

subtrop JOURNAL

your doorway to the subtropical industry

FIRST EDITION 2026

VOLUME 45



● Litchi: Top-grafting techniques



● Mango: Flush control and protection



● Avocado: ASBVd in orchards



For the Love of Avos



Tutor 500 SC

Pre-harvest application
FRAC: 9 & 12
Application rate:
• 150 mL/100 L
• First application at blossom
• 14 to 21-day intervals
Withholding period:
180 days
Disease:
Anthracnose



CopperKill SC

Pre-harvest application
FRAC: M01
Application rate:
• 180 mL/100 L to a max of 12 L/ha
• 3 full cover applications every 4 weeks
Withholding period:
14 days
Disease:
Fruit spot



Obstructo 250 SC

Pre-harvest application
FRAC: 11
Application rate:
• 30 mL/100 L
• 2 consecutive sprays 28 days apart
Withholding period:
28 days
Disease:
Cercospora spot
Dothiorella fruit rot
Anthracnose



Marksman 240 SC

Pre-harvest application
IRAC: 18
Application rate:
• 60 mL/100 L
Withholding period:
30 days
Pest:
False codling moth



NaturaFend 550 SP

Pre-harvest application
FRAC: NC
Application rate:
• 180 g/100 L
Withholding period:
0 days
Disease:
Anthracnose



SunFlo 800 SC

Pre-harvest application
IRAC: UN
Application rate:
• 3.0 - 4.5 L/ha
Pest:
Thrips



ICA Thiabendazole 500 SC

Postharvest application
FRAC: 1
Application:
• Dip/Drench
• Spray on
• Fruit coating
Disease:
Anthracnose
Stem-end rot



Teacher 230 SC

Postharvest application
FRAC: 12
Application:
• Dip/Drench
• Spray on
Disease:
Anthracnose



HyperCide

Postharvest application
FRAC: NC
Application rate:
• 100 mL/100 L
Disease:
Anthracnose infections due to contaminated wash and treatment water.

PRODUCTS TO KEEP AVOCADO YIELD IN TIP-TOP SHAPE

Copperkill SC (copper hydroxide 538 g/L) Reg. No. L10999 (Act 36/1947) Danger. H302, H318, H332, H410. **HyperCide** (peracetic acid 145 g/L & hydrogen peroxide 228 g/L) Reg. No. L11483 (Act 36/1947) NRCS Reg. No. NRCS/8054/243642/532 (Act 5/2008) Danger. H242, H303, H312, H314, H332, H335, H400. **ICA Thiabendazole 500 SC** (thiabendazole 500 g/L) Reg. No. L7784 (Act 36/1947) Warning. H303, H313, H410. **Marksman 240 SC** (methoxyfenozide 240 g/L) Reg. No. L10389 (Act 36/1947) Warning. H303, H313, H316, H317, H320, H332, H410. **NaturaFend 550 SP** (L-phenylalanine) Reg. No. L11632 (Act 36/1947) H410. **Obstructo 250 SC** (azoxystrobin 250 g/L) Reg. No. L9323 (Act 36/1947) Warning. H332, H317, H410. **SunFlo 800 SC** (sulphur 800 g/L) Reg. No. L11000 (Act 36/1947) Warning. H315, H320. **Teacher 230 SC** (fludioxonil 230 g/L) Reg. No. L9919 (Act 36/1947) Warning. H317, H410. **Tutor 500 SC** (pyrimethanil 400 g/L & fludioxonil 100 g/L) Reg. No. L9948 (Act 36/1947) Warning. H303, H313, H332, H410. **Hazard phrases:** H242 Heating may cause fire, H302 Harmful if swallowed, H303 May be harmful if swallowed, H312 Harmful in contact with skin, H313 May be harmful in contact with skin, H314 Causes severe skin burns and eye damage, H315 Causes skin irritation, H316 Causes mild skin irritation, H317 May cause an allergic skin reaction, H318 Causes serious eye damage, H320 Causes eye irritation, H332 Harmful if inhaled, H335 May cause respiratory irritation, H400 Very toxic to aquatic life, H401 Toxic to aquatic life, H410 Very toxic to aquatic life with long lasting effects.

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There is a lot of marketing underway, some that we are aware of and others not. Think of word-of-mouth marketing as well as marketing over social media. If a consumer or an influencer promotes a commodity, where did they source it? When a food influencer promotes a recipe featuring avocados, mangoes, or litchis, where did they source the fruit? The fruit obviously originated from a retailer, but which one? Which packhouse, directly or indirectly, supplied that retailer? And finally, which farm supplied that packhouse? When you participate in the value chain, putting fruit onto a market signals that you want business, and a customer wants yours to be a successful business supplying a quality product..

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IMPORTANT DATES



- | | |
|---------------------------|--|
| 12 February 2026 | SAAGA Research Symposium, Tzaneen |
| 21 May 2026 | Subtrop Transformation Summit |
| 11 June 2026 | SALGA Research Symposium |
| 6-9 September 2027 | World Avocado Congress 2027, Cape Town |

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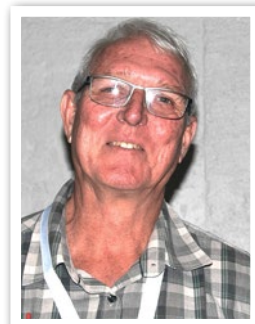
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SALGA

Chairman's Report

2025



**Bram Snijder, SALGA
Chairperson**

In 2022 I made the comment, based on our production figures, that the litchi industry was in an upward trend, and prospects were looking good for that season. Looking at the latest set of figures the opposite is to be seen, where the last two seasons were below average, with last year the worst harvesting season in the past 25 years.

Those seasons made a big dent in all our finances, including SALGA's. As a very small industry, this type of year hits hard on our financial situation and some serious thought went into the budget in the last two years. Currently, the situation is looking much better and the prediction is that we will have an average to above-average year.

The question everyone is secretly asking is if this will be the beginning of an upward trend again. Unfortunately, we can discuss this at length, but we have learned in the past few years that the climatic conditions during flower initiation and fruit development are very strong overriding factors which we do not understand yet.

From Graph 1 it can be seen that the industry does have these low yield years from time to time, and recovers with some good years again. This year it is estimated that we should recover to just below the 25-year average. To stabilise the industry as a whole, it is important that we grow our industry with new plantings to soften blows like this past season and keep our commitment to research and Subtrop sound and safe.

The positive side of these two bad years was that we had intense looks inward to review our policies regarding finances. It was decided at Board level that we should increase our reserve fund policies. The intention is to double our reserve fund within the next 3 to 4 years to ensure that the organisation can withstand bad production seasons again. We still have additional reserves in the bank that could finance the

past financial year, but one cannot rely on this for too long.

Another positive outcome from last season was that the EU market in general was undersupplied and prices received were good. The USA market also performed well, and a large portion of our crop was focussed there. This coming season we are expecting to grow this market even further. The tariffs that President Donald Trump of America imposed on all imports in April 2025 were lifted, which bodes well going forward.

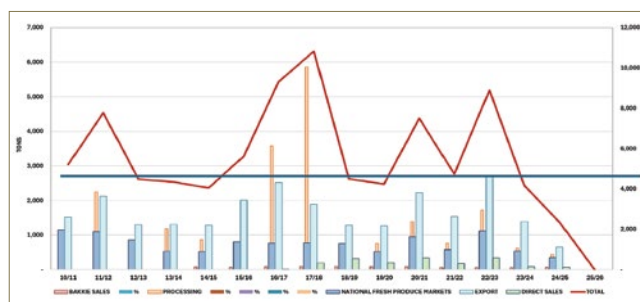
On the Indian market access side, things are still quiet. We are still waiting for the final protocols to export to that market. Hopefully they wake up soon and send us the protocols so that we can prepare ourselves for exporting, giving opportunity to expand our industry to a next level of production.

For that reason, the Board has decided to focus our research efforts on increasing production and improving fruit quality to be able to grow enough volumes for those markets. We are awaiting project proposals to start this research after this harvesting season. Other priorities are post-harvest work on sulphur treatments to improve on our practices lowering the risk of MRL issues as recently experienced.

We are also commissioning post-harvest work on the new cultivars which are showing good potential in the industry for higher and more constant yield and fruit quality. This could stretch our season further, opening new opportunities in the USA and possibly India. Cooperation with China might also give us other opportunities around production of new cultivars destined for the Chinese New Year.

On the transformation side, a partnership with Nedbank is moving the upliftment of a few litchi growers in the Vhembe district to the next level (See page 7). Together with Subtrop staff, these growers are getting themselves ready for their first GlobalGAP audit so they can also enter the international arena and show their fellow farmers what can be achieved when marketing internationally.

From an administration point of view; Johan Benadé, Derek Donkin, and the team have the finances and administration of our organisation under control. Being a non-profit



Graph 1. Litchi production 2010 – 2026.



LEGAL MATTERS:

Xander Levendal



Four months for all

On 3 October 2025 the Constitutional Court declared Sections 25, 25A, 25B, and 25C of the Basic Conditions of Employment Act 75 of 1997 (BCEA) unconstitutional. These sections govern maternity, parental, adoption, and commissioning parental leave.

Xander Levendal

LWO EMPLOYERS ORGANISATION

PREVIOUSLY

Before this landmark judgment, the BCEA provided for differentiated leave entitlements based on the role of the parent. Specifically:

- Section 25 granted a birth mother at least four consecutive months of unpaid maternity leave, typically starting one month before the expected due date.
- Section 25A allowed ten days of unpaid parental leave to the father or non-birth parent, to be taken for the first ten days after the child's birth or adoption.
- Section 25B provided for unpaid adoption leave of ten weeks to one adoptive parent, while the other adoptive parent would only qualify for parental leave in terms of section 25A.
- Section 25C provided a similar framework of unpaid commissioning parental leave for commissioning parents in a surrogate motherhood agreement, allowing one parent 10 weeks of unpaid leave whereas the other would qualify for parental leave in terms of Section 25A.

The Judgement: *Van Wyk and Others v Minister of Employment and Labour; Commission for Gender Equality and Another v Minister of Employment and Labour and Others* [2025] ZACC 20.

The Constitutional Court has recognised that South Africa's parental leave laws were unfair to many families and found that the sections dealing with maternity, parental, adoption,

and commissioning parental leave were unconstitutional because they failed to treat all parents equally and with dignity.

Importantly, the Court affirmed that all parents, whether through birth, adoption, or surrogacy should be free to decide together how to share the responsibilities of raising their child. Laws that prevent families from making those choices without any legitimate reason not only discriminate but also intrude on their personal/family lives, which unnecessarily impacts their human dignity.

THE NEW 'LAW'

Parliament received 36 months to enact remedial legislation addressing the unconstitutionality of these sections and until then the court has given an interim reading-in of amendments to the BCEA to cure the inequality in parental leave summarised as follows:

Parental leave

- Single parents or the only employed parent: at least 4 consecutive months parental leave.
- If both parents are employed: a combined entitlement of 4 months and 10 days, taken concurrently or consecutively as agreed.
- If no agreement: leave is split equally as far as possible, starting from the child's birth, provided that female employees who are giving birth to the child may begin leave from four weeks before birth, or earlier if medically required, and may not return to work for six weeks after birth, unless certified fit by a medical practitioner.

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SALGA Chairman's Report 2025

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company (NPC) now, SALGA is off to a good start and this bodes well for the future. We welcomed all the new directors last year and we can already see that new blood gives new opportunities to relook our business. Although we had to tighten the belt, we still have some excess reserves in the bank, and building onto this will give us more leverage to do ad hoc work when needed.

The Subtrop staff component are all committed to their

various industries and showing good spirit even during difficult times.

In closing, I would like to wish all our growers a prosperous season under the blessing hands of God our Father. May He bless our season and our families. ✨

Bram Snijder,
SALGA Chairperson



Subtrop Marketing Symposium White River November 2025





Legal Matters: Four months for all

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Adoption leave

- A single or only employed adoptive parent of a child under 2 years: 4 months adoption leave.
- If an adoption order is made in respect of two adoptive parents, both parties are entitled in the aggregate to 4 months and 10 days, taken in any agreed manner (concurrently, consecutively, or a mix).
- If no agreement: adoption leave is apportioned as near as possible to half each, provided that such balance is completed within a period of four months from the adoption of the child.
- Leave may start on the date that the adoption order is granted or placement by a competent court pending the finalisation of adoption, whichever is earlier.

Commissioning parental leave

- Starts from the date a child is born as a result of a surrogate motherhood agreement.
- A single commissioning parent in a surrogate motherhood agreement: 4 months commissioning parental leave.
- Two commissioning parents: they shall each be entitled in the aggregate to 4 months and 10 days combined, taken as agreed including concurrently or consecutively, or partly concurrently and partly consecutively, and if no agreement

then the leave is apportioned equally, provided that such balance is completed within a period of 4 months of the child's birth.

Employers should obtain advice and update internal policies and practices to remain compliant. ♦

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Market access update



... it's exactly what the President said, competition is essential. Competition is essential otherwise you unravel to the lowest common denominator. If you've got competition, you have an incentive to do better. – Helen Zille

... our farmers and farm workers in this country are the best in the world. And wherever I travel overseas, they are hugely well regarded. Think about this for a second. We are competing on international markets and we're shooting the lights out with our citrus, with our fruits, with our wines in a completely unsubsidised market. And we're competing against heavily subsidised agricultural economies like South America and Europe, and yet our products are consistently shooting the lights out and it's a testament to those in the agri space here in South Africa who do it. But if we want to grow the sector, we have to find those overseas markets. – John Steenhuisen

James Mehl
SUBTROP

A carton of fruit from a farm that lands in a market may be up for sale, but it usually has to compete with other cartons. Some of those cartons may be from other farms in South Africa, or they may be cartons from other countries supplying the same commodity to that market. As such, appearance and internal quality play key roles in ensuring a consumer will buy that carton and then buy cartons from either the same farm or from the same country.

The above may seem obvious, but it bears remembering that a consumer does not just buy fruit from a farm, the consumer buys fruit from a country, and so ensuring that Brand South Africa delivers exceptional fruit is important. Especially if the carton is from an export consignment, the consumer expects the very best on offer.

Market access is based around the GRO principle – **g**aining, **r**etaining, and **o**ptimising access for a commodity. Now that all three of our commodity organisations – SAAGA, SAMGA, and SALGA – have gained access to at least one special market¹, the focus must shift to optimising access. Optimising involves whatever Subtrop can do to facilitate and ease access.

Examples of this include recent proposals for a Systems Approach for avocado access to China and Japan as alternatives to existing mitigation measures or following up on progress with applications or trade agreements that are being negotiated. However, optimising also means that the industry must focus on quality to differentiate ourselves (South African avocados, mangoes, or litchis) from other supplying countries.

There is a lot of marketing underway, some that we are aware of and others not. Think of word-of-mouth marketing as well as marketing over social media. If a consumer or an

influencer promotes a commodity, where did they source it? When a food influencer promotes a recipe featuring avocados, mangoes, or litchis, where did they source the fruit? The fruit obviously originated from a retailer, but which one? Which packhouse, directly or indirectly, supplied that retailer? And finally, which farm supplied that packhouse? When you participate in the value chain, putting fruit onto a market signals that you want business, and a customer wants yours to be a successful business supplying a quality product.

AVOCADOS

USA: Comments on the draft Pest Risk Assessment (PRA) were submitted in June 2023. After finalising the PRA, the USDA-APHIS² will consider the proposed Systems Approach. The technical bilateral meeting between the DOA and USDA-APHIS was postponed. The DOA continue to follow up with the USDA-APHIS on this and the other two applications noted below.

Other markets: Applications have also been submitted for access into Taiwan, South Korea, Vietnam, Thailand, Israel, Mexico, and Pakistan. Information on the progress of these applications is available to our members upon request and in the avocado app. We have also submitted proposals for a Systems Approach into China and Japan as potential alternatives to fumigation and the cold treatment, respectively.

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¹ A special market requires one or more mitigation measures (cold treatment, fumigation, irradiation, etc.) to reduce the risk of a pest accessing the destination country and establishing there.

² USDA-APHIS – United States Department of Agriculture Animal and Plant Health Inspection Service



Subtrop and Nedbank partnership opens new pathways for growers

Subtrop and Nedbank formalised a partnership that will assist ten emerging avocado and litchi growers to become export-ready in 2026. An agreement was signed in September 2025 and marks a practical milestone for these farmers. It also represents something much larger for the industry: a decisive step toward transforming market participation and ensuring long-term sector sustainability.

Stephen Mantsho
SUBTROP

The initiative aligns closely with Subtrop's transformation strategy, which focuses on building skills, enhancing market access, strengthening grower support structures, and enabling a fully inclusive industry. For emerging growers, especially those from previously disadvantaged backgrounds, the partnership offers a gateway into an export environment that has historically been difficult to access.

Transformation through skills and technical capacity

A central element of Subtrop's transformation agenda is the enablement of technical knowledge and farm production skills. Through this partnership, growers will receive targeted support to obtain GlobalGAP certification, a key requirement for international trade.

Training will include operational planning, compliance management, record-keeping, food safety, financial literacy, orchard

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Market access update

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MANGOES

USA: Comments on a draft work plan were sent to the USDA-APHIS in July 2023.

China: Access for SA cherries and SA blueberries are to be granted before the application for SA mangoes can be processed.

Japan: Extended access for SA table grapes (the Crimson Seedless variety – current access into Japan only allows for imports of the Barlinka variety) and SA citrus need to be finalised before the PRA for SA mangoes can be processed. A Systems Approach proposal to mitigate against the risk of mango seed weevil being present in consignments, will be submitted once additional research has been done.

Other markets: Applications for access into Vietnam and Thailand have also been submitted.



LITCHIS

USA: Two cold treatments are under consideration here, and feedback from the USDA-APHIS is pending on both:

- A protocol for trial work supporting the initial cold treatment (1 °C for 19 days) and addressing the concerns of the USDA-APHIS, was sent mid-October 2021.
- The alternative cold treatment (-0.55 °C for 22 days – T-107e): while the USDA-APHIS have accepted the proposal to use this treatment, they confirmed in the bilateral end-October 2022 that they are still reviewing the Quarantine Pest List to decide if additional mitigation treatments will be needed.

India: A response is pending from the MAFW³ on proposed mitigation treatments and associated facilities.

China: The PIP for SA litchis has been submitted.

Other markets: Applications for access into South Korea and Vietnam have also been submitted. ♦

³ MAFW – Indian Ministry of Agriculture and Farmers Welfare



Subtrop and Nedbank partnership opens new pathways for growers

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management, and best practice production techniques.

These skills not only prepare farmers for audits but also strengthen farm productivity, build long-term sustainability, and create a foundation for commercial success. As one project facilitator noted, "certification opens the door, but knowledge keeps it open". This programme aims to achieve both.

Opening and enabling sustainable markets

Market access remains one of the greatest barriers for black growers across South Africa. Without strong entry points, emerging farmers often remain confined to local informal markets or face major price disadvantages.

The Subtrop-Nedbank initiative directly addresses this by:

- creating structured pathways into formal domestic markets,
- preparing growers for high-value international markets, and
- strengthening relationships with buyers who demand certified, traceable, ethically produced fruit.

Countries in Europe and Asia are showing growing interest in South African avocados and litchis. By equipping emerging growers to meet export standards, the programme ensures they can tap into these opportunities on competitive terms.

A stronger local market also remains essential. Increased local consumption provides the industry with a buffer and an alternative when export markets face constraints, strengthening resilience across the value chain.

Strengthening study groups and grower support structures

Subtrop has long used operational study groups as a tool to support knowledge-sharing among growers. These groups allow farmers to compare production methods, tackle challenges collectively, and learn directly from technical specialists.

Under the new partnership, these study groups will be enhanced with:

- certification-focused training sessions,
- compliance mentorship,
- business management workshops, and
- networking opportunities with industry experts and market players.

This strengthens the peer-to-peer ecosystem that emerging farmers rely on for support, helping them transition from survival farming to sustainable commercial production.

Protecting and sustaining current establishments

Transformation is not just about creating new participants; it is also about protecting the gains of existing emerging farmers. Many growers already in Subtrop's development programmes have invested years into building orchards, developing basic production capacity, and overcoming initial market barriers.

By focusing first on these growers, the programme ensures that:

- existing orchards remain productive,
- farmers secure better prices,
- farms withstand climate, market, and compliance shocks, and



Subtrop and Nedbank representatives during the signing of the project agreement at the Subtrop offices in Tzaneen.



Subtrop and Nedbank representatives during the signing of the project agreement at the Subtrop offices in Tzaneen.

- growers transition from vulnerable to viable.

This approach protects the progress already made while positioning these growers for future growth.

A step toward fully transforming the industry

At its core, Subtrop's long-term transformation vision is to fully integrate black growers into mainstream value chains, ensuring fair participation, economic equity, and generational sustainability.

The Nedbank partnership directly contributes to this goal by:

- addressing historic barriers,
- enabling certification and compliance,
- improving business capacity, and
- preparing growers for competitive export markets.

As Derek Donkin, Subtrop CEO reflected, "Transformation is not a project; it is a structural shift. Every grower who gains access, secures certification, or enters a new market strengthens the future of the entire industry."

The broader industry also benefits. As more farms follow sustainable practices, adopt global standards, and diversify market access, South Africa becomes a more reliable supplier of subtropical fruit globally. This strengthens national economic contributions while uplifting rural communities.

Looking ahead

While a detailed impact assessment of the certification and export-readiness programme was prepared the early signs were clear: the Subtrop-Nedbank partnership is more than a funding arrangement, it is a catalyst for long-term transformation.

For emerging avocado and litchi growers, this initiative offers the training, tools, and market opportunities needed to finally compete on equal footing. For the industry, it charts a path toward a more inclusive, resilient, and economically competitive future. ♦



Transformation in action: Westfalia-Rakwadu partnership sets a benchmark for inclusive growth

As the fruit sector continues to drive rural development across South Africa, transformation remains at the heart of the industry's long-term sustainability. One of the most compelling examples of meaningful change is the growing partnership between Westfalia Fruit and the Rakwadu community.

Stephen Mantsho
SUBTROP

The journey began in 1998 when Chief Ntsaupa David Mohale led the Rakwadu community in lodging a land claim on Deelkraal Farm, a 1 123,90-hectare property. Recognising the need for a sustainable economic future, Hans Merensky Holdings supported the inclusion of the adjoining Goedgelegen Farm.

On 25 October 2024, the land was officially restored to the Rakwadu community in a milestone title deed ceremony.

Shared prosperity

The collaboration between Westfalia Fruit and the Rakwadu Communal Property Association (CPA) is structured as a partnership of 49% - 51% respectively, placing majority ownership firmly in the hands of the community while allowing Westfalia to contribute commercial expertise, technical capacity, and access to global avocado markets.

This partnership model embodies the transformation principles championed by the industry:

- Community ownership strengthened by strong governance.
- Commercial productivity maintained and expanded.
- Long-term market access secured through global supply chains.
- Ongoing development supported through training and skills transfer.

In an industry where transformation is often discussed but not always delivered, the Westfalia-Rakwadu partnership demonstrates practical, measurable impact:

- Sustainable land reform
Instead of farms collapsing after land transfers, this model shows how communities can retain ownership while partnering with experienced operators to maintain productivity and profitability.
- Economic inclusion
The Rakwadu CPA receives financial returns while actively participating in strategic planning, strengthening the community's role in the agricultural value chain.
- Job creation and skills development
Local employment is prioritised, with training programmes equipping youth and farmworkers with competencies rang-

ing from orchard management to packhouse operations.

- Rural economic development

The partnership supports local service providers, stimulates rural business activity, and creates a ripple effect of growth across surrounding villages.

As Subtrop continues to champion transformation across avocados, litchis, and mangoes, the Rakwadu-Westfalia partnership stands as a blueprint for future land reform initiatives:

- It shows that community ownership and commercial agriculture can co-exist.
- It proves that well-structured partnerships reduce risk and build resilience.
- It demonstrates that transformation is strongest when driven by trust, transparency, and shared decision-making.

This collaborative model has already been cited nationally as an example of how to successfully transition land back to communities without compromising agricultural output.

Together, Westfalia Fruit and the Rakwadu community are not only growing avocados; they are growing skills, opportunities, and generational wealth. For Subtrop, this is transformation in its truest form: practical, inclusive, and sustainable.

As we look ahead, partnerships like this will remain essential in shaping an industry that is productive, competitive, and reflective of the communities who call our agricultural landscapes home. 🌱



Ramawela Mokibela Albert (Chairperson of Rakwadu CPA), Chief Nchaupa David Mohale Rakwadu, Nakedi Kekana (LDARD MEC), and Minister Mzwanele Nkhontso of Land Reform and Rural Development.



ASBVd in avocado orchards

Understanding Avocado Sunblotch Viroid (ASBVd): A threat to orchard health and productivity

ASBVd is a viroid - a very small infectious agent made of a short, circular single-stranded RNA molecule that lacks a protein coat and does not encode proteins. Unlike viruses, viroids do not produce their own proteins and instead rely on host cell RNA polymerases and host factors to replicate, sometimes using self-cleaving (hammerhead) ribozyme activity during replication. In avocados, ASBVd causes sunblotch disease, which may produce leaf, stem, and fruit symptoms but can also remain latent for long periods (symptomless carrier trees), allowing infection to persist undetected.

Ulrich Koster
SAAGA

The viroid spreads primarily through vegetative propagation: grafting, budding, or use of infected scion or root-stock material. It can also be spread mechanically via contaminated tools or, less commonly, by seeds and pollen in specific cultivars as well as root grafting. Once introduced, the viroid remains systemic and persistent within the tree for life.

Notably, infected trees may be symptomatic or asymptomatic, making visual detection unreliable. Also, different viroid titres (viroid concentrations) occur between different plant organs and even leaves. Asymptomatic carriers often have the most devastating effect, as they provide a reservoir allowing

the viroid to persist and spread within orchards without being detected.

SYMPTOMS IN TREES AND FRUIT

ASBVd symptoms can vary widely depending on the cultivar, the age of the tree, environmental stress, and even individual plant genetics. Recognising the disease can be difficult, especially when trees appear healthy but are asymptomatic carriers. That is why regular observation and indexing suspected trees are key.

Basic symptoms include:

- Chlorotic (yellow/orange) streaks or sunken blotches on fruit, stems, and leaves.

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- . Kontak die volgende persone vir gespesialiseerde bemesting-programme

Navrae:

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FERTASA

Fertilizer Association of Southern Africa





ASBVd in avocado orchards

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- Flattened or cracked stems (especially on young shoots).
- Deformed, small, or discoloured fruit.
- Reduced leaf size and abnormal leaf shape.
- Leaves show distinctive white, pink, or yellow streaks or mottles, and can be distorted.
- Stunted tree growth and dieback in severe cases.
- Infected trees suffer from canopy loss and flower excessively.
- Infected trees set fruit later than uninfected trees and have a lower yield.

FRUIT SYMPTOMS (visible on mature fruit)

The most economically damaging symptoms are often seen on the fruit, particularly in export markets where cosmetic appearance is crucial.

Common signs include:

- Chlorotic (yellow or white) streaks, blotches, or lines. These appear as irregular discolouration on the skin and are more visible on dark-skin cultivars like Hass. Example: In 'Hass' orchards in Limpopo, infected fruit often shows pale zigzag or linear patterns that are hard to detect when immature but become obvious at harvest.
- Sunken, cracked, or pitted areas on the fruit surface. These can resemble insect damage or physical injury, leading to misdiagnosis.
- Misshapen or undersized fruit. The viroid disrupts fruit development, often resulting in small, lopsided fruit - frequently seen in younger trees (<5 years) where vegetative growth is more sensitive to infection.

STEM AND LEAF SYMPTOMS (visible on vegetative growth)

Symptoms on stems and leaves can be subtle but are often

early indicators of infection, especially during active growth periods.

On shoots and branches:

- Flattened or grooved stems (especially on young green shoots). Instead of the typical round shape, the stems may have deep grooves or ridges. More pronounced in cultivars like Fuerte or Pinkerton.
- Striping or bark cracking on older wood. These appear as light-coloured streaks running along the stem, often confused with sunburn or mechanical damage.

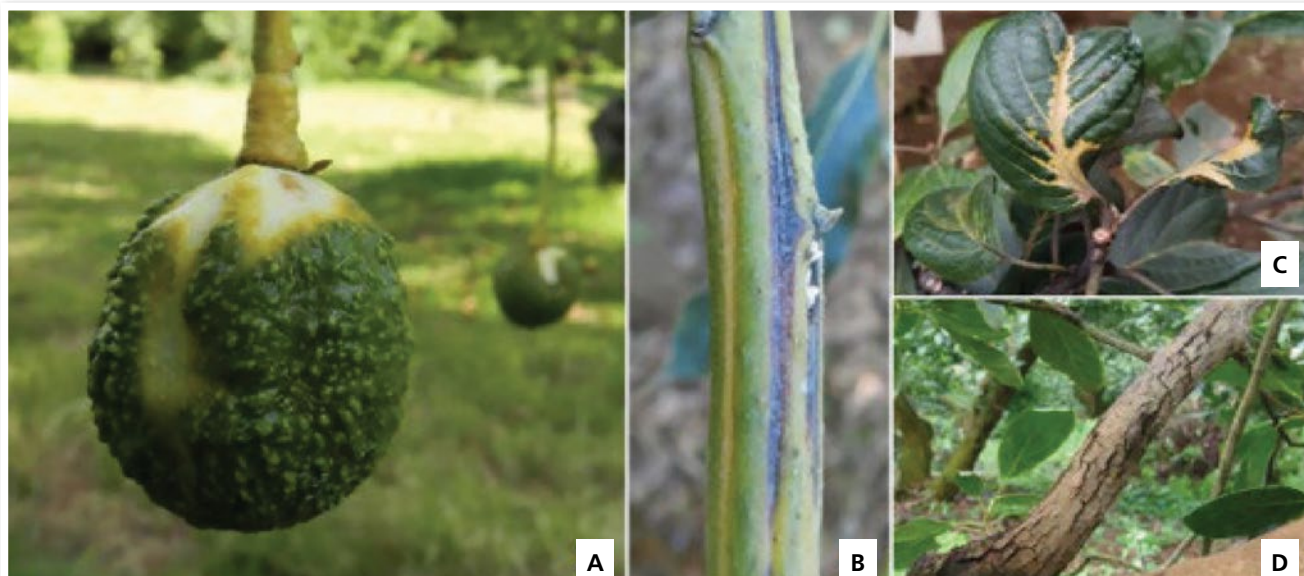
On leaves:

- Smaller-than-normal leaves with irregular shapes or wavy margins. This occurs because the viroid interferes with cellular development in the growing tips. Leaf yellowing may occur sporadically but is not a reliable indicator on its own.

WHOLE TREE EFFECTS (systemic impact on tree health and productivity)

In long-term infections or heavily symptomatic trees, the overall structure and performance of the tree decline significantly.

- Stunted growth and reduced tree size. Infected trees may appear noticeably smaller than their healthy neighbours of the same age and rootstock. Sometimes younger trees showcase lateral growth but barely any vertical growth (stunted).
- Thin or open canopy with weak branching. The canopy may lack density, leading to reduced photosynthesis and increased vulnerability to heat or wind stress.
- Flowering and fruit set. Trees may flower sparsely or produce flowers that fail to develop into fruit, reducing annual yield potential. Infected





- High yield losses have been reported in infected trees.
- Fruit quality is severely affected, with downgraded or rejected fruit due to visible blemishes (blotches).
- Infected trees exhibit reduced vigor, with smaller canopy size and lower flowering intensity.
- Asymptomatic trees can act as reservoirs of infection, threatening the long-term productivity of an entire orchard.

DETECTION AND DIAGNOSIS

Because of its latent nature, laboratory testing is the most reliable method for detecting ASBVd. Methods include RT-PCR (reverse transcription polymerase chain reaction).

These tests are available through diagnostic laboratories and are especially recommended for mother trees, nursery stock, and any newly introduced plant material.

MANAGEMENT AND CONTROL STRATEGIES

Currently, there is no cure for ASBVd. Prevention and sanitation are the best tools available:

- Use certified, ASBVd-free planting material: This is the most effective way to prevent introducing the viroid into orchards, as well as regular indexing of trees.
- Rogue infected trees: Immediately remove and destroy infected trees, especially if they are symptomatic.
- Sanitise tools and equipment: Pruning shears, grafting knives, and other tools should be disinfected regularly.

To effectively sanitise tools and prevent the spread of ASBVd, it is recommended to use a sodium hypochlorite solution. Specifically, scrubbing tools clean and then soaking them in a 1,5% sodium hypochlorite solution has been shown to be effective. Alternatively, a household bleach solution can be prepared by mixing one part commercial-strength bleach with four parts water.

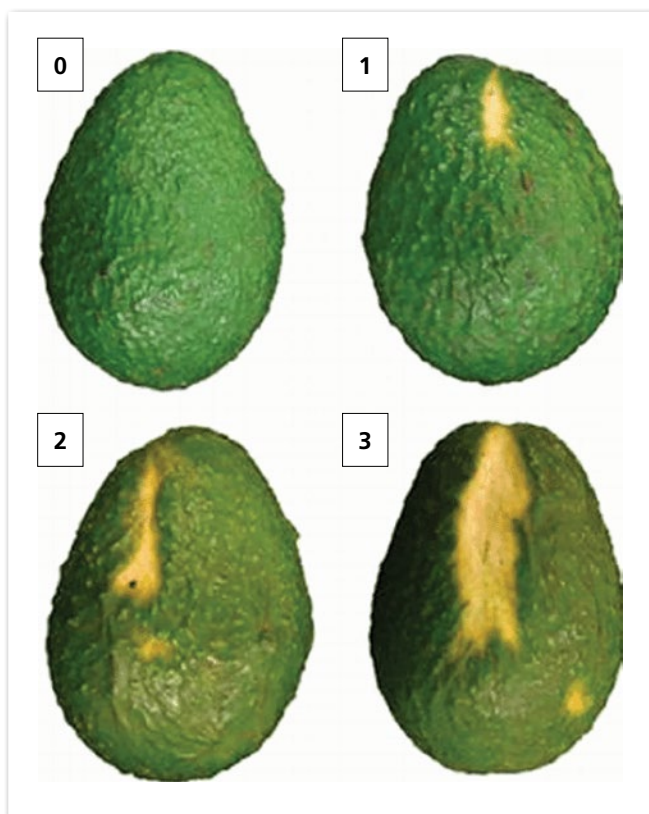
- Monitor high-risk trees: Trees propagated before viroid testing became widespread should be monitored and tested periodically - once to twice a year where necessary, scan orchard trees for visual symptoms.
- Nursery vigilance: Only source plant material from reputable nurseries that follow viroid testing protocols.

In South Africa, the growing demand for high-quality avocados in both local and export markets leaves little room for compromised orchards. ASBVd poses a unique challenge, particularly for regions with older orchards where viroid testing was not historically routine.

Farmers must prioritise awareness, routine testing, and good orchard hygiene practices. Collaboration with nurseries, extension officers, and research institutions is key to managing the spread and long-term impact of this disease.

ASBVd may be a microscopic enemy, but its impact is far from small. Proactive management and vigilant nursery practices can help avocado growers protect their investments and ensure orchard longevity. If growers are unsure about the status of an orchard, consult with the local agricultural advisor or plant pathology laboratory to arrange for testing of ASBVd.

For more info please refer to the fact sheet and other information on the SAAGA website about ASBVd. ♦



trees suffer from canopy loss and flower excessively but only set small amounts of fruit.

- Premature fruit drop.
Fruit may set initially but fail to reach maturity, especially during dry or stressful growing conditions.

Note: In mature orchards (10+ years), these systemic symptoms can lead to chronic underperformance, with some trees producing less than 20% of their expected yield. These signs can be mistaken for nutrient deficiencies or sunburn, complicating accurate diagnosis without laboratory confirmation.

IMPACT ON YIELD AND FRUIT QUALITY

The economic impact of ASBVd is substantial:



Review of foliar spray on mango flowering and fruiting

A study on foliar spray of different chemicals on flowering and fruiting in mango was carried out in the 2022/23 season with parameters recorded on the cultivar Dashehari in India.

André Botha

SUBTROP

The study was conducted at Horticulture farm, Bharregaon under Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon, (C.G.) India, during the period from the first fortnight of October 2022 and November 2022.

In the case of flowering in mango, it is most important that the trees should be able to produce new vegetative growth in the “on” year, which should also be mature to be ready to enter the reproduction phase and give flowering in the following season. Moreover, early flowering results in advanced fruit maturity and provides opportunities to have the commercial advantages of early marketing in the season.

The flowering, fruit set, and fruit yield of mango are the most critical events. They are dependent upon many biotic and abiotic factors; amongst them foliar sprays of growth regulators play a very important role in regulating these factors in mango for qualitative and quantitative production.

The experiment was laid out in randomized block design and replicated three times. A total of 11 treatments were used with urea at 1,5%, 2%, and 2,5%; KNO₃ at 1,5%, 2%,

and 2,5%; Ethephon at 250 mg; SOP (sulphate of potash) at 0,5%, 1%, and 1,5%; and the control (spray in water). In this study, observations were recorded on the three parameters namely: flowering and fruit set, quality, and yield.

From the overall experiment it can be concluded that foliar application of (T6) KNO₃ @ 2,5% treatment gave minimum vegetative shoots and maximum flowering shoots per terminal and minimum vegetative shoots (%), maximum flowering shoots (%), maximum length of panicle, and minimum days for full bloom. Based on results obtained in the present investigation, it can be summarised that foliar application of (T6) KNO₃ @ 2,5% during the first fortnight of October and November can be utilised for enhancing flowering and fruiting in ‘Dashehari’ mango.

References

SINGH, S., DESHMUKH, U.B., PAIKRA, M.S., SINGH, J., NISHAD, D., GUPTA, N. & DAHARIYA, B.K. 2025. Study the Effect of Foliar Spray of Different Chemicals on Flowering and Fruiting in Mango (*Mangifera indica* L.) cv. Dashehari. *International Journal of Biochemistry Research & Review*, 34(1): 116-122.

Table 1. Observations of foliar spray of different chemicals on flowering and fruiting.

Notation	Treatments	Number of vegetative shoot per terminal	Number of flowering shoots per terminal	Vegetative shoot (%)	Flowering shoot (%)	Days require for full bloom (days)	Panicle length (cm)
T_{1}	Urea @ 1,5%	1,20	0,68	19,37	75,20 (8,72)	21,14	35,80
T_{2}	Urea @ 2%	1,29	0,76	21,49	78,68 (8,92)	21,22	40,30
T_{3}	Urea @ 2,5%	1,34	0,81	25,16	83,69 (8,92)	21,93	40,98
T_{4}	KNO ₃ @ 1,5%	1,11	0,86	16,67	85,14 (9,28)	20,91	40,87
T_{5}	KNO ₃ @ 2%	1,22	0,91	17,64	88,35 (9,45)	20,58	41,33
T_{6}	KNO ₃ @ 2,5%	0,62	0,98	7,64	91,55 (9,61)	19,11	44,39
T_{7}	Ethephon @ 250 mg	0,93	0,61	14,97	72,88(8,59)	21,00	36,80
T_{8}	SOP @ 0,5%	0,69	0,39	9,86	64,79 (8,10)	23,68	34,54
T_{9}	SOP @ 1%	0,75	0,48	11,47	67,34 (8,26)	23,12	34,96
T_{10}	SOP @ 1,5%	0,78	0,53	12,63	69,68 (8,40)	22,45	35,36
T_{0}	Control (spray in water)	1,03	0,36	15,09	57,91 (7,67)	25,31	32,14
	SE (m) ±	0,03	0,02	0,81	2,41	0,77	1,25
	C,D, at 5%	0,10	0,06	2,43	7,18	2,29	3,66
	C,V, %	6,33	5,19	9,06	5,51	6,12	5,63



Australian growers Paul and Krystal Caton and André Schoeman.



Dr Smadar Harpaz-Saad.

A litchi study group with global perspectives

In November 2025, the Mpumalanga Litchi Study Group welcomed to Riverside Farm a delegation of international growers including four representatives from Israel and two litchi producers from Australia.

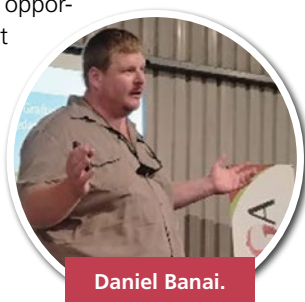
André Botha
SUBTROP

Dr Smadar Harpaz-Saad of the Hebrew University of Jerusalem delivered an insightful presentation on winter pruning and flower induction, highlighting techniques to boost productivity through cross-pollination. She also introduced 'Hung Long' as a promising new litchi cultivar gaining traction in Israel.

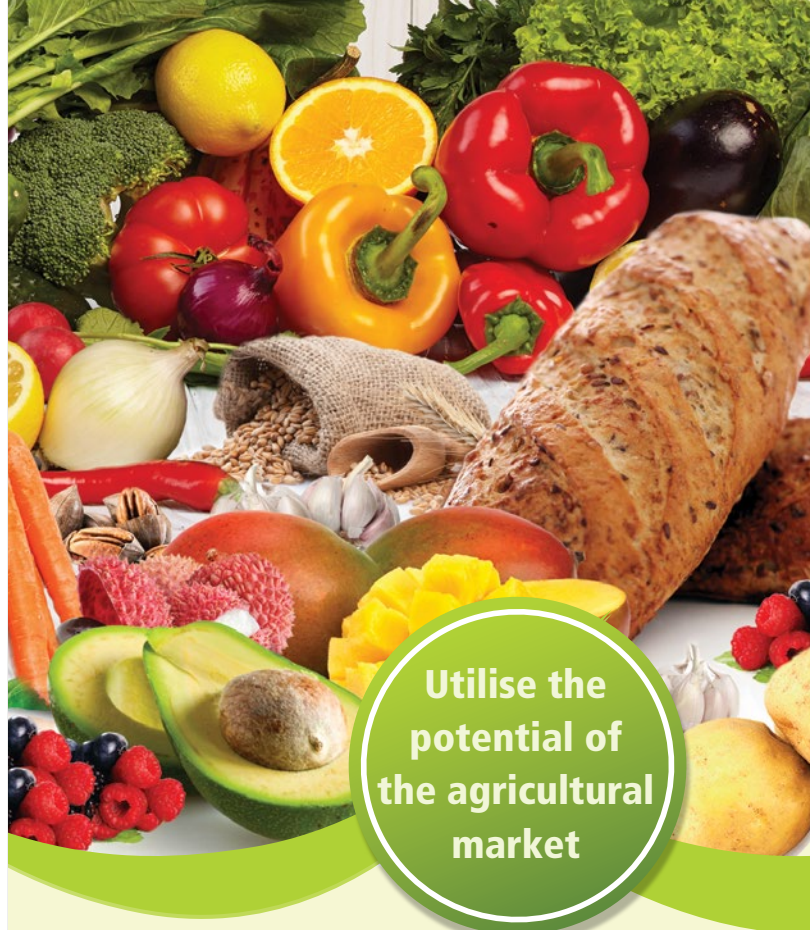
Daniel Banai, an experienced nursery owner and agricultural consultant, followed with a talk on litchi grafting practices suited to Israel's Mediterranean climate. He emphasised optimal grafting periods and detailed the bark grafting method commonly used, while also sharing developments in 'Hung Long' cultivation.

Australian growers Paul and Krystal Caton offered a perspective on their export-oriented litchi production, describing the challenges and opportunities of supplying fresh fruit to international markets.

The event drew strong attendance and fostered valuable networking among local and international participants, enriching the exchange of knowledge and practices across borders. 🌱



Daniel Banai.



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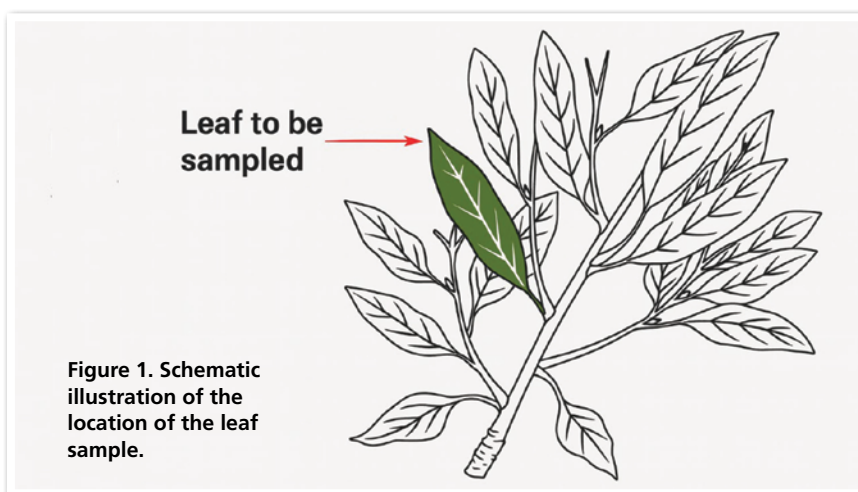


Practical guidelines for avocado leaf and soil sampling

Regular soil and leaf sampling is one of the most reliable ways to understand the nutritional needs of an avocado orchard. Soil analysis shows what nutrients are available, while leaf analysis shows what the tree has actually absorbed. When done correctly, these two tools help growers make better fertiliser decisions, avoid nutrient problems, and maintain healthy, productive orchards.

Mukondeleli Munzhedzi
SUBTROP

To get meaningful results, sampling must be done correctly and consistently every year. Healthy, fruit-bearing trees must be sampled separately from stressed or non-bearing trees, as their nutrient levels are naturally different. Trees chosen for sampling should represent similar soil type and microclimate, and the same indicator trees should be marked and used year after year. This consistency helps track trends over time and improves the value of results.



Leaf sampling guidelines

The best leaves to collect are 6 - 8 months old, taken from terminal, non-bearing shoots exposed to full sunlight (Fig. 1). Sampling should be done in the morning once the dew has dried. Growers should follow the following key steps:

- Choose healthy, fruit-bearing trees. Sample stressed trees separately.
- Select trees from areas with the same soil type and microclimate.
- Pick leaves from terminal, non-bearing shoots with no new flush.
- Collect 6-8 month-old leaves.
- Take samples in the morning after dew has dried off.
- Pick 4 leaves per tree at shoulder height.
- Sample randomly from 20 trees per 3 ha block (± 80 leaves).
- Sample different soil types, cultivars, and tree ages separately.
- Place leaves in a paper or perforated plastic bag and label clearly.
- Keep samples cool and send to the laboratory within 24 hours.
- Use the same laboratory every year

to ensure comparable results.

Soil sampling guidelines

Soil sampling should be done at the same time as leaf sampling, usually between February and April, when nutrient levels are stable. Avoid sampling within a week after fertilising, as this can affect the results. As with leaf sampling, the same indicator trees should be used each year.

Just before taking samples, clear away mulch or fertiliser from the soil surface so that the sample represents the true soil conditions.

- Sample soil at the same time as leaf sampling (Feb-Apr).
- Do not sample within a week of fertiliser application.
- Analyse sand, silt, and clay fractions for every soil type on the farm.
- Take soil from the same indicator trees used for leaf sampling.
- Clear mulch or fertiliser from the surface just before sampling.
- Take topsoil at 15-30 cm depth and subsoil at 35-55 cm depth.
- Collect soil halfway between the

trunk and the canopy drip line.

- Keep topsoil and subsoil samples separate.
- Combine at least 10 subsamples to make one representative sample.
- Place soil in a strong, clean plastic bag and label clearly.
- Keep samples cool and send to the laboratory promptly.
- Use the same laboratory each year for reliable comparison.

By following these guidelines, avocado growers can ensure they are collecting accurate, representative samples that truly reflect the orchard's nutritional status. Consistent sampling helps identify nutrient deficiencies early, improves fertiliser planning, and contributes to healthier, more productive avocado orchards year after year.

Reference

ABERCROMBIE, R.A. 2011. Fertilization. The cultivation of avocado. In: E.A. de Villiers & P.H. Joubert (eds). ARC-Institute for Tropical and Subtropical Crops, p. 142-144.



Humic and fulvic acids in avocado production

This article developed from a conversation between Kondi Munzhedzi from Subtrop and Richard Lamar from Huma Inc., who wanted to help avocado growers make sense of humic and fulvic acids; products many growers hear about, yet often find it difficult to apply with confidence.

Richard Lamar

HUMA INC/DUX AGRI

A discussion between Kondi Munzhedzi and Richard Lamar aimed to clarify what the substances humic and fulvic acids are, how they work, and where they genuinely fit into avocado production. The result is this practical questions and answers, written to give growers clear, useful guidance on using humic and fulvic acids to support healthier soils, stronger root systems, better nutrient uptake, and improved stress resilience.

What are humic and fulvic acids?

Humic and fulvic acids are highly active carbon compounds that form during the long-term breakdown of plant material into stable organic matter. They contain reactive chemical groups that bind and stabilise nutrients, influence soil chemistry, and assist in oxidation - reduction reactions.

Fulvic acids are the lighter, more oxidised fraction that dissolves easily in water and moves readily in the soil. Humic acids are heavier and more strongly bound to soil minerals, making them important for soil structure and long-term carbon storage.

Commercial products come from ancient carbon deposits such as Leonardite and humic shale, which differ in chemistry depending on their geological history. This is why the effectiveness of humic products can vary widely.

Why have these acids become important in commercial avocado production?

As orchards become more intensive, the need for resilient, high-performing trees grows. Humic and fulvic acids act as biostimulants, triggering mild beneficial stress that prepares plants to better cope with real environmental challenges.

Treated trees often show improved photosynthetic efficiency, higher energy production, and stronger feeder roots growth. These changes help the plant use nutrients more effectively and maintain vigour during demanding periods of the season. For avocado growers, this translates into healthier, more productive orchards.

How do humic acids influence soil physical structure and chemical balance?

Humic substances improve soil mostly through their effects on plant roots and the surrounding microbial community. They stimulate the formation of feeder roots and root exudates, both of which feed beneficial microbes. As microbes break down dead roots, they create more humic material and in-

crease soil carbon content.

This biological activity enhances soil structure, improves aeration, increases water-holding capacity, and supports more stable nutrient cycling. Over time, soils treated with humic substances become more friable and better able to support healthy avocado roots.

Are certain soil types more responsive to humic substances?

Yes. Soils that lack organic carbon or have weak structure such as sands, compacted soils, and degraded top soils respond well to humic substances. These conditions are common in most commercial avocado regions.

The boost in fine root activity and microbial growth resulting from humic applications helps rebuild soil resilience, improve nutrient retention, and support a more balanced underground environment.

In what ways do humic and fulvic acids enhance nutrient availability and uptake?

Humic substances increase nutrient use efficiency both inside the plant and in the soil. Physiologically, plants treated with humics often photosynthesise more effectively, producing more sugars and energy to support biomass growth and nutrient movement.

Morphologically, the stimulation of fine roots and root hairs gives the tree a much larger soil volume to explore. At the same time, humics support microbial communities that convert nutrients into plant-available forms. Many growers find that fertilisers perform better and sometimes at lower rates when used alongside high-quality humic or fulvic products.

Do humic and fulvic acids offer measurable benefits for stress tolerance?

Yes. The improvements in root structure, nutrient uptake, and microbial activity all contribute to better stress resilience. Humic treated trees tend to maintain more stable water and ion balance during drought, salinity events, or uneven irrigation cycles. They also develop stronger root systems that can better withstand low-oxygen conditions, which avocados are particularly sensitive to. These benefits help the tree remain metabolically stable during stressful periods.

Can fulvic acid improve calcium movement into avocado fruit?

It can. Calcium in soils often becomes locked in mineral forms such as calcium carbonate. Root exudates, especially low-

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Litchi top-grafting technique for variety replacement

Compared to replanting, top-grafting litchi trees offers advantages such as simple operation, high survival, rapid tree recovery, and a short production restoration cycle (generally 2-3 years). This technique is suitable for trees and branches of various ages and sizes. In southern China, litchi growers have changed to new varieties after several rounds through top-working.

Houbin Chen

SOUTH CHINA AGRICULTURAL UNIVERSITY, CHINA

Root grafting success is influenced by multiple factors. Beyond weather conditions, the selection of rootstock and scion varieties and their compatibility, grafting season, scion quality, grafting techniques, and post-grafting management are all crucial.

Rootstock-scion compatibility

Although cultivated litchis belong to the same species of *Litchi chinensis*, graft incompatibility exists between different varieties, which is relatively uncommon in other fruit trees. Generally, early maturing varieties should be grafted onto early maturing rootstocks, and late maturing varieties onto late maturing rootstocks.

It is important to note that some early maturing varieties like 'Da Zao' ('Mauritius') and 'Hei Ye' ('Haak Yip') are prone to incompatibility when used as rootstocks. For those incompatible combinations, an inter-stock may be an effective way to overcome this difficulty. In contrast, 'Baila', an early variety, and 'Huai Zhi' ('Wai Chee'), a late variety, exhibit good compatibility and are widely used as a rootstock for other varieties.

Grafting season

Litchi grafting should be performed when tree carbon accumulation is highest and weather conditions are mild, making early spring the optimal period (from January to April in the Northern Hemisphere; from July to October in the Southern Hemisphere), with ten to twenty days before spring shoots sprout or flower panicle emergence being particularly ideal. During this time, branches are strong and buds are fully developed. During our trials in 2023 and 2024 at the Gaozhou experimental field, top-grafting in February had a budwood take of 90% compared with only about 30% in September. After spring grafting, new shoots emerged quickly and grew vigorously.

Late autumn to early winter, after temperatures drop, serves as a secondary grafting period. However, shoots are thinner and buds weaker at this time, leading to lower graft survival rates, uneven bud sprouting, inconsistent tree growth after grafting, and higher susceptibility to pests. Hot, rainy summers and cold, dry winters are unsuitable for top-grafting.

Rootstock and scion selection

Top-grafting accommodates a wide range of rootstock thicknesses, with minimum diameters over 2 cm and maximum



Figure 1. Strong new shoots can be achieved from both big (A) and small (B) rootstocks.

Photos: Houbin Chen

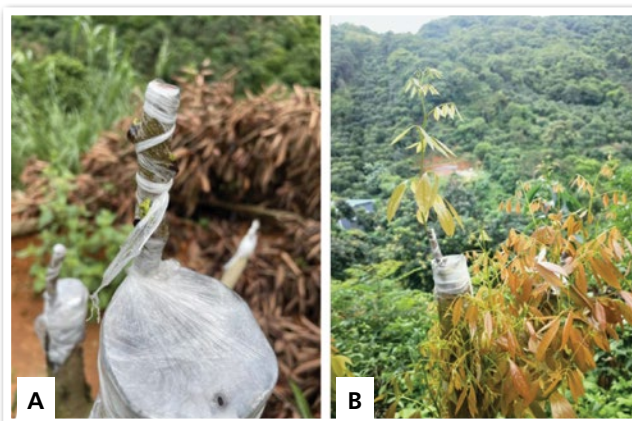


Figure 3. Bud growth after grafting. A. Three buds growing visibly under one layer of film. B. Young shoots growing from the grafted variety and the rootstock. Shoots from the rootstocks must be removed timeously.

Photos: Houbin Chen

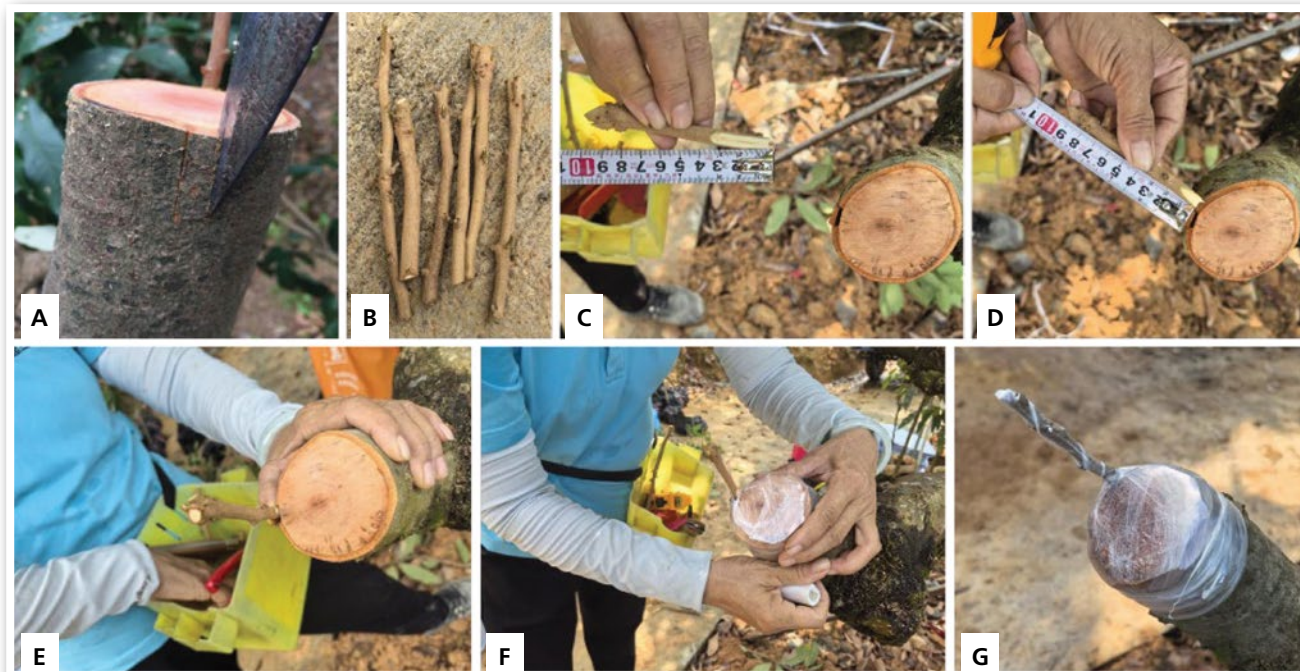


Figure 2. Top-grafting process. A. Cutting of a litchi rootstock and making bark incision for grafting; B. Litchi scions ready for grafting; C & D. Scion of 8-10 cm length with a long cut of 3 cm on one side (C) and a short cut of 1,5 cm on the opposite side (D); E. Insertion of scion onto the rootstock; F. Wrapping of PE films; PE films must cover all the cut surfaces; G. Finished graft (photo taken on the 2nd day after grafting, water vapors seen inside films)

Demonstrated and photographed: Shilan Wang

diameters up to 20 cm (Fig. 1); tree height should be reduced to between 1,5 and 1,7 m, with one branch remaining as a water shoot for better graft take. Studies and experience have indicated that thicker branches offer better compatibility as rootstocks but require higher grafting skills.

If using the current season shoots as scions, select robust branches with diameters over 1 cm which should be pinched or topped about one week before grafting to promote good bud development. Branches older than one year have sturdier buds and more adventitious buds, making them suitable for grafting in late winter or early spring. If necessary, scions may be soaked for approximately thirty minutes in a water solution containing pesticides, fungicides, and glucose or sucrose (0,3%). During grafting practices, scions should be kept moist

with a damp towel, and all scions should be used on the same day they are collected.

Key grafting steps

Select upright, robust branches as graft stocks. Saw them off with a smooth cut and smoothen the wood surface, grafting directly onto these large branches (Fig. 2 A). Each tree may receive about 5 scions, ensuring that at least 3 survive, which are evenly distributed in all directions. Grafting many scions onto many shoots of one tree is not recommended in China nowadays (Fig. 4). However, under some special conditions like 'Feizixiao' ('Fay Zee Siu') in Hainan, China, many scions are grafted onto many branches of one tree for early canopy recovery and production restoration (Fig. 5).

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Humic and fulvic acids in avocado production

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molecular-weight organic acids can dissolve these minerals and release the calcium into the soil solution. Because humic substances increase root exudation, they indirectly increase calcium availability. This is important for avocados, as early calcium uptake strongly influences cell wall strength and fruit shelf life.

What application methods and timings are recommended?

Humic acids are most effective when applied to the soil or through fertigation during active root growth periods, such as before flowering or after harvest. Fulvic acids, being more soluble, are well suited to foliar sprays during flowering, fruit set, and early fruit development.

Product quality plays a major role in the overall response;

growers sometimes assume humics do not work when the real issue is that the product was low-grade or poorly refined.

Are humic and fulvic acids replacements for conventional fertilisers?

No. They do not replace fertilisers but improve the plant's ability to use them. Humic substances increase the density of fine roots and stimulate the H⁺-ATPase enzyme responsible for nutrient uptake. This enhances the proton motive force that drives nutrient absorption into root cells.

They also increase the production of transporter proteins, making uptake more efficient. Because treated plants use nutrients more effectively, growers can often achieve the same productivity with lower fertiliser rates. ♦



Litchi top-grafting technique for variety replacement

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Figure 4. Fifteen buds grafted onto one tree for quick recovery, with one branch remaining for better graft take. This many scions are not recommended nowadays in China.

Photo: Houbin Chen



Figure 6. Only the bottom of the U-shaped graft union healed and broke during a wind.

Photo: Houbin Chen

Grafting knives must be sharp, and cuts should be smooth (Fig. 2 A). Each scion shoot should have 3 to 5 buds, be 8 to 10 cm long, and the base of removed petioles should be flattened to prevent puncturing the wrapping film during binding (Fig. 2 B, C). The cut surfaces on both rootstock and scion should be similar in size, ideally 3 cm long and about 1 to 1.5 cm wide (Fig. 2 C).

On the scion base, create one long flat side and a shorter cut at a 45° angle on the opposite side, with the top trimmed flat (Fig. 2 C, D). Gently open the bark flap on the rootstock and insert the scion. One or two scions may be grafted onto each rootstock cut surface, depending on rootstock branch size.

Tap the area with the inserted budwood carefully from the base to the top to ensure tight contact (Fig. 2 E). Ensure that



Figure 5. Many branches of a 'Feizixiao' tree grafted with an early variety 'Guihuaxiang'; flowering was restored in one year.

Photo: Houbin Chen

the cambium layers align at least on one side, with no gaps, and the rootstock bark wraps snugly around the scion. Ideally, callus tissue should form on both sides and the bottom of the graft union for complete healing (Fig. 6). For large branches where grafting failed, re-graft onto the new shoots after two or more flushes of new shoots have fully hardened, which may take 5 to 6 months. Chip-bud grafting is used in younger rootstocks (Fig. 1).

Wrapping materials and method

It is recommended to use 0,03 mm thick white polyethylene (PE) elastic stretch film. When wrapping, stretch the film thinly to tightly cover the scion and rootstock, creating a sterile, humid environment (Fig. 2 F, G). This film gradually degrades or expands as the scion grows, reducing the risk of constricting the graft union. Wrap evenly and tightly, ensuring all wounds are covered and sealed airtight. Over the scion buds, apply only one layer of film to allow easy bud emergence (Fig. 3 A, B).

Post-grafting management

For spring grafts, apply pesticides based on pest incidence. For late autumn grafts, spray pesticides (targeting ants, aphids, leaf-eating pests, etc.) every 5 to 7 days after grafting. Scion buds typically begin to sprout 10 to 15 days (30 days or longer during the winter season) after grafting, while rootstock buds sprout around 15 to 20 days later. Remove rootstock sprouts every 20 to 30 days or more frequently as needed (Fig. 3 B). Shade the grafted trunks or trees when sunlight is too strong.

Film removal and support

If the film restricts bud growth or cuts into the graft union, carefully slice it open vertically with a sharp blade. Re-wrap with new film for protection to prevent the fragile grafted bud from breaking before it is fully secure.

The goal of top-grafting for variety replacement is to restore production within 2 to 3 years, reaching full productivity after another 3 to 5 years. 🌱



The importance of flush control and protection

The age of the last vegetative flush is a key determinant of flowering success in mango. In subtropical climates, it is crucial to stimulate vegetative flushing as soon as possible after harvest to ensure that the new growth has enough time to mature and harden off before the next flower induction period.

André Botha and Estelle Louw

SUBTROP AND RDAGRIC (PTY) LTD

Different cultivars require flushes of varying ages to initiate flowering:

- 'Tommy Atkins' typically needs flushes that are 3 to 4 months old.
- 'Keitt', on the other hand, can flower on flushes that are just 1 month old.

Managing the timing and maturity of flushes is essential for aligning growth with flowering potential.

In cool subtropical regions, shoot behaviour after harvest varies significantly based on their fruiting history:

- Only 4% of shoots that produced fruit in the previous season will flush and flower immediately after harvest.
- About 36% of shoots that lost their fruit during the growth phase will flush promptly after harvest and eventually flower.
- Approximately 49% of shoots that did not flower in the prior season will flower and set fruit in the upcoming season.

To encourage vigorous flushing and optimal timing for flower initiation, it is recommended to tip-prune or remove panicles as soon as possible during or immediately after harvest. Tip pruning at harvest - where fruit is removed through a pruning cut - promotes the fastest flush response and enhances the likelihood of strong shoot development that can properly harden off before flowering begins.

Timely removal of panicles

Dead panicles should be removed as soon as possible after harvest for optimal flush and flowering. This practice not only improves orchard hygiene but also helps reduce disease pressure on subsequent growth, especially from flower-related diseases such as blossom blight.

Early-season removal of empty panicles using a pruning cut - ideally between October and November - encourages vigorous vegetative flushes. These flushes tend to be robust and well-hardened by the time the next flower induction period arrives. This is particularly critical for late-hanging cultivars like 'Keitt' and 'Brooks', which often lack sufficient time for new flushes to mature before the June-July induction window.

Once the desired growth flush reaches the dark green stage,



The "red" and light green flushes will be hardened off and synchronised by deficit irrigation before flowering.

irrigation should be stopped or significantly reduced. This helps harden off the flush, prevents late vegetative growth, and promotes a synchronised rest period -

setting the stage for uniform flower induction in autumn.

Consistent and uniform flushing is typically observed when panicle removal and tip pruning are carried out promptly at harvest.

Gall fly management in mango orchards

Gall flies typically produce two generations per year on mango trees: one during the first vegetative flush after pruning, and another on the pre-flowering flush. Controlling these pests is challenging because adult flies live for only 24 hours, making it difficult to prevent egg-laying.

Mango trees often exhibit uneven and extended flushing periods, which further complicates control efforts. Therefore, the focus should be on targeting the egg and larval stages, as these are the most vulnerable. Systemic control methods are best suited for this purpose.

Although the damage caused by gall flies is difficult to quantify precisely, infestations can lead to leaf deformities and even defoliation in severe cases. The extent of damage varies by region and cultivar. While natural predators do exist, their impact is minimal and not sufficient for effective control.

Infestations typically occur during the unfurling of new leaflets, making this a critical window for monitoring and intervention.

Outcomes of effective flush protection

- Strong, uniform canopy growth.
- Reduced pest and disease incidence.
- Better preparation for synchronised flowering.
- Higher fruit yield and quality in the next season.

In short, flush protection is about nurturing the tree's "reset button" after harvest - keeping the soft flush safe and healthy so the mango tree can enter its next cycle with vigour. ♦



Combined coatings promise retained fruit firmness and quality during exports

Controlled atmosphere and 1-MCP promise retained fruit firmness and quality during extended avocado sea freight exports

The sea freight export voyage of exported South African 'Hass' fruit to various markets can be up to 8 weeks. In some cases, this already long export period has been even further extended up to 10 weeks due to delays at the harbours.

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EXPERICO AGRI-RESEARCH SOLUTIONS

This study aimed to verify the effect of coatings as an additional postharvest treatment with controlled atmosphere (CA), towards improving shelf-life and reducing loss in firmness during these extended storage periods.

Edible and wax coatings can help extend the shelf-life of freshly cut fruit by several mechanisms: they act as a barrier to reduce moisture and solute migration, gas exchange, respiration, and oxidative reaction rates (Shami *et al.*, 2019). The potential of edible coatings to act as carriers of antimicrobial

compounds such as essential oils, "generally regarded as safe" (GRAS) compounds, and even microbial antagonists, can help to extend the shelf life of fruit and reduce the risk of establishment of pathogens on their surfaces - known as active coatings.

In addition to the advantage that the application presents, edible coatings can be applied with different methods which range from immersion and dispersion to more sophisticated methods such as spreading/brushing (Ncama *et al.*, 2018).

DECCO, AgroFresh South Africa, JTB Corporation, and Apeel Sciences were approached as they have registered coatings for avocado fruit. DECCO indicated their wax

Table 1. (continued on adjacent page) Fruit quality parameters of 'Hass' count 20 fruit with and without coating applications after 4-, 7-, and 10-weeks storage under CA or CA + 1-MCP storage regime, at 5.5 °C, 4 °C and 3 °C.

Fruit Quality Parameters 'Hass' with or without coatings applied and stored at CA alone or CA + 1-MCP									
Treatments	Coatings applied	Storage	WEEK 4	WEEK 7	WEEK 10	WEEK 4	WEEK 7	WEEK 10	
			(a) Average No. of days to ripen (DTR) (Days)			(b) Firmness (iQ)			
T1A	No coating applied	CA	9.0 bc	8.8 ab	8.6 a	56.3 efgh	50.0 bc	47.0 a	
T2A	Vegan Longlife ¹		10.6 defg	10.1 def	9.8 bcde	59.3 ijklmn	55.8 efgh	53.6 de	
T3A	Naturcover Avo. ¹		11.3 ghijk	11.2 ghij	11.0 fghi	62.4 pqrtst	54.8 ef	48.6 ab	
T4A	Teycer™ ²		12.7 nopqrs	12.3 jklmnop	11.7 hijklm	62.8 qrst	58.1 hijkl	55.3 efg	
T5A	VitaFresh™ ²		12.7 nopqrs	12.7 mnopqrs	12.6 lmnopqrs	64.8 tuv	58.1 hijkl	56.3 efgh	
T6A	Nature-Cote™ ³		12.8 nopqrst	12.1 jklmno	11.2 ijklm	66.0 uv	56.2 efgh	57.1 cde	
T7A	Vegan Wax™ ³		12.0 ijklmno	11.8 ijklmn	11.6 hijkl	61.9 nopqrs	57.6 ghijk	59.8 ghijkl	
T8A	Apeel ⁴		10.0 defg	10.0 cdef	9.6 abcd	59.9 jklmnop	54.2 de	48.6 ab	
T1B	No coating applied	CA + 1MCP	11.8 ijklmn	11.4ghijk	10.7 efgh	58.4 hijkl	58.2 hijkl	57.1 fghi	
T2B	Vegan Longlife ¹		13.2 qrstuv	12.8 nopqrst	12.2 klmnopq	60.6 jklm	61.8 lmnop	59.8 ghijkl	
T3B	Naturcover Avo. ¹		14.3 wx	14.2 vwx	13.5 stuv	62.7 nopq	59.6 fghijk	57.1 cde	
T4B	Teycer™ ²		14.0 uvwx	13.5 rstuvw	13.0 pqrst	63.9 pqr	59.8 ghijkl	57.9 defg	
T5B	VitaFresh™ ²		14.8 x	13.9 tuvw	13.1 pqrstu	66.1 s	61.4 klmno	56.6 cd	
T6B	Nature-Cote™ ³		13.9 uvwx	13.6 stuvw	13.4 rstuv	66.5 s	62.8 opq	60.3 hijkl	
T7B	Vegan Wax™ ³		13.4 tuvw	12.7 mnopqrs	11.5 ijklmn	62.4 mnopq	60.3 hijkl	59.8 ghijkl	
T8B	Apeel ⁴		12.49 cdef	11.7 hijklm	11.2 ghijk	62.7 nopq	59.1 efghij	53.8 cd	
Prob .> F ₂			0,0000			0,0000			
Coatings of: 1. DECCO 2. AgroFresh 3. JTB Corporation 4. Apeel Science									

Coatings of: 1. DECCO 2. AgroFresh 3. JTB Corporation 4. Apeel Science



coatings are the best option to optimally create a modified atmosphere. The EU market has a concern regarding the use of Avoshine carnauba wax which contains amines. DECCO indicated their carnauba wax coatings do not include amines and are accepted in the EU.

Seven coatings available in South Africa were included in the trial:

- Two DECCO products: Vegan Longlife and Naturcover Conservation Extra,
- two AGROFRESH products: Teycer Originals Prime18 and VitaFresh™ Botanicals - Life 18,
- two JBT Corporation products: Nature-Cote™ Avocado and Vegan Wax™, and
- one Apeel Sciences product: Apeel.

Six coatings were applied at a dosage of 1.4 L/ton fruit and the Apeel coating at 1.5 L/ton fruit. These 7 coatings were applied to fruit stored under controlled atmosphere only (CA: 6% CO₂, 4% O₂) and as a combination of CA + 1-MCP (300 ppb, SmartFresh™ applied in the packhouse directly after the coating application).

Two control treatments with no coating applied were stored under CA and CA + 1-MCP.

Availability of active coatings which already include fungicides is limited. However, fungicides can be added to the coating as was done by some packhouses in the past.

- ICA Thiabendazole 500 SC that is registered on avocado to be applied in coatings was included in the trial with the CA plus 1-MCP storage only.

After the coating and 1-MCP application, fruit were stored at 5.5 °C in CA for a duration of 70 days (total of 324 x 4 kg export cartons of 'Hass' fruit). The storage temperature was lowered every four weeks in a 3-day step down manner, from 5.5 °C to 4 °C and from 4 °C to 3 °C.

Fruit were removed from cold storage for evaluation after 4 weeks, 7 weeks, and 10 weeks of cold storage.

Evaluation was done upon ripening (4 cartons per treatment) and included a full set of fruit quality parameters:

- number of days to ripen (DTR),
- % moisture loss,
- physiological disorders (grey pulp, black cold damage, vascular browning) and
- pathological disorders (anthracnose and stem-end rot).

Firmness evaluations (Sinclair firmness meter) were done upon removal from cold storage for the three evaluation periods.

The 'Hass' fruit (export class 1, count 20) were sourced from the Westfalia Estate Packhouse on 9-10 July 2024. The fruit maturity progressed quickly in the 2024 season and fruit sourced had 33% dry matter. Initially it was proposed to source fruit of 30% dry matter that would be able to handle the long shipping period better. The current cut-off of maturity for export fruit is 36% dry matter. As the incidence of pathological disorders increases as fruit maturity progresses, it would be wise to implement a stricter cut-off point for exports with a duration of longer than 4 weeks.

Results

Although there was a high incidence of colouring with the coating treatments stored under CA, some definitely delayed ripening of fruit during the 10-week storage period. The combination of CA and coatings did not provide enough to maintain fruit quality to an acceptable level. Nature-Cote™ and Vegan Wax™ (Fig. 1) proved to be the only coatings that resulted in no colouring after 7 weeks of CA storage.

The seven different coatings applied stored at CA + 1-MCP, obtained significant higher days-to-ripen (DTR) values

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Table 1. (continued) Fruit quality parameters of 'Hass' count 20 fruit with and without coating applications after 4-, 7-, and 10-weeks storage under CA or CA + 1-MCP storage regime, at 5.5 °C, 4 °C and 3 °C.

Treatments	Coatings applied	WEEK 4	WEEK 7	WEEK 10	WEEK 4	WEEK 7	WEEK 10	WEEK 4	WEEK 7	WEEK 10
		(c) % Moisture Loss (%)			(d) Anthracnose % Without TBZ in coating			(e) Anthracnose % With TBZ in coating		
T1A	No coating applied	0.81 fg	1.44 nopq	2.26 w	4.2 a	19.4 ghijk	27.8 lmno	-	-	-
T2A	Vegan Longlife ¹	0.62 bcdef	1.26 lkmn	1.87 uv	6.9 abc	29.2 mno	55.1 s	-	-	-
T3A	Naturcover Avo. ¹	0.70 def	1.36 lmnp	1.67 rst	15.3 defghij	23.6 jklmn	40.3 r	-	-	-
T4A	Teycer™ ²	0.70 bcdef	1.32 lmno	1.62 qrs	16.7 efghij	22.2 ijklm	30.6 nop	-	-	-
T5A	VitaFresh™ ²	0.63 bcdef	1.32 lmno	1.67 rst	18.1 fghij	30.6 nop	38.9 qr	-	-	-
T6A	Nature-Cote™ ³	0.59 abcde	1.20 ijklm	1.58 qrs	18.1 fghij	19.4 ghijk	39.2 qr	-	-	-
T7A	Vegan Wax™ ³	0.54 abcde	1.19 ijkl	1.69 stu	5.6 ab	16.7 efghij	32.4 opq	-	-	-
T8A	Apeel ⁴	0.72 ef	1.23 jklm	1.99 v	6.9 abc	27.8 lmno	26.9 klmno	-	-	-
T1B	No coating applied	0.81 fg	1.36 lmnp	1.80 tuv	4.2 a	18.1 fghij	20.8 hijkl	-	-	-
T2B	Vegan Longlife ¹	0.51 abcd	0.97gh	1.26 lkmn	8.3 abcd	19.7ghijk	30.6 nop	1.4 a	18.1 ef	19.1 efg
T3B	Naturcover Avo. ¹	0.48 abc	1.11 hijk	1.45 opq	9.7 abcde	34.9 nopqr	40.3 r	1.4 a	25.8 ijk	34.9 mn
T4B	Teycer™ ²	0.45 ab	1.09 hijk	1.49 opqr	13.9 cdefgh	41.7 r	50.2 s	9.7 cd	23.6 ghij	38.24 no
T5B	VitaFresh™ ²	0.45 abc	1.04 hij	1.38 mnop	9.7 abcde	38.9 qr	40.3 r	4.2 ab	27.8 jkl	39.3 no
T6B	Nature-Cote™ ³	0.43 a	1.04 hij	1.34 lmnp	12.5 bcdefg	32.4 opq	39.3 qr	4.2 ab	19.4 fg	21.0 fghi
T7B	Vegan Wax™ ³	0.48 abc	1.02 hi	1.26 lkmn	9.7 abcde	18.1 fghij	27.0 klmno	2.8 ab	8.8 cd	18.1 efg
T8B	Apeel ⁴	0.64 cdef	1.06 hij	1.52 pqrs	11.1 bcdef	30.6 nop	39.0 qr	8.3 bc	23.6 ghij	30.6 klm
Prob. > F ₂		0,0000			0,0000			0,0000		

Coatings of: 1. DECCO 2. AgroFresh 3. JTB Corporation 4. Apeel Science



Combined coatings promise retained fruit firmness and quality during exports

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(14.8 - 12.9 days) (Table 1a), compared to the CA + 1-MCP treatment without a coating (11.8 days) and storage under CA without coatings (9 days). This proves the efficacy of the CA + 1-MCP to lengthen the number of days to ripen, which is linked to improved shelf life.

Pathological disorders proved to be the most limiting factor to maintain optimum fruit quality during extended storage. In an attempt to reduce the increased incidence of pathological disorders associated with extended storage, Thiabendazole was added to each of the seven coatings which led to significantly lower anthracnose incidence compared to coating treatments without Thiabendazole (Fig. 1d).

The two best coating treatments with storage at CA + 1 MCP, with Thiabendazole added in the coatings, were Nature-Cote™ and Vegan Wax™ which attained the least colouring (Fig. 1) and showed the lowest loss of firmness during the 10 weeks of storage (Table 1b).

A third option would be CA + 1-MCP which resulted in no colouring after 4 - 7 weeks of storage and in 65% coloured fruit per carton after 10 weeks of storage (Fig. 1) with only low intensity of colouring present, but which maintained firmness of all fruit.

Some coatings resulted in a drastic drop in fruit firmness between week 7 and week 10 (Table 1b), which suggests that the absorption of 1-MCP was limited by the coating barrier. In this regard the 1-MCP and CA without coatings could maintain fruit firmness for the full 10-week treatment duration. Only Nature-Cote™ Avocado and Vegan Wax™ could attain firmness for the full 10-week treatment duration. At lower dosages the other coatings could have achieved similar results.

In the study grey pulp and black cold damage evaluations were also included (tables not shown).

The incidence of grey pulp between treatments after 10 weeks of storage was as follows:

- Under CA storage alone = 20%.
- Under CA + 1-MCP storage alone = 1.45%.
- Under CA + 7 different coatings it varied between 9.67% and 13.6%. The inclusion of coatings seemed to reduce grey pulp to some extent when compared to storage under CA alone.
- Under CA + 1-MCP + 7 different coatings grey pulp varied between 1.36% and 5.5%. The inclusion of 1-MCP reduced grey pulp incidence compared to storage under CA alone.

The inclusion of 1-MCP is important to keep grey pulp incidence low for the long shipping times and emphasises the shortcoming of CA storage on its own to retain fruit quality for extended storage that exceeds 4 weeks.

The incidence of black cold damage between treatments after 10 weeks of storage was:

- Under CA storage alone = 5.45%.
- Under CA + 1-MCP storage alone = 4.08%.
- Under CA + 7 different coatings this varied between 0%

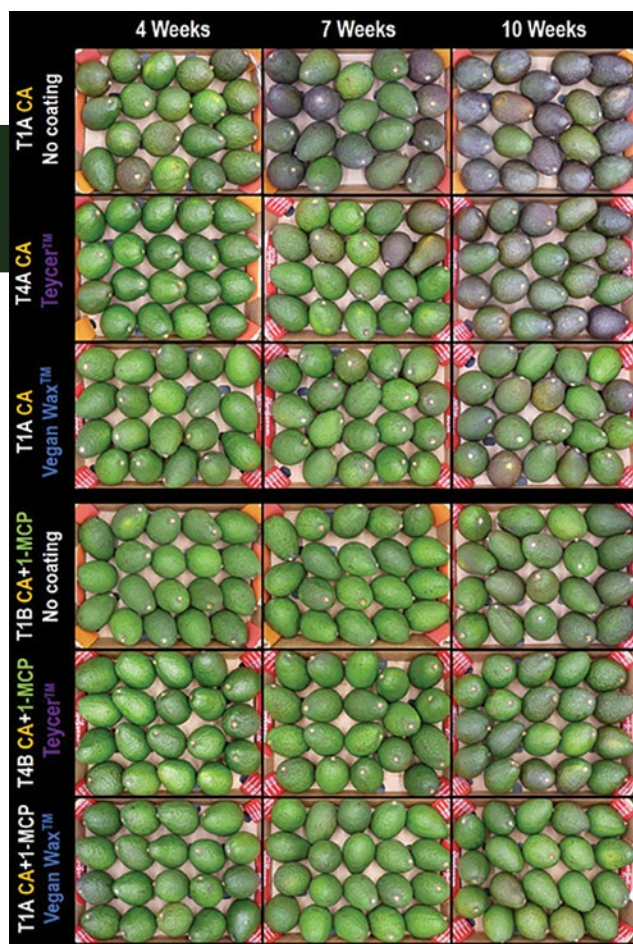


Figure 1. Visual appearance of 'Hass' count 20 fruit with and without coatings applied, after 4-, 7-, and 10-weeks storage in controlled atmosphere or controlled atmosphere + 1-MCP. The storage temperature was lowered every four weeks in a 3-day step down manner, from 5.5 °C to 4 °C and from 4 °C to 3 °C.

and 5.45%.

- Under CA + 1-MCP + 7 different coatings this varied between 1.36% and 5.5%.

It is known from previous research that 1-MCP does not reduce black cold damage. Although the inclusion of some coatings did not result in any black cold damage, it cannot be conclusively stated that these reduce black cold damage as only 4 replications were used in this trial and the highest incidence of 5.45% indicates that overall incidence was low. The temperature was stepped down on a monthly basis in a stepdown manner, starting at 5.5 °C and ending at 3 °C. Fruit with a maturity of 33% DM can withstand the stepdown to 3 °C without risking increased black cold damage. Research is needed to refine the stepdown regime during the early season when fruit of 28% DM may be more prone to develop black cold damage.

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Suppression of Soft brown rot



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Disease:
Soft brown rot &
Anthracnose

Postharvest application
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Disease:
Anthracnose,
Stem-end rot & Soft brown rot



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Disease:
Anthracnose,
Stem-end rot &
Soft brown rot

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