Du Roi Group of Companies

ROOTED

FOR THE CITRUS
AND SUBTROPICAL FRUIT GROWER

WHERE HAVE ALL MY AVOS GONE?

INTEGRATED PEST MANAGEMENT (IPM) IN CITRUS

FEEDING THE PLANTATION: ADVANCED NUTRIENT MANAGEMENT AND SOIL HEALTH IN COMMERCIAL BANANA PRODUCTION

CHOOSING A LITCHI CULTIVAR TO EXTEND THE HARVESTING PERIOD AND EXPAND MARKET ACCESS

ISSUE 07
JULY 2025

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Q1&2

"The soil is the great connector of lives, the source and destination of all."

Wendell Berry

Du Roi Group of Companies

Du Roi Nursery

Letsitele, Limpopo Province, South Africa

With its 35 years of excellence, Du Roi Nursery specialises in the production of recommended citrus cultivars and rootstocks from certified material. It is the biggest establishment of its kind in Southern Africa. With over 9 hectares of grow-out structure (under shade and under cover), Du Roi Nursery can annually produce more than 1,5 million citrus trees.

Du Roi Nursery follows strict phytosanitary standards by being registered with the South African Department of Agriculture, Forestry and Fisheries in terms of the Plant Improvement Act, as well as being a member of the South African Citrus Nurserymen's Association. Du Roi Nursery is also fully accredited by the Citrus South African Improvement Scheme as a five-star nursery.

Du Roi's team of technical specialists strives to provide the best technical support to all its clients to ensure the success of their citrus development, locally or internationally.

The company does not only aim to get the benefits of selling good products, but also to enhance the communities in and around the vicinity of the facility.

Du Roi Laboratory

Letsitele, Limpopo Province, South Africa

Du Roi Laboratory, established in 1994, specialises in the production and distribution of disease-free, virus-indexed tissue culture plants, with a focus on the banana and sugarcane industries. The Laboratory annually produces over eight million plants for supply to local and international customers in more than 35 countries. Elite selections of banana plants are made available at three stages of development: rooted in-vitro, weaned in-vivo, and nursery-hardened field-ready plants. As an ISO 9001 accredited facility for banana tissue culture production, Du Roi Laboratory provides customers with quality plants with complete traceability from foundation block to the grower.

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Du Roi Multiplant

Letsitele, Limpopo Province, South Africa

Established in 1998, Du Roi Multiplant specialises in the production of subtropical crops, such as macadamia and mango, as well as the micro-propagation of guava, pomegranate, litchi and granadilla plants. The company also possess the technology and genetics to produce dragon fruit, kiwi and casuarinas. The company is equipped with specialised rooting facilities which allow for multiple types of plants to be cultivated simultaneously. The plants can be produced in different formats that are suitable for local and international growers.

Du Roi Multiplant is fully accredited by the Seedling Growers Association of South Africa (SGASA) as well as the Department of Agriculture, Land Reform and Rural Development (DALRRD), which guarantees that only high standard trees are distributed locally and internationally.

Furthermore, the nursery partners with the Agricultural Research Council (ARC) in plant breeding and cultivar selection programs and holds propagation licenses with Citrogold and Westfalia to guarantee the supply of elite cultivars.

Cederberg Tree Nursery

Citrusdal, Western Cape Province, South Africa

Established in 2014, Cederberg Tree Nursery (CTN) specialises in the propagation and distribution of field-ready commercial citrus trees. The facility is located in Citrusdal, which has been declared a greening-free and citrus black spot-free area. CTN is fully accredited by the South African Citrus Improvement (SACIP) Scheme, which means all trees are certified and disease-free. The CTN team delivers unparalleled plant quality and goes the extra mile for all their clients.

Du Roi Halls Nursery

Nelspruit, Mpumalanga Province, South Africa

We believe in enabling excellence for all farmers by giving access to top-quality clonal avocado trees that are produced within an environment of developing our people and supported by our collective passion, experience, and pioneering, innovative approach.

In 2017 Halls (a sub-tropical fresh produce business with global footprint) and Du Roi Nursery (SA's largest and most progressive citrus nursery) combined their expertise to address the shortfall of quality avocado trees resulting from the current and projected growth trajectory of the industry.

Du Roi Halls Nursery is registered with the Department of Agriculture, Forestry and Fisheries (DAFF), Avocado Nurserymen's Association (ANA) with a current 5-star accreditation, and a member of the South African Avocado Growers' Association (SAAGA).

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From the Director

Zylon McGaffin

The South African citrus and subtropical fruit industries remain dynamic centres of agricultural innovation, despite ongoing challenges such as climate change, market pressures and the need for long-term producer sustainability.

This issue offers a combination of practical insights and scientifically grounded knowledge for growers looking to strengthen and expand their operations responsibly.

Each contribution in this edition is focused on a shared goal: to equip producers with relevant, actionable knowledge that makes a difference in the field and keeps pace with a changing production landscape.

We hope this content brings value to your planning, decision-making and day-to-day farming practices for the season ahead.

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What's News?

Meet our new colleagues at Du Roi

DUNCAN REYNHARDT

Newly Appointed
Technical Manager

Duncan's background in plant and soil sciences, a degree from the University of Pretoria and his great passion for the subtropical fruit industry in South Africa, positions him perfectly.

"Being able to work with wonderful colleagues and clients and the variety that Du Roi Multiplant offers in terms of plants produced, really excites me," he says. *"I'd like to help position the company as the premier supplier of top-quality plants to the South African and global fruit industries."*

His work philosophy says, *'Be the kind of person you would like to work with and work for.'*

And his "superpower": to try look for the positives in any situation and to turn setbacks into opportunities. *"In my spare time I like to fish."*

"Be the kind of person you would like to work with and work for."

ROCHÉ MALAN

Newly Appointed
Technical Manager

Roché has a BSc in Horticulture and Soil Science at Stellenbosch University, followed by a MSc in Horticultural Sciences, focusing on tree phenology and carbohydrate reserves in macadamia trees. *"This is my first job and I'm impressed by the endless number of opportunities and exposure, and to be part of a company with an incredible culture."*

"I want to build a solid foundation of agricultural knowledge and then expand on that as much as possible. The company has all the tools, knowledge and expertise. My goal is to actively contribute to the company's development, helping it grow and adapt in meaningful ways."

Roché is an outdoorsy person, with a love of camping and mountain biking, *"but nothing beats a proper braai with my friends."*

Fun fact: he has sleepless nights about the mysteries of the pyramids.

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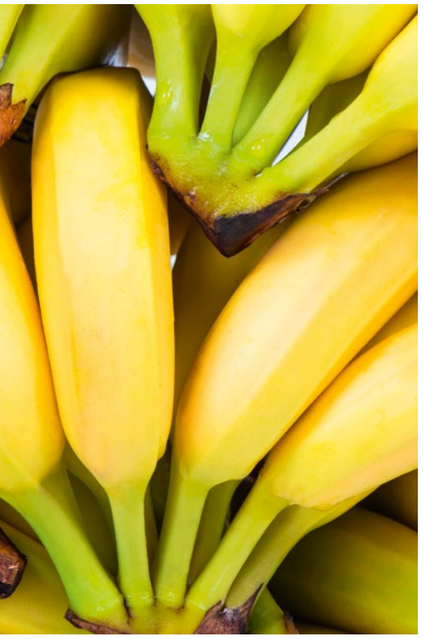
Feeding the plantation:

ADVANCED NUTRIENT MANAGEMENT AND SOIL HEALTH IN COMMERCIAL BANANA PRODUCTION

For commercial banana producers, maintaining consistent high yields and premium fruit quality isn't only desirable—it's essential. At the heart of any successful operation lies a deep understanding of how nutrients move through the banana plant, how they are lost from the system, and how best to replace them.

This article explores nutrient cycling, fertilisation strategies, and soil management practices that directly influence the success and sustainability of commercial banana plantations.



Main Function of Plant	
NUTRIENT	**FUNCTIONS**
Nitrogen (N)	Synthesis of proteins (growth and yield).
Phosphorus (P)	Cellular division and formation of energetic structures.
Potassium (K)	Transport of sugars, stomata control, cofactor of many enzymes, reduces susceptibility to plant diseases.
Calcium (Ca)	A major building block in cell walls and reduces susceptibility to diseases.
Sulfur (S)	Synthesis of essential amino acids, cystin and methionine.
Magnesium (Mg)	Central part of chlorophyll molecule.
Iron (Fe)	Chlorophyll synthesis.
Manganese (Mn)	Necessary in the photosynthesis process.
Boron (B)	Formation of cell wall. Germination and elongation of pollen tube. Participates in the metabolism and transport of sugars.
Zinc (Zn)	Auxins synthesis.
Copper (Cu)	Influences the metabolism of nitrogen and carbohydrates.
Molybdenum (Mo)	Component of nitrate-reductase and nitrogenase enzymes.

Table 1: *Table explaining the function of different elements in the banana plant - Haifa's Crop Guide: Banana fertiliser.*

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UNDERSTANDING NUTRIENT CYCLING IN BANANAS

Banana plants are unique in how they distribute and recycle nutrients. Unlike annual crops, bananas operate within a perennial mat system, where nutrients are shared between mother plants and developing suckers. Nutrients are not only stored in the fruit but throughout the plant, in the pseudostem, rhizome, leaves, and roots.

However, nutrients are constantly being depleted through fruit harvesting, leaching (especially during rainy seasons), and runoff. Potassium (K) is the most heavily removed nutrient, followed by nitrogen (N) and calcium (Ca). Research shows that between 45–55% of the plant's total nutrient content in N, P, K, and Ca is exported from the field with every harvested bunch *(Lahav & Turner, 1983)*.

Nutrient Uptake and Removal for 50t Yield (kg/ha)										
	N	**P**	**K**	**Ca**	**Mg**	**Fe**	**Mn**	**B**	**Zn**	**Cu**
Fruits (removed)	189	29	778	101	49	–	0.5	0.7	0.5	–
In plant	199	23	660	126	76	–	12	0.57	4.2	–
% of total	**49**	**56**	**54**	**45**	**39**	**–**	**–**	**–**	**–**	**–**

Table 2: *Shows the amount of nutrients removed from the field in the fruit and how much is recycled in the field through nutrients remaining in the plant material – Dr J.C. Robinson.*

This has serious implications for fertiliser strategies: if nutrients are not adequately replaced, soil fertility declines quickly — and so does yield.

LEACHING, RUNOFF, AND NUTRIENT LOSSES: WHY PRECISION MATTERS

Commercial banana plantations in tropical and subtropical regions are often exposed to heavy rainfall, which accelerates nutrient leaching—particularly in light, sandy soils with low organic matter. Under the worst conditions, up to 80% of applied nitrogen can be lost through leaching *(Stover & Simmonds, 1987)*.

Phosphorus (P), though less mobile in the soil, can still be lost through surface runoff, especially if fertilisers are applied on top of the soil or fields lack a mulched groundcover. Potassium is more stable but remains vulnerable in poorly managed systems.

To reduce nutrient losses and improve fertiliser efficiency, growers should consider the following practices:

- Promote strong root development by encouraging beneficial soil microbes and by controlling nematode pressure *(Obiefuna, 1990)*.
- Split fertiliser applications into smaller, more frequent doses to match plant uptake and reduce leaching.
- Apply mulch to reduce surface runoff and help stabilise soil moisture and temperature.
- Avoid concentrated fertiliser 'hot spots' by applying nutrients in a broad band around the plant base.

MAXIMIZING NUTRIENT RECOVERY THROUGH RECYCLING

Banana production generates large volumes of organic biomass, particularly from post-harvest pseudostems. For every tonne of fresh fruit harvested, an estimate tonne of dry matter can be returned to the soil as mulch—a rich source of recyclable nutrients.

In Uganda, a study showed that cutting senescent pseudostems at 1 to 1.5 m above ground allowed up to 61% of nitrogen and 55% of phosphorus to translocate to developing suckers within six weeks after harvest *(Wortmann et al., 1994)*. When pseudostems are chopped and mulched directly into the field, over 70% of nitrogen, potassium, and magnesium can be recycled into the soil within nine weeks.

These findings highlight the value of effective residue management.

By recycling plant biomass, growers can reduce fertiliser costs and enhance soil fertility. However, because the parent crop in a new planting is typically smaller and returns fewer nutrients to the system, it is recommended to apply more fertiliser to the first ratoon than to subsequent ratoons to compensate for this initial nutrient shortage.

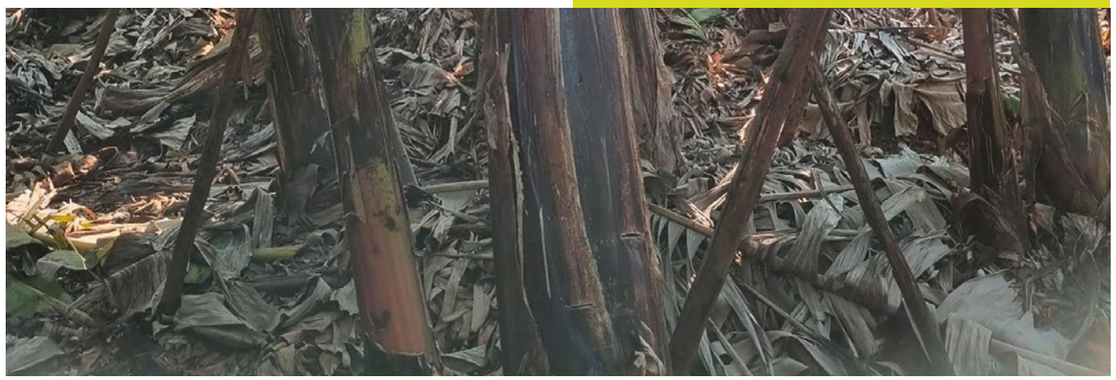

Image 1 *– Plantation in Mozambique. Photo credit: Tam Johnson.*

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TAILORED FERTILISATION STRATEGIES FOR HIGH-YIELD PRODUCTION

Fertiliser Placement and Timing

Fertiliser form and timing are critical to maximizing yield in banana production. Insoluble nutrients like phosphate, lime, and gypsum must be deeply incorporated into the soil before planting. In contrast, soluble nutrients such as nitrogen and potassium should be applied after planting through top dressing or fertigation *(Pattison et al., 2008)*.

For the plant crop, early nutrition is critical — especially for building reserves that will support the bunch later. In ratoon systems, where plants of various ages coexist, fertiliser timing should follow seasonal climate patterns rather than plant growth stages.

	N	P	K
YIELD/TARGET	**KG/HA**	**KG/HA**	**KG/HA**
30 t/ha	155	24	465
35 t/ha	180	27	540
40 t/ha	205	31	615
45 t/ha	230	35	690
50 t/ha	255	39	765
55 t/ha	280	42	840
60 t/ha	305	46	915
65 t/ha	330	51	990
70 t/ha	365	55	1095

Table 3: *Table depicting fertilising and expected yields in ideal conditions at different rates of NPK – J.C. Robinson.*

Delays in fertiliser application can drastically reduce yield. For example, a three-month delay in nitrogen application, has been shown to lower yield potential by over 40%, even if corrected later *(Obiefuna, 1984)*. Among all nutrients, nitrogen and potassium are the most critical, typically applied in a 1:3 N:K ratio. However, excessive nitrogen should be avoided, as it can promote lush, soft growth that makes plants more susceptible to pest and disease.

It is important to recognise that climate, soil type, and other environmental factors set the upper limit for banana yield. Fertilising for 60 t/ha when the agroecological conditions of the farm can only support 50 t/ha not only wastes money, but also increases the risk of nutrient leaching and environmental harm. Therefore, to farm profitably and sustainably, fertiliser inputs must align with the realistic yield potential of the specific site.

Application Frequency

Smaller, more frequent fertiliser applications are generally more effective in banana production, especially in light-textured soils or high-rainfall areas where nutrient leaching is a risk. In subtropical regions, fertiliser should be withheld during the coldest months, when banana plants become semi-dormant and stop producing new root tips, limiting nutrient absorption.

To match nutrient supply with plant demand, ***nitrogen should be applied*** *in at least eight small doses per year, and potassium in four or more split applications, timed to coincide with periods of active growth.*

PLANT ANALYSIS: A TOOL FOR INFORMED FERTILISATION

Tissue (leaf) analysis gives growers real-time insights into a plant's nutrient status, allowing for targeted adjustments to fertilisation programmes. Sampling should be standardised — typically using the third youngest fully expanded leaf from a flowering plant during late summer *(Lahav & Turner, 1985)*.

Several factors affect nutrient concentrations in plant tissue:

- **Leaf age.**
- **Seasonal changes** (e.g., lower concentrations in winter).
- **Environmental stress,** like heavy rainfall or disease pressure.

Plant analysis not only identifies deficiencies but also detects toxicities and allows early intervention.

Soil health is the foundation of fertility.

A healthy soil supports plant growth, nutrient cycling, water retention, pest suppression, and toxin filtration *(Magdoff, 2007)*.

However, modern intensive agriculture has caused serious degradation:

- **Excess P:** Suppresses beneficial mycorrhizal fungi *(Hayman, 1987)*.
- **Too much N:** Leads to soil acidification and aluminium toxicity *(Delvaux et al., 2005*).
- **Excess K:** Can reduce Ca and Mg availability *(Vimpani et al., 1991)*.
- **Pesticide overuse:** Accumulates heavy metals and disrupts soil biology.

Rebuilding Soils with Organic Matter

Adding organic material can restore soil structure and biological activity, while reducing erosion and nutrient loss.

Options include:

- **Animal manures:** Cow (20 t/ha), chicken (10 t/ha).
- **Compost:** Especially from banana residues; retains nutrients, suppresses pathogens, and improves water holding capacity.
- **Biofertilisers:** Including effective microorganisms (EM), *Trichoderma, mycorrhizae* and *rhizobacteria* to enhance nutrient uptake and disease resistance.

Organic inputs not only complement synthetic fertilisers but also pave the way toward integrated or even fully organic systems.

Commercial banana growers operate in high-stakes environments where nutrient mismanagement can lead to serious losses. Precision fertilisation, residue recycling, and soil health restoration are not just best practices — they're essential for sustainable, profitable production.

Incorporating science-based strategies into fertilisation programmes ensures not only higher yields but long-term viability of the plantation.

Image 2: *Ilanzi, Zambia taken by Martin Simumba.*

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Where have all my avos gone?

IMPROVING PACK-OUT PERCENTAGES IN AVOCADOS. UNDERSTANDING THE COST OF QUALITY LOSSES—AND HOW TO FIX THEM

INTRODUCTION

Global avocado production has experienced remarkable growth over the past decade, driven by rising consumer demand and the fruit's reputation as a nutrient-dense superfood. Yet, despite the increasing market potential, the industry continues to grapple with challenges that impact both productivity and profitability. From the nursery through to the packhouse, losses can occur at every stage of the value chain.

These losses – whether environmental, biological, logistical, or economic – can significantly reduce marketable yield and lower fruit quality.

Understanding the root causes of these losses is essential for growers, agronomists, and industry stakeholders committed to improving efficiency, pack-out rates and long-term sustainability.

This article highlights some of the most critical loss factors in South African avocado production, drawing from current data. Future articles in *Rooted* will focus on how to address them through technology, innovation, and best practices.

THE DATA BEHIND YOUR CROP

There's a well-known saying: *"To measure is to know"*. But measurement alone isn't enough – if data isn't converted into meaningful, actionable insights, it is difficult to use effectively. Thankfully, platforms like Source BI are bridging the gap by providing data from multiple packhouses in summarised, easy-to-under-stand formats.

Source BI's annual **Loss Factor Benchmark**, available to all SAAGA-registered growers, offers a detailed view of where and why avocado losses occur.

The 2024 benchmark includes data from the following packhouses:
Amondel Pakkers, Koeltehof Packers, Dole – Letaba Packers, TFFGSA – Polpak, Bassan, Mopanie, and Natal, Westfalia – Politsi and Tzaneen Fruit Packers.

The benchmark identifies the primary reasons why fruit fails to meet Class 1 or 2 standards for export, local retail, or ripe-and-ready markets.

The quantity (kg) of avocados delivered to the abovementioned packhouses, split between provinces are presented in ***Figure 1***. In ***Figure 2*** the pack-out percentage and the benchmark average are shown.

Figure 1: *Volumes packed at participating packhouses by region.*

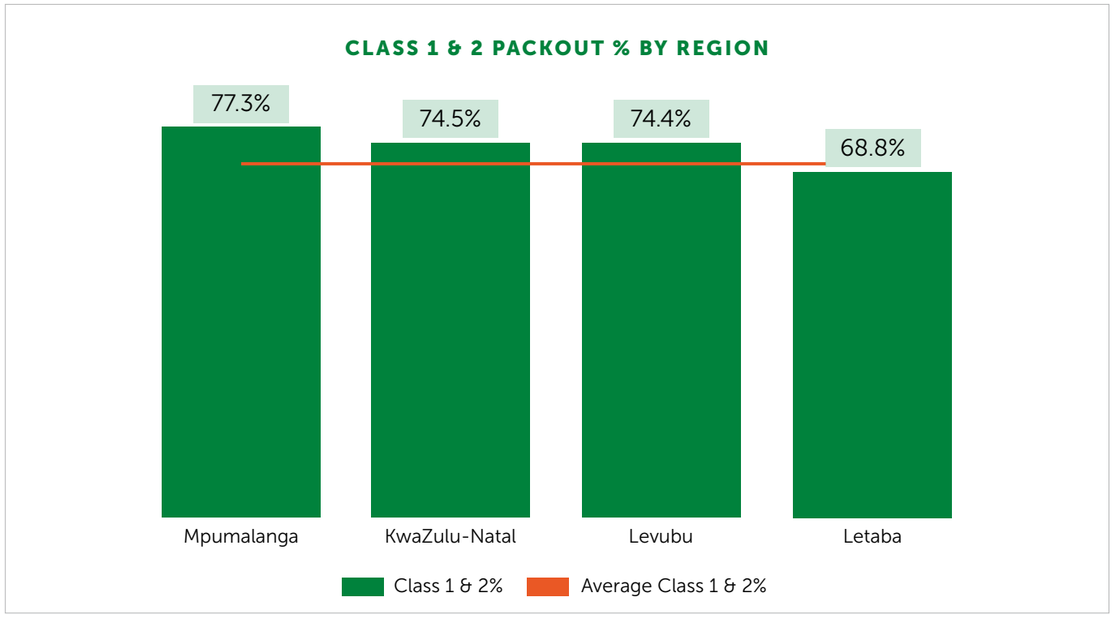
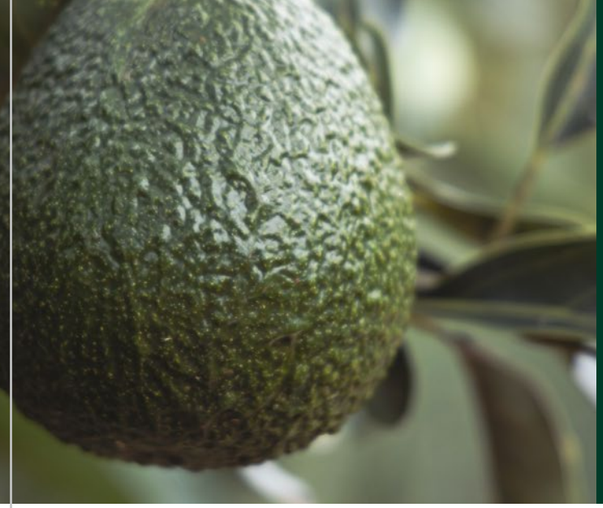


Figure 2: *Class 1 and Class 2 fruit packed by region at participating packhouses, expressed as percentage of total fruit delivered at packhouse.*



The Top 3 Loss Factors

Fortunately, Source BI's data provides clarity on the main drivers of these losses. Three factors alone account for nearly 60% of the total ***(Figure 4)****:*

Wind damage – 20.9%

Sunburn – 20.3%

Insect damage – 16.3%

PACK-OUT REALITIES AND REVENUE LOSS

The data shows a clear trend: on average, only 70% of fruit harvested ends up packed as Class 1 or 2 cartons. For an orchard producing 15 tons per hectare, that translates to only 10.5 tons per hectare being packed in premium-grade cartons. Let's be clear – achieving a 70% pack-out is no small feat. It is above global norms and should be celebrated.

However, it also means that 30% of fruit is diverted to lower-value channels due to various defects. The monetary impact of these losses is significant. A summary of average losses per ton – broken down by cultivar – is shown in ***Figure 3***.

The headline number? R16 291 lost per ton of avocados produced. That's not per hectare – per ton.

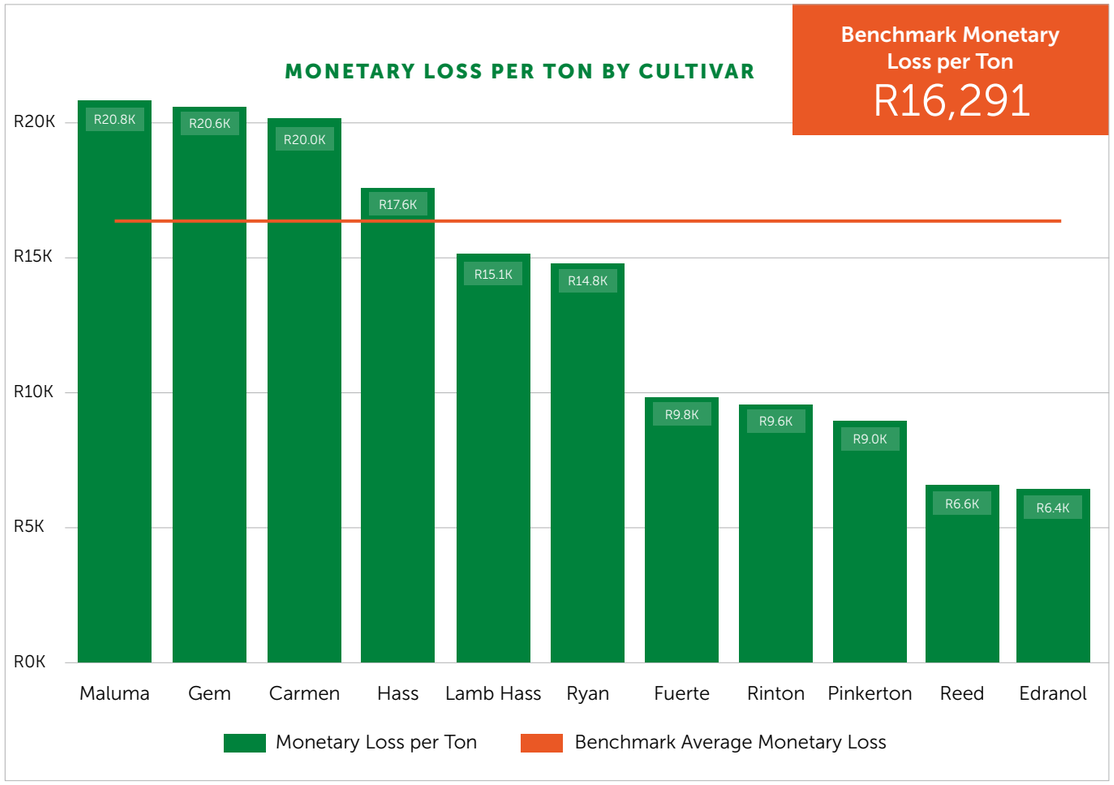


Figure 3: *Value lost per cultivar due to major loss factors and represents the difference between income potential between fruit sold as class 1 or class 2, and the value of class 3 fruit.*

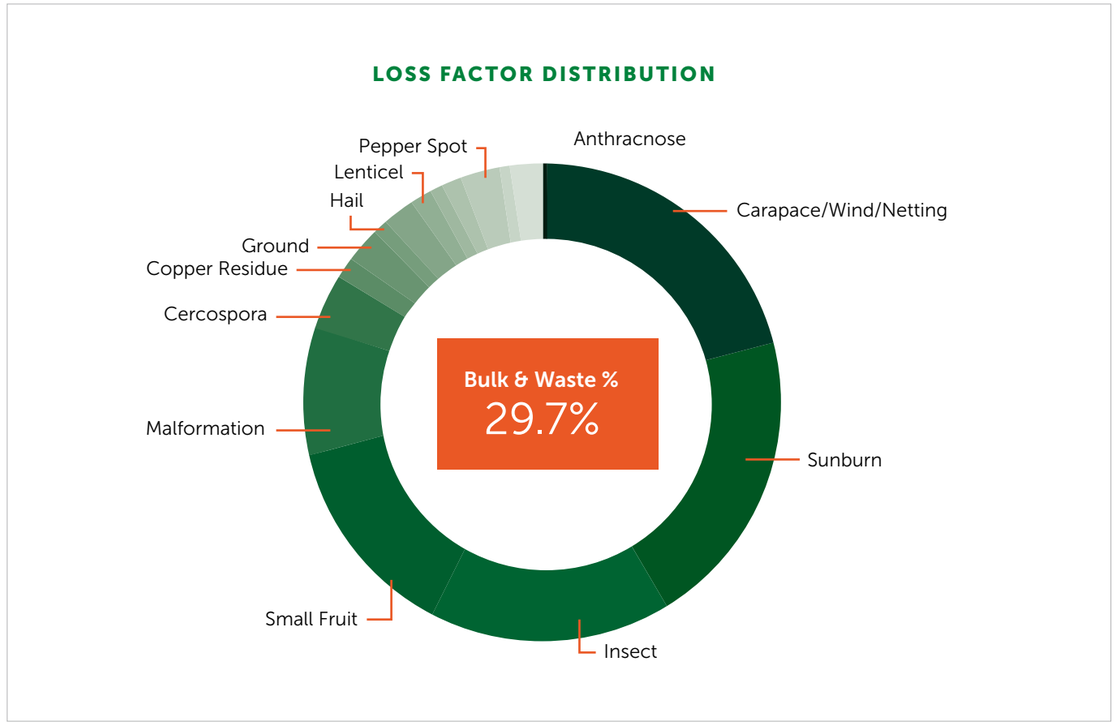


Figure 4: *The distribution of loss factors at harvest in the South African avocado industry.*

This is where the value of benchmarking becomes clear. With this information, farmers can now correctly target interventions. Instead of continually chasing higher yields, it may be more profitable – and more sustainable – to focus on improving fruit quality and reducing preventable losses.

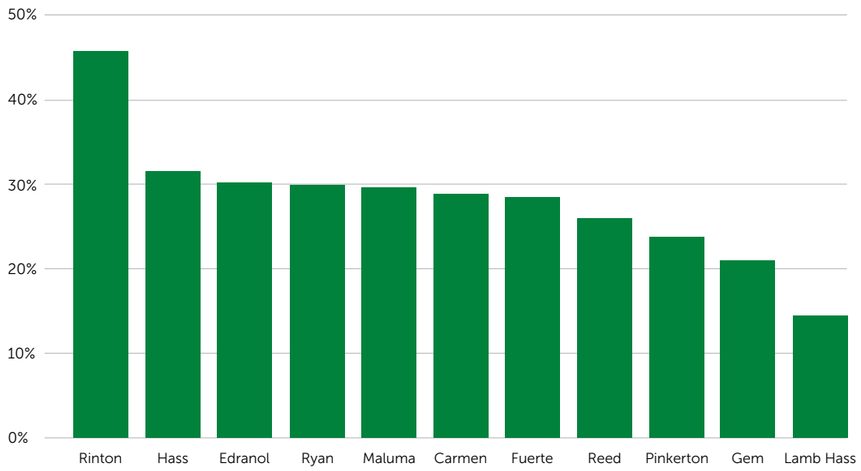
As we like to say in South Africa: *'n Boer maak 'n plan*. With the right information in hand, those plans can now be more focused, more efficient, and more rewarding.

SUMMARY OF LOSSES BY CULTIVAR 2024 SEASON

Total kg Delivered	Avg Class 1 & 2 %	Bulk & Waste %	Monetary Loss per Ton	Carapace/Wind/Netting %
65,636,115	70.26%	29.74%	R16,291	20.9%

Loss kg	Total Monetary Loss Value	Sunburn %	Insect %	Small Fruit %
19,518,163	R317,977,110	20.3%	16.3%	13.7%

Handling/Picking %
2.3%



REGIONS:
KwaZulu-Natal
Letaba
Levubu
Mpumalanga

sourcebi
AGRICULTURE DATA ANALYTICS

Figure 5: *Summary of losses per cultivar and the major causes of loss.*

WHAT'S NEXT?

Over the next few editions of *Rooted*, we'll dive deeper into these top three loss factors, including wind damage, sunburn, and insect damage, and explore practical solutions. We'll look at how technology, innovation, and strategic on-farm adjustments can reduce loss and improve pack-out percentages.

Thank you

A special thank you to Source BI for making the data available and for their continued contribution to the South African avocado industry.

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"Agriculture is our wisest pursuit, because it will in the end contribute most to real wealth, good morals, and happiness."

Thomas Jefferson

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Establishing young citrus orchards:

IRRIGATION, FERTIGATION, AND EARLY CARE GUIDELINES

Proper handling of young citrus trees before and during planting—especially transport, storage and planting techniques—is critical to long-term orchard success.

This article focuses on best practices for managing young trees after planting, with practical guidelines for irrigation, fertigation and early orchard care.

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IRRIGATION SCHEDULING

Irrigation is the most critical factor for successful orchard establishment after planting. Farmers must ensure that the irrigation system is fully functional, and that water is applied in the right zone, at the correct time, and in suitable volumes.

For drip irrigation, place emitters within 10 cm of the tree's trunk. This ensures water reaches the planting media (often coir) and penetrates the root zone. Due to the larger pore size of coir compared to the surrounding soil, water from the soil is unlikely to move into the coir—thus, targeted irrigation is essential.

Micro-sprinklers should also be placed 10–20 cm from the main trunk.

Drip-irrigated orchards typically require more frequent irrigation. In sandy soils during summer, daily irrigation may be necessary, while heavier soils (higher clay and silt percentage) may only require irrigation every second day. For micro-irrigation systems, intervals can be every 2–3 days, depending on the water-holding capacity of the soil.

The above irrigation guidelines is only a theoretical recommendation, and field observations are essential. Use manual field observations to assess moisture in the topsoil (20–40 cm depth). Aim to maintain the topsoil between a 3 and 4 (out of 5) feel test. Each irrigation event should reach a depth of 40 cm. Calculate the theoretical irrigation system run-time to achieve this and monitor irrigation depth to adjust if necessary.

It is important to monitor the subsoil using field observation tests as well to ensure it is moist, but not wet. Aim for a feel test on the drier side of 3 out of 5.

FERTIGATION

NITROGEN (N)

Nitrogen is crucial for vegetative growth in young non-bearing orchards. In micro-irrigated orchards, apply 35–45 g LAN (Limestone Ammonium Nitrate) per tree every two weeks.

If fertigating, choose the nitrogen source based on soil pH:

- **Low pH soils:** Prefer ammonium nitrate.
- **High pH soils:** Prefer ammonium sulphate.

Young trees benefit more from higher nitrate-N levels than older bearing orchards. Begin seasonal N applications in early spring, when soil temperature starts to rise, and taper off in autumn (April–May) depending on temperature.

Recommended seasonal rates:
110 kg/ha in tropical regions (e.g., Limpopo).
140 kg/ha in Mediterranean climates (e.g., Western Cape).

POTASSIUM (K)

Potassium is required in non-bearing orchards in small quantities. Granular potassium sulphate is the best form of K to apply on micro-irrigated orchards, whilst in drip-irrigated orchards a combination of potassium sulphate and potassium nitrate can be applied.

Recommended seasonal rates: 60-75 kg/ha can be applied throughout the growing season.

PHOSPHORUS (P)

Phosphorus stimulates root growth. Optimal root development and growth is especially important in young orchards. In micro-irrigated orchards, MAP (33) or Double Super Phosphate may be applied, whilst MAP (39) may be used in fertigation.

Recommended seasonal rates: 15 kg/ha.

MAGNESIUM (MG)

The soil magnesium content will determine whether magnesium should be applied or not. On heavier soils (Robertson, Southern Cape, Burgersfort, Letsitele and Northern Limpopo regions) where the soil Mg percentage may be quite high, additional Mg is not required. Foliar nutrient applications may be sufficient.

In the Citrusdal and Sandveld regions (Western Cape) and some areas in Nelspruit where soils are sandy and contain low Mg (percentage and ppm), it is advised to supply additional Mg, while also applying one to three Mg foliar nutrient applications during the growing season. In micro-irrigated orchards, magnesium oxide may be applied.

For fertigation, magnesium sulphate or magnesium nitrate may be used in drip-irrigated orchards.

Recommended seasonal rates: Depends on soil mineral analysis.

CALCIUM (CA)

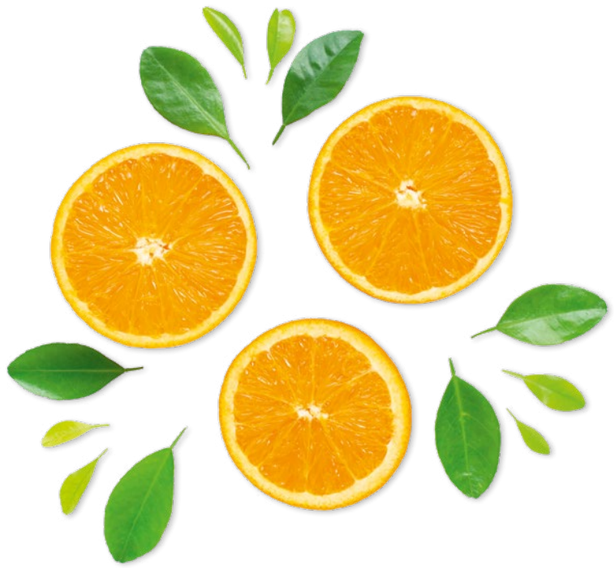
Calcium plays a big role in fruit rind integrity and is an important element in bearing orchards. However, calcium nitrate should be applied to young trees throughout the growing season as nitrate-N will encourage vegetative growth and Ca-levels (soil and leaves) should be maintained in a ratio to other cations (Mg and K). Calcium can also be helpful to maintain a good soil structure.

FOLIAR SPRAYS

Trace elements—manganese (Mn), zinc (Zn), boron (B), copper (Cu) and iron (Fe)—may be supplied using foliar applications and there are many different approaches and strategies when considering foliar nutrient applications.

Various foliar nutrient products are available for trace elements and macro nutrients, e.g., N, Mg and K. These products include traditional salt products ('straights') or several chelated options and forms are effective.

Apply foliar nutrients during flush periods, as elements are taken up best by new, young leaves.



PRUNING

While structural pruning is not recommended in the first season, some light maintenance is necessary. Remove water shoots—vigorous, abnormal shoots with large leaves and no side branching—that emerge either below or above the graft union. Also eliminate any growth from the trunk below 40 cm. Light skirting may be done if needed to aid airflow or prevent disease near the soil line.

MULCHING

Applying an organic mulch along ridges or within the planting rows can significantly improve soil water retention and enhance organic matter content.

In hot regions with sandy soils, mulching helps moderate soil temperature by keeping the root zone cooler during peak summer heat. This cooling effect promotes the development of feeder roots closer to the soil surface, improving both water and nutrient uptake.

Mulch also suppresses weed growth—particularly when applied at a thickness greater than 10 cm. However, care must be taken to keep mulch away from direct contact with the trunk. Prolonged moisture around the stem can create favourable conditions for diseases such as *Phytophthora* collar rot.

STEM PROTECTORS

Young citrus tree stems with small canopies are particularly vulnerable to sunburn, which can negatively affect early growth and development. It is advisable to install stem protectors that shield the trunk from the soil surface up to 40 cm high. In addition to providing sun protection, these guards also help prevent herbicide drift damage during weed control operations.

However, stem protectors can interfere with pest monitoring and chemical spray applications, allowing certain pests to hide or escape treatment.

When scouting for pests or diseases, ensure that areas covered by the protectors are regularly inspected.

Conclusion

Establishing a citrus orchard requires attention to detail in the first season, particularly regarding irrigation and fertigation. By closely monitoring soil moisture, applying nutrients strategically, and maintaining tree structure, growers can lay a strong foundation for healthy and productive orchards.

Integrated Pest Management in Citrus

A CHALLENGING START, BUT A SUSTAINABLE AND REWARDING APPROACH

Effective pest control in citrus orchards is no longer just about eliminating insects—it's about doing so responsibly, sustainably, and in a way that safeguards export potential. As global export regulations tighten and scrutiny around maximum residue levels (MRLs) increase, pest control strategies must evolve. Integrated Pest Management (IPM) offers a proactive, multifaceted solution to these modern challenges.

IPM combines several control methods, placing a strong emphasis on early detection and informed decision-making. Key components include regular scouting and monitoring, the strategic reduction of chemical inputs, increased use of biological control agents, and improved cultural practices.

SCOUTING AND MONITORING

Scouting is the cornerstone of any successful IPM programme. It should be conducted at least once per week in both random and allocated blocks. Trained personnel should be equipped with a pest identification manual, clipboard, magnifying glass, fruit knife and a standardised scouting form.

Supplementary tools such as insect traps can improve monitoring accuracy. For example, yellow sticky traps placed on the northern, sun-exposed side of the tree are effective for monitoring thrips, while yellow Delta traps baited with pheromone lures are used for false codling moth (FCM) surveillance. These tools can be utilised to help quantify pest populations and support timely, targeted interventions.

REDUCED CHEMICAL DEPENDENCY

Excessive or improper use of chemical pesticides contributes to insect resistance development, environmental degradation, and export limitations due to high residue levels. Markets such as the European Union (EU) enforce particularly strict MRLs, putting pressure on citrus producers to minimise chemical inputs.

Beyond regulatory concerns, chemical pesticides can impact human health and contaminate ecosystems. Integrating alternative methods—such as combining insecticides with horticultural oils—can enhance efficacy while reducing overall chemical use.

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Horticultural oils serve a dual purpose: *they act as adjuvants, improving spray coverage and absorption, and as insecticides by smothering soft-bodied pests like aphids, thrips and mealybug, and mites.*

INCREASED USE OF BIOLOGICALS

The adoption of biological products in citrus IPM programmes offers producers a strategic advantage. Unlike conventional pesticides, biologicals eliminate concerns about maximum residue levels (MRLs) on fruit, making them especially valuable for export-focused operations.

In addition, these products are safer for farm workers and the broader environment.

Various organisms can be used as biological control agents. ***Table 1*** *(below)* outlines some common examples.

BIOCONTROL AGENTS	EXAMPLES
Predators	Ladybugs, dragonflies, lacewings, pirate bugs, rove and ground beetles, aphid midge, centipedes.
Parasitoids	Ichneumonid wasps, braconid wasps, chalcid wasps, tachinid flies.
Nematodes	*Heterorhabditidae* spp., *Mermithidae* spp., *Rhabditidae* spp., *Steinernematidae* spp.
Bacteria	*Bacillus thuringiensis, Bacillus popillae.*
Viruses	Cytoplasmic polyhedrosis (CPV), granulosis (GV), and entomopox viruses (EPN.)
Fungi	*Metarhizium anisopliae, Beauveria bassiana, Trichoderma viride.*

Table 1: *Different types of biological control agents and examples of these agents.*
Source: *Biological pest control. In: New World Encyclopedia.*

In biological insect control, two key groups of beneficial insects are used: **predators** and **parasitoids**. Predators actively hunt and consume target pests. In contrast, parasitoids lay their eggs on or inside the target pest, ultimately leading to its death.

Both types of beneficial insects can be introduced into orchards to naturally regulate pest levels and support sustainable pest management.

Certain bacteria and fungi are used as biological control agents and can be applied either as foliar sprays or soil drenches, depending on the target pest and application purpose.

These microbial agents offer broad-spectrum pest management, effectively targeting various insects. For example, *Beauveria bassiana* and *Metarhizium anisopliae* are entomopathogenic fungi that infect and kill a wide range of pests, including thrips, aphids, mealybugs, and red spider mites.

Figure 1a: *Two-spotted ladybug (Adalia bipunctata) predator feeding on aphids. They can also feed on mealybugs, scales and spider mites.*
Source: *BioBee – BioAdalia.*

Figure 1b: *Parasitic wasp (Aphidius colemani) infecting aphids by injecting their eggs inside the aphids' body.*
Source: *BioBee – BioAdalia.*

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OPTIMISING CULTURAL PRACTICES

The value of sound cultural practices is often underestimated, yet they play a vital role in effective pest and disease management. In citrus production, these practices not only enhance orchard health and productivity but also support IPM principles.

***Proper pruning** improves light penetration, airflow, and fruit quality. It also facilitates better spray coverage and enhances the efficacy of applied chemicals. The removal of dead or diseased branches further reduces inoculum sources of various diseases.*

Good orchard **sanitation** is essential. The regular removal—at least once per week—of fallen, damaged, infected or decaying fruit from both the orchard floor and trees, is crucial for pest management.

By removing these fruits, you remove breeding and feeding sites—the source of infestation—for major pests such as fruit fly and false codling moth, both of which target decaying and ripening fruit as oviposition sites.

Well-maintained and properly calibrated **equipment** is essential for effective pest and disease control. Critical components—such as power take-off (PTO) settings, tractor speed, spray pump and filter efficiency, pressure regulation, nozzle type and arrangement, and flow rate—must be carefully designed and maintained. Calibration should be performed at the beginning of each season and monitored regularly throughout to ensure consistent performance.

Regular leaf and soil analysis allows for tailored fertiliser programs that meet the specific requirements of the orchard, improving overall **tree health** and resilience against diseases. Similarly, optimising irrigation—based on crop needs and environmental conditions—supports optimal tree vigour and reduces stress-related susceptibility to infestations.

Growers are encouraged to make use of the detailed guidelines and best practice resources available through the Citrus Research International (CRI) and Citrus Resources Warehouse (CRW). These platforms offer practical, evidence-based insights to help producers implement sustainable and effective orchard management strategies.

By optimising cultural practices, citrus growers not only improve immediate pest control outcomes but also contribute to a more resilient, productive, and ecologically stable agricultural system.

Choosing a litchi cultivar

TO EXTEND THE HARVESTING PERIOD AND EXPAND MARKET ACCESS

The South African litchi industry dates back to 1875, when the first trees were introduced from Mauritius. Since then, litchis have been established in regions with warm summers, frost free winters, and high humidity. These regions include KwaZulu-Natal and the Mpumalanga and Limpopo lowveld *(ARC-ITSC, 2010)*.

As of 2025, approximately 1389 hectares of litchis are planted, with Mpumalanga province accounting for the majority with 801 hectares (58%), followed by Limpopo province with 426 hectares (31%), particularly in the Letaba region, which includes Tzaneen and Letsitele. Despite this established footprint, the South African Litchi Growers Association reported no new plantings as of 2023, suggesting a plateau in expansion *(SALGA, 2025)*.

South African litchis are marketed through a range of channels, including processing, municipal fresh produce markets, informal (bakkie) trade, direct sales, and exports. A breakdown of the 2023–24 season's market distribution is presented in ***Figure 1***.

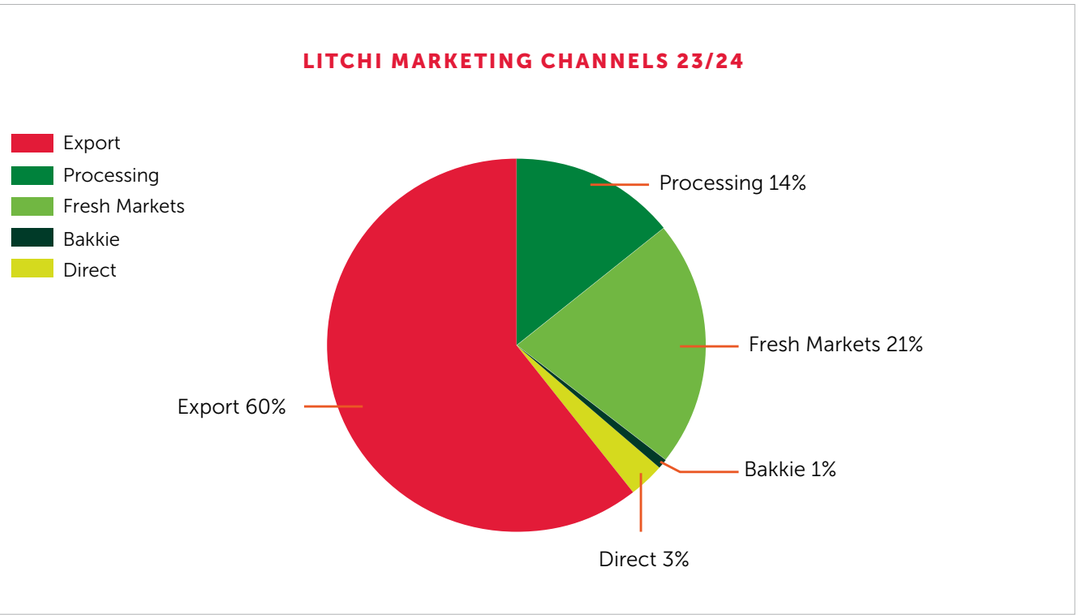


Figure 1: *The various marketing channels for Litchis in South Africa (SALGA, 2024).*
**Undeclared sales not included.*

Despite no significant new plantings reported since 2023, litchis continue to enjoy strong consumer appeal due to their sweet, floral taste and unique eating experience. The South African litchi hold a good reputation in international markets. According to *Nelson (2024)*, European wholesalers regard South African litchis as being of superior quality compared to other Southern Hemisphere suppliers. With a large portion (60%) of South African litchis destined for export, it is important to maintain this high quality and market reputation.

Approximately 58% of exported South African litchis end up in the EU, 21% in the United States, 16% in the United Kingdom and the remainder in the emerging markets such as Russia, Canada and the Middle East *(Dube, 2025)*. Continued access to these markets is essential, particularly as trade uncertainty with the United States—currently the second-largest export destination—raises the risk of future disruptions. As a result, expanding into new markets has become just as important as maintaining traditional ones.

Strategic export growth can be achieved in three key ways: (1) aligning supply with peak demand periods, such as Chinese New Year; (2) producing fruit from cultivars that meet specific market preferences and standards; and (3) ensuring consistent supply of quality fruit when competitors are not in the market. As highlighted in early South African litchi research, the selection and establishment of high-quality, well-adapted cultivars that mature outside the main harvesting window of other Southern Hemisphere producers remains vital *(Oosthuizen, 1998)*.

In the South African domestic market, a 1 kg box can fetch over R100 outside of the peak harvest window, while a 2 kg box typically sells for R130 to R140 during peak harvest season *(Coleman, 2024)*. This makes litchi production an attractive option for both established and aspiring growers. Profitability increases significantly when export opportunities are utilised.

However, a key factor that influences the economic potential of South African litchis—especially in traditional markets such as Europe—is the timing of harvest. When the local crop ripens simultaneously, it leads to market saturation. This challenge is compounded by volumes from other Southern Hemisphere litchi producers, resulting in a litchi surplus *(Froneman et al., 2001)*.

To ensure long-term growth and profitability, the South African litchi industry should actively encourage broader participation in litchi production. Capitalising on the lucrative export market—while still servicing the vital domestic segment—requires having the right cultivars at the right time. This begins with informed cultivar selection.

Right Image: *A bunch of litchis ready to be harvested – Fay Zee Siu variety.*

Several promising cultivars, oftentimes historically underutilised, could potentially extend the South African harvest window—from very early to relatively late in the season *(Snijder, 2024)*. By diversifying the cultivars, producers can better align harvest timing with global demand trends. This may improve consistency of supply to key markets such as the US—provided continued access—and create new opportunities in emerging markets across the Far East and Middle East. India is also being actively pursued as a potential export destination for South African litchis *(Snijder, 2024)*.

Ultimately, the industry's strategic objective should be to shift production of litchis into periods of lower global supply and higher market demand to optimise returns to the grower *(Froneman et al., 2001)*.

In South Africa, litchi production is dominated by a few well-established cultivars. The distribution of these cultivars, as reported to SALGA, is shown in ***Figure 2***.

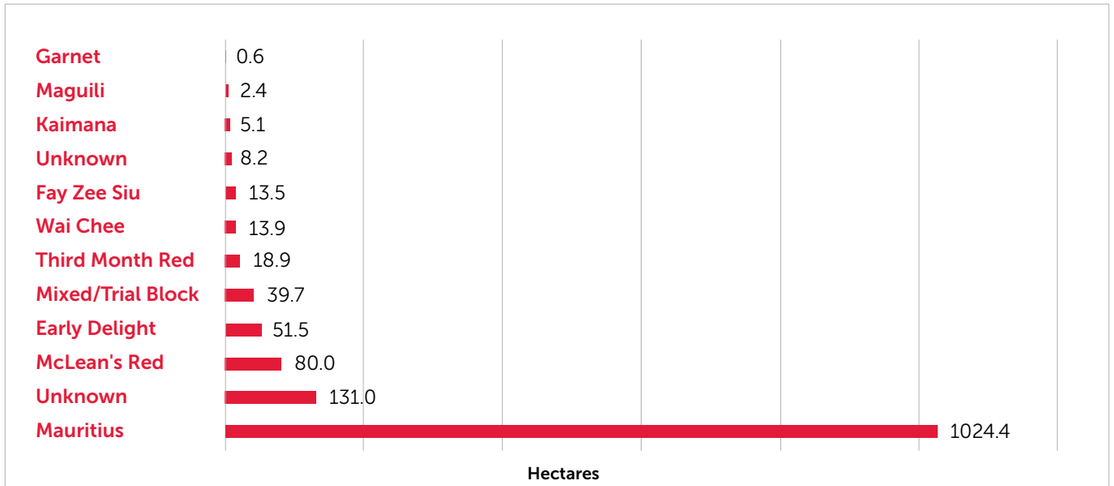


Figure 2 : *The distribution of litchi cultivars across all production regions of South Africa (SALGA, 2025).*

The most widely planted litchi cultivar in South Africa is 'Mauritius', occupying 1024 ha—around 74% of the country's total litchi production area. 'McLean's Red' follows as the second most known planted cultivar in South Africa, with around 80 ha.

'Mauritius' is known for its excellent eating quality and high yields during "on" years, though it is prone to alternate bearing. It is a mid-season cultivar, typically ready for harvest from the second week in December. Unfortunately, this coincides with peak production from many other Southern Hemisphere countries, as well as South Africa's December school holidays—posing logistical and security challenges for producers. Orchards left unattended during this time are particularly vulnerable to theft, as heavily laden trees may prove too tempting for unwanted visitors.

'McLean's Red', although a later cultivar, also suffers from alternate bearing. It is further limited by its poor seed-to-flesh ratio and short shelf life, reducing its appeal for export.

In response to these limitations, the ARC-Institute for Tropical and Subtropical Crops (ARC-ITSC) initiated a breeding programme in 1992. This programme facilitated the selection and evaluation of promising cultivars—both locally bred and imported— across multiple trial sites *(Rheeder and Froneman, 2000)*. The goal has been to identify cultivars with improved characteristics that address timing, quality and market preference challenges *(Froneman and Sippel, 2015)*.

Figure 3 summarises some of the traditional and promising cultivars, including their harvest periods.

While 'Mauritius' is displayed across all production regions, the other cultivars are based on trial data from Nelspruit.

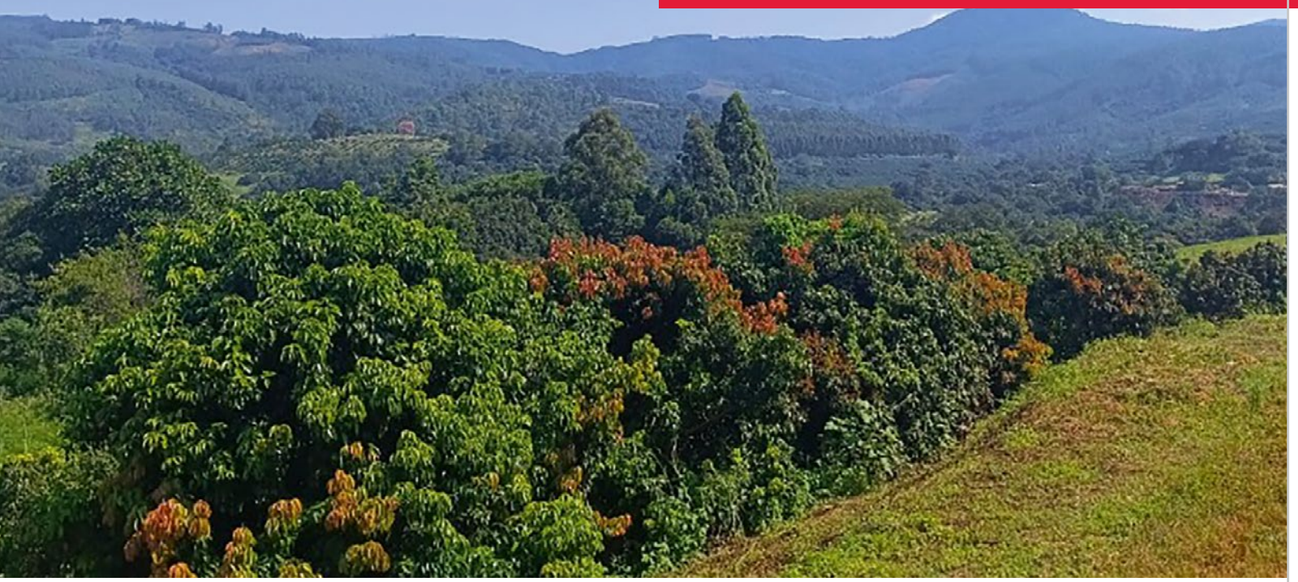
As a general rule, litchi maturation is delayed with increasing latitude and altitude. This allows even a single cultivar, such as 'Mauritius', to be harvested over an extended period due to the natural variation in topography across litchi-growing regions in South Africa *(Froneman and Sippel, 2015)*.

LITCHI CULTIVAR HARVEST TIMELINE

CULTIVAR	HARVEST PERIOD (NOV - FEB)				FRUIT CHARACTERISTICS	GENERAL COMMENTS
	NOVEMBER	DECEMBER	JANUARY	FEBRUARY		
Mauritius					Medium to large. Up to 10% chicken tongue seed.	Alternate bearer, excellent eating quality.
Souy Tung					67% aril. Thin skin and firm flesh.	Early season, bright red skin.
Fay Zee Siu					Soft, juicy, fragrant. High flesh %, small seed.	Green skin when ripe. Popular in Europe.
Hung Long					High flowering and fruit yield, sweet pulp.	Earlier than Mauritius.
Garnet					Crisp and sweet.	High yielding, good flesh recovery.
McLean's Red					Soft, sweet and juicy.	Attractive red coloured fruit.
Chakrapad					Fragrant taste, thick skin, slightly acidic.	Potentially heavy bearer.
Shuangbaili					Juicy flesh.	Chicken tongue seed.
Maguili					Sweet taste.	Late variety, yellow skin colour.
Tibby Selection					Small to medium fruits, aromatic and sweet.	Late variety, similar taste to Wai Chee.
Goose Egg					Large, heart-shaped. Juicy and flavourful flesh.	Very thick skin. Low yielding.
Chompogo					Juicy flesh and pleasant taste.	Small seed, thick skin, easy to peel. Good yielding.
Wai Chee					Sweet, aromatic, and flavourful.	Most popular Chinese cultivar. Good eating quality, consistent flowering and cropping.

Figure 3: *A summary of traditional and promising litchi cultivars currently available.*
Source: *Litchi cultivar information kindly provided by the ARC-Institute for Tropical and Subtropical Crops (ARC-ITSC), Nelspruit.*

"By introducing a broader range of early- and late-maturing cultivars, South Africa's litchi production season can be effectively extended—reducing overlap with competitors and improving market access and returns." (Froneman and Sippel, 2015)



Above image: *A litchi orchard in George's Valley, Tzaneen.*

THE OPPORTUNITY

There is no one-size-fits-all approach when it comes to selecting a litchi cultivar. As with all fruit crops, the choice must be guided by the intended market, the producer's capabilities, the local environment, and personal preferences. Careful consideration of these factors is essential to making an informed and sustainable decision—one that lays the foundation for long-term success in litchi production.

Selecting the right cultivar, or combination of cultivars, can help ensure consistent access to both local and international markets, enhance profitability, and support the growth of a resilient and competitive litchi industry in South Africa. While well-established cultivars such as 'Mauritius' and 'Wai Chee' are widely available and reliably propagated, *Du Roi Multiplant* is also actively increasing propagation material of the other promising cultivars. This positions *Du Roi Multiplant* as a reliable partner in supplying top-quality litchi plants tailored to the needs of both new and established litchi growers.

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