

NICKY TAYLOR

Making every drop count: the scientist helping South African farmers use water smarter

For Dr Nicky Taylor, understanding how plants use water is as much about getting her hands dirty as it is about sophisticated science. After decades working at the intersection of agriculture, plant physiology and water research, she is equally passionate about the next generation of researchers who will carry the work forward.

Article by Kim Trollip.

Taylor did not set out to become a water researcher. Her route into the field was shaped by a love of plants, a fascination with how things work and, ultimately, a chance encounter with a mentor who changed the direction of her career. If you had asked Taylor in her twenties where she expected to end up, the answer would probably have been plant physiology. Her Master's and PhD research at the University of KwaZulu-Natal focused on avocados and the mechanisms controlling fruit growth. She enjoyed understanding what was happening inside a plant and, importantly, why.

Then came a job advertisement, a trip to Pretoria and a Sunday lunch that changed the course of her career.

A few years ago, Taylor applied for a position at the University of Pretoria and travelled there for the interview. John Annandale, a professor involved in irrigation and water research, needed someone with a plant background for a water project. During the interview process, Annandale and his wife took her to lunch. He subsequently arranged for her to attend a water course in Pietermaritzburg.

Before she quite realised what was happening, Taylor had been drawn into agricultural water research. "It really was chance. And serendipity," she recalls.

She has never regretted it.

Today, Taylor is a Senior Lecturer in the University of Pretoria's Department of Plant and Soil Sciences. Her research focuses on measuring and modelling the water use of fruit trees, using field measurements and plant physiological techniques to understand how trees respond to their environment. Her work has included pecans, macadamias, apples, citrus and avocados.

Agricultural water-use research is a relatively small community,



Dr Nicky Taylor is a senior lecturer in Plant Production and Soil Science at the University of Pretoria.

says Taylor, and that has been one of the things she has enjoyed about the field. Researchers work together, share ideas and challenge one another's thinking.

Over the years, she has been fortunate to work alongside and learn from a number of people who have influenced her own approach. Soil scientist Prof Keith Bristow, who later moved to Australia but remained connected to the department, was an inspiration – highly intelligent, but also someone Taylor admired for his sense of social responsibility. Agricultural scientist and irrigation/water researcher Dr Richard Stirzaker introduced her to practical irrigation tools, while hydrometeorologist Prof Colin Everson remains someone she says she “still can’t keep up with”.

She also points to the contribution of women working in the field, including agricultural and climate-change researcher Prof Stephanie Midgley in the Western Cape and agrometeorologist researcher Dr Caren Jarman. Agricultural water research can be physically demanding, particularly when it involves long days of fieldwork, and Taylor has seen the field gradually become more diverse.

A curiosity about how things work

Taylor's interest in plants began long before her career in research. Growing up in Pietermaritzburg, she was surrounded by plants. Her father was an enthusiastic gardener and family holidays were often spent outdoors in the nearby Drakensberg. Her childhood passion, however, was sport.

“I was just sport mad,” she says. “Anything that involved a ball and involved chasing a ball like a small Jack Russell was me.”

At school, science, history and geography captured her attention far more than accounting. A Grade 10 project on plants sparked a particular interest in botany and in the mechanisms behind how plants work.

There were other interests she never had the opportunity to explore. At the all-girls school she attended at the time, practical subjects such as woodwork and electronics were not available.

Instead, she had needlework.

She laughs about it now, but Taylor has always been drawn to figuring things out. “I like the mechanisms,” she explains. “I quite enjoyed being a bit of an electrician.”

Working with sap-flow measurements, evapotranspiration, instruments and data loggers allowed her to investigate plant water use in the field and understand the processes behind the numbers. The transition also taught her the value of a good mentor. Annandale introduced her to projects, networks and opportunities that helped establish her career. Taylor believes young academics can struggle to find their way into research projects and funding while they are still finding their feet.

A good mentor can make all the difference.

“Sometimes as scientists, we think we know best and we really don’t,” she says.

“We need to find what they [farmers] need, and how we can then communicate it or adapt what we’re doing to make it a little bit more applicable to them.”

From measurements to decisions

At the heart of Taylor's research are deceptively simple questions: how much water does a crop need, how much land can a grower plant with the water available, and how much water should be applied at a particular time?

Answering them requires careful measurement and an

understanding of the many factors affecting a tree's water use. Taylor's work examines transpiration, soil evaporation, canopy size and weather, and uses models to estimate water requirements across orchards.

For growers, the answers have real financial and operational consequences. They are also becoming more important as South Africa faces increasing competition for a limited water resource.

Climate change adds another layer of uncertainty. Taylor is interested in what hotter and drier conditions will mean for crops but cautions against assuming that plant water use simply rises in a straight line as temperatures increase. "The relationship is not linear," she explains. That complexity is precisely why good measurements matter.

Her pecan research illustrates the point. Working across three contrasting production environments, the research team built detailed datasets on orchard water use and tested their approaches under different conditions. The work also challenged the perception that pecans are exceptionally thirsty crops.

"We got really nice water data sets from three slightly contrasting environments," she says. "Our pecans are seen as using so much water, and then to actually have data to say, well, actually, it's not that bad."

For Taylor, the value of research lies partly in being able to replace assumptions with evidence. But producing the evidence is only part of the job.

Taking science into the orchard

For Taylor, research has to reach the people who can use it. She has shared her findings through grower associations, research days, orchard visits and water-management courses. These interactions are also opportunities to listen.

"Sometimes as scientists, we think we know best and we really don't," she says. "We need to find what they [farmers] need, and how we can then communicate it or adapt what we're doing to make it a little bit more applicable to them."

That exchange matters because farmers are making decisions in a much bigger context than irrigation alone. Water has to be managed alongside marketing, spraying, fertilisation, labour, finances, electricity disruptions and rising fuel costs.

Taylor's relationship with the Water Research Commission has been important in supporting this work. She credits the commission's long-standing support, often in partnership with grower associations, with providing reliable funding for research and students.

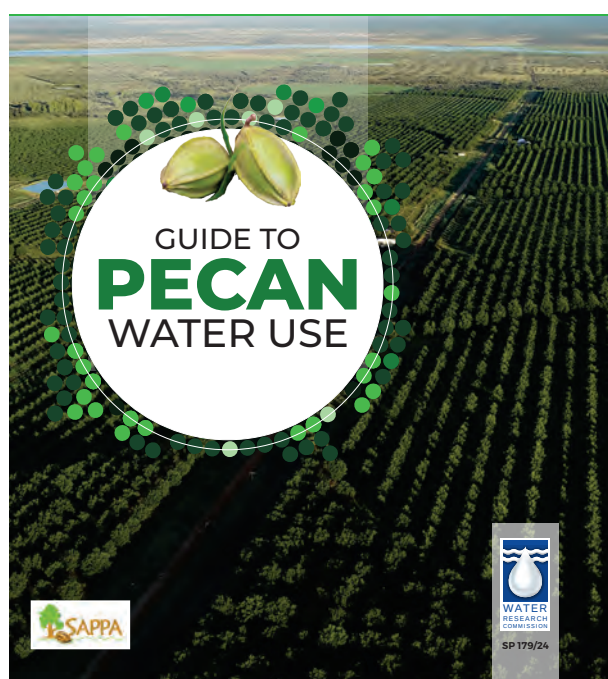
For Taylor, translating research into something useful is an essential part of the work. The same philosophy carries into her teaching. Taylor describes mentoring students as the most rewarding part of her job. She wants young researchers to become excited about agriculture and science and takes seriously the responsibility of giving them the kind of support she received early in her own career.

She also believes in leading from the front. When students are working in the field, Taylor works alongside them. If there is a difficult or unpleasant job to be done, she is prepared to get stuck in. There are long days, mud, troubleshooting, humour and music.

Seeing former students later in their careers, sometimes encountering them again at farmer days, is particularly rewarding. It is a reminder that the impact of research can extend beyond the research itself.

The water questions ahead

Taylor sees considerable challenges ahead for agriculture.



Taylor's research on pecan water use has combined detailed field measurements with modelling to build a better understanding of how much water orchards need, and how those requirements vary between regions and seasons. The work has provided growers with evidence to support irrigation planning and more productive use of water – an increasingly important consideration for an industry largely located in South Africa's semi-arid regions. Her work has resulted in products such as the WRC published Guide to pecan water use, which has become a popular guide among pecan nut growers.



Taylor's work often involves the installation of specialist equipment – potentially dangerous work.

Climate change, a drying climate, population growth and increasing competition for water will place growing pressure on farmers to use water efficiently. Domestic water needs will increasingly compete with agricultural demands, while growers will have to produce food under increasingly uncertain conditions.

Yet she believes South Africa has a strong foundation of irrigation expertise and agricultural water research on which to build.

Technology will increasingly form part of that picture. Satellite and spatial tools can help researchers and growers identify stressed areas within orchards, assess uniformity and even identify potential irrigation problems such as leaks or blocked equipment.

Artificial intelligence has a role too, particularly in programming, analysing information and handling large amounts of material.

But Taylor is wary of allowing technology to replace curiosity and judgement. "You still need to think a lot." It is a characteristically direct observation from someone whose career has been built around asking questions, testing assumptions and figuring out how things work.

For young people considering a career in agriculture, water research or related fields, her advice is equally straightforward: find what excites you. Be curious. Pay attention to detail. Keep learning. Agriculture, she points out, has room for people with many different interests and skills. There are opportunities across fields ranging from genetics and microbiology to water science, and she has seen the sector become more diverse over the course of her career.

Her own path is perhaps the clearest illustration of where

curiosity can lead. A childhood fascination with plants became a career in plant physiology; a chance meeting over Sunday lunch opened a door into water research. And the questions have kept coming. "There's no replacement for water," she says. "So there's always going to be a role for water scientists."

For someone who was always interested in understanding how things work, there is perhaps no better reason to keep looking. There is always another question to ask, another problem to solve, and another generation of researchers to bring along.



To read more on Nicky Taylor's research, visit: <https://orcid.org/0000-0002-2912-4416>



Aerial view of the 18-year-old mixed cultivar pecan orchard on the banks of the Orange River between Groblershoop and Grootdrink, which for a while served as Taylor's study area.