funded several research projects towards this goal. One Dzikiti stepped into: *The water use of selected fruit tree orchards*, a project led by Gush, introduced him to another career-defining partnership, this time with the WRC.

The start of a journey with the WRC

The project also introduced him to "the WRC way" of doing research. This entails, he explains, a practical approach to research, spending multiple days in the field collecting data – an approach he still practices. It also leans on reference group meetings, cementing his habit of working on projects that bring together sector experts, researchers, and stakeholders to guide, monitor, and evaluate ongoing work.

Already familiar with many quantitative techniques, including water use modelling, Gush now introduced Dzikiti to key ecophysiological and micrometeorological equipment, allowing him to move from estimating water use to actually measuring it.

These include the eddy covariance and surface renewal systems that permit measurement of evapotranspiration at the level of a whole orchard block, and the heat ratio sap flow methods for monitoring tree water use, which work at the level of the individual tree. Dzikiti could now validate and calibrate his models against real measurements rather than literature values and generate the site-specific water use figures that irrigation scheduling, water allocation and licensing decisions require.

For the first WRC project he led (from 2012 to 2014), Dzikiti used it to understand the actual water cost of the alien invasive species *Prosopis*, or mesquite. The tree was brought to the Northern Cape in the 1890s for wood, shade and fodder but, with taproots intruding as much as 70 metres down, it now chokes the region's riparian zones in dense thickets.

The study investigated how *Prosopis* invasions compete with indigenous deep-rooted tree species like the sweet thorn (*Vachelia karoo*), and quantified potential groundwater savings that could be obtained by clearing the invasions. Working in a heavily invaded catchment near Nieuwoudtville, a town that depends entirely on groundwater, the team compared *Prosopis* water use with that of the indigenous sweet thorn.

The difference was stark. Invaded stands transpired around



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Dr Sebinasi Dzikiti is a senior lecturer in the Horticultural Department of Stellenbosch University.



Dr Sebinasi Dzikiti with former colleague and mentor, Dr Mark Gush, now with the Royal Horticultural Society in the UK.

544 mm a year, against just 91 mm for the native trees. The study also showed that *Prosopis* lifts deep water into shallow soil, suppressing local plants and helping itself spread.

Dzikiti and colleagues recommended clearing sparse stands early, before they thicken into impenetrable, high-consumption thickets. Where invasions were removed, the water table's decline slowed, opening the way for the land to recover.

Back to the orchard

The next WRC project that Dzikiti led (co-funded with Hortgro Science) took him back to the orchards. Running from 2014 to 2018, the project set out to answer how, and if, a water-scarce country could afford its most productive apple orchards. At the time, some farmers were already pulling 120 to 140 tons of apples per hectare, well above the 80 to 90 tons that have long marked a profitable orchard. More fruit, however, meant more water. "Yes, we want high yields," Dzikiti notes, "but what if we didn't have the water for it the following year?" Dzikiti and his collaborators wanted to know where the limit lay.

Leading a team drawn from the CSIR, the Agricultural Research Council, and the universities of Pretoria and Stellenbosch, Dzikiti compared two cultivars: Golden Delicious and Cripps Pink, the latter sold as Pink Lady when it colours well. What surprised him was that crop load mattered far less than canopy size. It is the leaves, not the fruit, that drink the water.

Golden Delicious carries a dense canopy to shield its green fruit from sunburn, and used about a fifth more water than the open-canopied Pink Lady. Pink Lady, kept open so sunlight can trigger its pink pigments, used less water and earned close to double the income per cubic metre of water consumed. It was, on every measure that counted, the more sensible tree to grow.

His third project grew out of the first two. The volume of high-quality data from actual orchard water-use measurements was growing, and Gush wanted to consolidate it and add value. In essence, the idea was to develop a simple yet scientifically credible tool that runs on platforms easily accessible to farmers to help them plan irrigation in real time. They wanted to build a smartphone app to forecast how much water an orchard would need over the coming week. But when Gush left for the UK before the work began, the lead passed to Dzikiti.

The app pulls a weather forecast for the farmer's location and, with simple inputs from the farmer, calculates accurate crop coefficients (a forecast of a tree's actual water needs). "From the palm of your hand, if you click a few buttons," Dzikiti says, "you get a projection of how much water you are going to need between one and two weeks ahead."

Due to its success, the WRC has since funded a follow-up to extend the app to pears, nectarines, peaches, plums and cherries.

Award-winning work

But it was Dzikiti's next project that would become a global landmark. Initiated and funded by the Inkomati-Usuthu Water Management Area (IUWMA) and the WRC, it ran from October 2020 to March 2024. The IUWMA is a major producer of subtropical fruit such as mango, litchi, banana, avocado, macadamia and citrus. With water resources in the catchment almost fully allocated, little to no water is left for new developments. Yet some established growers hold far more water than they use.

"Because of historical imbalances, some farmers have more water than others," Dzikiti says, "so it's very difficult for new players to come on board who also need water." As such, allocation reform and the redistribution of that water, a promise written into the 1998 Water Act, could not take place. For these reforms to happen, the catchment required tools to ensure accurate and equitable redistribution of water. The aim of the resulting study was to develop a tool to estimate water requirements of key irrigated crops in any part of the IUWMA catchment.

The resulting Decision Support System (DSS) for monitoring orchard water use was developed using 50 years of daily climate data (1960 – 2010) in each of the more than 250 quaternary catchments in the IUWMA, together with scientifically validated crop coefficients. A grower clicks their spot on the map, loads their farm boundary, and enters a few plain facts about the orchard. Using the same crop-coefficient method as in earlier work, a reliable estimate of trees' water needs, yield, and efficiency is obtained.

A pioneering piece of work, the DSS won the international Watsave Innovative Water Management Award from the International Commission on Irrigation and Drainage (ICID) in 2025, which Dzikiti describes as a major honour, particularly because it validates the scientific depth of the work and its practical value. And he points out that, though it is a uniquely Inkomati product, it can travel if researchers elsewhere adapt it to their own environment.

The measure of success

The recognition that means most to him, though, is not for a tool. Asked about his most important achievements, Dzikiti immediately reaches for a glass, drop-shaped trophy on his desk. It is a WRC Knowledge Tree Award, bestowed on him in 2021 for his work to build people rather than products, in Dzikiti's case with researchers at universities short of resources, among them the University of the Western Cape, Zululand, and Venda.

"Quite a number of students and staff have benefited from our interactions," he says with clear pride. "It shows I've made a contribution in terms of capacity building here in this country."

The work continues

His most recent WRC project, co-funded by Hortgro, saw the team turn to pears. Investigating the green Packham's Triumph and the blushed Forelle, the team examined how a growing region's climate shapes an orchard's water use and yields. They built a model that splits an orchard's water loss between the trees and the ground, then ran it forward under hotter, drier conditions in the Western Cape. Earlier studies had warned that

orchard water use might climb by as much as 18% by mid-century. His model puts the rise far lower, around 6 or 7%, and only by the end of the century.

The difference comes down to the trees themselves. As the air grows thirstier, they close their pores and hold on to water, a reflex the older forecasts had left out. What drives most of the extra demand is not the trees at all but bare, evaporating soil, exactly the loss a grower can cut with mulch, drip lines and narrower sprinklers.

That a study finished in 2026 could still be sharpening answers first asked of apples a decade earlier owes much to one funder. The WRC, Dzikiti says, gave him something rare in research: the room to follow a thread across many projects rather than dropping it when a contract ended.

"We have been able," he says, "to follow up on ideas that would have otherwise been left hanging out there." Instead, each project grew out of the one before it, staying close to on-the-ground needs from the industry partners and farmers who ultimately use the results.

"It's only through consistency that you achieve significant milestones in life," he says. For him, the real measure of success will be impact. By the time he retires, he says, he hopes to leave behind tools "with my name stamped on it" that farmers and water managers routinely rely on to make better decisions in a waterscarce world. Inspired by the South African stalwarts who developed models like SAPWAT (South African Plant Water) and SWB (Soil Water Balance model) that have become industry standards, Dzikiti's ambition is quietly resolute: to keep doing the science, building the tools, and working with the right people, consistently, until his own contributions are as firmly rooted in the country's orchards and catchments as the trees he has spent his career helping to sustain.

To read more about Sebinasi Dzikiti's research, visit: <https://scholar.google.com/citations?user=Z1B6eV4AAAAJ&hl=en>



In 2025, Dzikiti won the international Watsave Innovative Water Management Award from the International Commission on Irrigation and Drainage (ICID). Handing over the award is ICID President, Dr Marco Arcieri.