

The Pro-Hort Ecophysiology Platform

A new Hortgro-funded initiative will extract more value from existing research investment. By Anna Mouton



South Africa has been called a world in one country, partly thanks to our diverse natural environment. This might be great for tourists but poses a challenge to pome- and stone-fruit growers – how do they choose the best cultivars for a site? And how do they best manage their trees?

Answering these questions requires an understanding of ecophysiology – the interactions between trees and their environment – that we often lack.

In apples, for example, we know that winter chill is central to everything from tree architecture to mixed fruit maturities. But in practice, we struggle with the optimal timing of rest-breaking treatments.

We also have a lot still to learn about the effects of seasonal temperature patterns on tree performance, flower quality and fruit size.

These challenges are compounded by climate change. Growers can no longer make assumptions about future tree behaviour based on past tree behaviour – the effects of new climatic conditions are too unpredictable.

Understanding the drivers of tree phenology would support better predictions about, for example, the effects of later or milder winters. It could also make it easier to evaluate and select cultivars.

Although comparing different cultivars grown on the same and different sites can reveal a lot about tree behaviour, suitable

orchards are seldom available to researchers. But as Prof Wiehann Steyn, general manager of Hortgro Science, recognised, Hortgro already has the ideal setup for ecophysiological studies.

The initial vision

In 2018 Hortgro launched the Pro-Hort programme in partnership with independent cultivar-evaluation company Provar. The aim was to assess new pome- and stone-fruit cultivars in different regions and provide growers with unbiased results.

Under this programme, Hortgro funds a certain number of cultivar evaluations every year while Provar conducts the evaluations and manages the programme. Cultivar



Dr Iwan Labuschagne from Provar at Klipboschlaagte

owners can screen and evaluate cultivars at the Pro-Hort sites on a user-pay basis.

Nine of the 11 Pro-Hort sites are in the Western Cape. They range from Klipboschlaagte, average 580 Utah chill units, near Ashton to Nootgedacht, average 1800 Utah chill units, in the Koue Bokkeveld. This environmental variability allows for thoroughly evaluating different pome- and stone-fruit cultivars.

The different sites also offer attractive research opportunities, and trials were soon established, starting with a Hortgro-funded adaptability project initiated and led by Dr Iwan Labuschagne of Provar. Dr Esmé Louw from the Department of Horticultural Science at Stellenbosch University is the academic head of the project, while Dr Nigel Cook of ProPhyta assists with conceptualising the project and provides technical horticultural advice.

Trees of 10 apple cultivars spanning a broad range of chill requirements were planted at Oak Valley in Elgin, Klipboschlaagte, and Nootgedacht. Trees of 10 plum cultivars representing different flowering times were planted at Boland Agricultural High School near Paarl, Klipboschlaagte, and Nootgedacht.

Pear cultivars were added to the project in 2022.

All trees of a fruit type were planted on the same rootstock and are trained and managed in the same way. On each site, half the trees of each cultivar receive a rest-breaking application, and half do not.

The purpose of the adaptability project is not to evaluate new or reassess old cultivars. Instead, the aim is to gather as much data as possible on tree behaviour – everything from bud-break and full-bloom dates to fruit sizes and yields – and identify predictors of tree performance in a given environment.

If certain measures correlate with success in a specific region, the cultivar-evaluation process could be condensed, enabling growers to establish – or reject – new cultivars sooner.



Die nuwe Pro-Hort Ekofisiologie Platform

Hortgro het in 2018 die Pro-Hort program in samewerking met Provar geloods om persele te skep vir die evaluasie van nuwe steen- en kernvrugkultivars. Daar is ook bome van 10 appel- en 10 pruimkultivars op drie persele elk geplant as deel van 'n aanpasbaarheidsprojek wat deur Dr Iwan Labuschagne van Provar geïnisieer is. Intussen is pere ook aangeplant.

Dr Esmé Louw van Universiteit Stellenbosch en Dr Nigel Cook van ProPhyta is medewerkers op die aanpasbaarheidsprojek.

Sedertdien het Prof. Wiehann Steyn van Hortgro die potensiaal gesien om die aanpasbaarheidsprojek se bome vir ander navorsingsprojekte aan te wend. Die bome sal dus in die Pro-Hort Ekofisiologie Platform omskep word. Navorsers wat die verhouding tussen vrugtebome en hul omgewing wil ondersoek sal kan aansoek doen om die platform, wat steeds deur Provar bestuur sal word, te gebruik.

The adaptability project has the additional benefit of exposing the next generation of horticulturists to fieldwork. Eight MSc students based at Provar, under the academic supervision of Louw, collect data at the Pro-Hort sites.

Although the first apples and plums have been harvested from the adaptability-project trees, trials still have several years to go. Meanwhile, researchers began seeing untapped potential in their study subjects.

A bigger picture

In 2019, Louw began leading another Hortgro-funded project in collaboration with Labuschagne and Provar to create a temperature-phenophase database while utilising the same trees established for the adaptability project.

The database includes measures of bud break and the dates of onset of growth, first flower, full bloom, and end of bloom, from which parameters such as the duration and extent of bud break, and the early, late, and total bloom periods are calculated. Added to this are temperature data – all the trial sites are equipped with loggers.

Different chill models will be applied to the temperature data to see how well their predictions match the actual behaviour of the trees.

The Pro-Hort site at Klipboschlaagte

project a fantastic resource.


Hence the birth of the Pro-Hort Ecophysiology Platform. Researchers can now apply to use the existing trees for new projects. A steering committee of Prof Wiehann Steyn of Hortgro Science, Louw and Labuschagne will screen proposals to ensure they are a good match for the platform and compatible with existing projects. The platform will continue to be managed by Provar.

Projects cleared by the steering committee will then go through the normal Hortgro application processes.

Examples of potential projects include investigating the effect of climate on blossom quality, fruit size and quality, and fruit storability. International researchers have already expressed an interest in coming to SA to work on the platform, studying questions such as how different cultivars handle heat stress and sunburn.

Labuschagne plans to add a special module to the Provar app, Culteva, to facilitate collecting and managing the masses of data generated by projects on the platform. In the long term, this will build up a databank that can help answer future research questions.

Ecophysiologicalists like to talk about $G + E = P$ – it means that the interaction between genes and environment explains phenotype or observable characteristics. But the P could equally stand for profits, which is why ecophysiology is vital to the deciduous-fruit industry.

By advancing our knowledge of the $G + E$ part of the ecophysiology equation, the Pro-Hort Ecophysiology Platform will help us predict and manage trees and support growers in achieving sustainable profitability. 

We already know that existing chill models struggle in regions with warmer winters, like many South African fruit-growing areas. But until now, researchers lacked the data to compare model performance in different cultivars and fruit types growing under various environmental conditions.

The same can be said for many other ecophysiological questions – researchers need standardised trees growing in different climates to tease out environmental effects on tree behaviour, making the trees originally established for the adaptability

