

2016

HORTGRO SCIENCE

TECHNICAL SYMPOSIUM

“EFFICIENCY THROUGH
THE VALUE CHAIN”

SUMMARY REPORT



HORTGRO SCIENCE
www.hortgro-science.co.za
+27 (0)21 882 8470/1

HORTGRO
www.hortgro.co.za
+27 (0)21 870 2900



CONTENTS

Introduction: HORTGRO Science Technical Symposium 2016 <i>“Efficiency through the Value Chain”</i>	5
Cautious Optimism: Politics & Climate Change	6
Make every drop count: Drought 2016: what does the future hold?	11
‘Intelligent Irrigation Key’	15
“Technology will never replace a farmer”	16
“The rain in Spain stays mainly on the plain” – <i>Learning from an irrigation expert about what to do when it doesn’t rain in Spain</i>	17
Dam Building 101	20
In search of <i>the apple</i>	21
Not Chilled Enough	23
Utopian options for nurseries	24
Tissue culture takes root	25
Cantankerous Nursery Trees	26
Biological control: Monitoring mites into oblivion	28
Optimising spray efficiency	29
Carbon dioxide (CO ₂) and the story of an apple producer’s worst nightmare	29
Playing it safe with DPA	31
There is life after DPA for ‘Packham’s Triumph’ pear exporters	33
To Cool or not to cool?	34
The good, the bad and how to save us from the ugly...	36
CATTS, Vapormate® show promise in postharvest pest control	37
FCM: “Full frontal” attack needed	39
Become a Pruning Connoisseur	40
Photo Page	42
Sponsors	44

HORTGRO Science Technical Symposium 2016

“Efficiency through the Value Chain”

WITH five days, 55 speakers, 28 sponsors and exhibitors, and more than 711 people attending six events – records were yet again shattered at the annual HORTGRO Science Technical Symposium that took place at Allée Bleue, Groot Drakenstein, during the first week of June this year.

The symposium themed ‘Increasing Efficiency along the Value Chain’ focussed on industry problems, technical challenges, opportunities and new research in the deciduous fruit industry. This year delegates from as far afield as Botswana, Limpopo, Mpumalanga, Free State, Eastern Cape and Western Cape attended the event which has its roots in the Cape Pomological Association. It has grown into its current format over several decades, changing slightly this year with two new attachments: a ‘new era grower’ day and a postharvest day.

“This year we decided to consolidate our different events into one focussed action with the objective of growing the symposium into the premium event of the year. Thereby creating opportunities for growers from other regions to get the full package from pre-harvest to postharvest, increasing the exposure for exhibitors and sponsors, showcasing our research, broadening the attendance and increasing the interaction between the different role-players in the deciduous industry,” said Hugh Campbell, HORTGRO Science General Manager.

‘NEW ERA’

Several role-players, including the Western Cape Government’s Department of Agriculture, congratulated HORTGRO with the ‘back to basics symposium’ that catered for emerging growers.

Pitso Sekhoto, Free State grower and Deciduous Fruit Development Chamber (DFDC) Chairman, said that it was a pleasure to be at an agricultural event and see such a good mix of black and white together. “The Chamber’s goal is to transform the industry and when we mix like this we share experiences, learn and make business.”

“We are not here today for the food or for social services, we are here today for one reason only and that is to grow our profit and grow our businesses. We are partners in the game of developing this industry.” - Pitso Sekhoto

PICTURE FROM LEFT: Pitso Sekhoto (DFDC Chairman), Mariëtte Kotze (HORTGRO Information Manager), Hugh Campbell (HORTGRO Science General Manager), and Dr Job Mthombeni (Day 1: Session 1 Chair and Limpopo Grower).



Cautious Optimism: Politics & Climate Change



"IN South Africa, good news lurks behind bad news," political analyst Max Du Preez (photo left) told growers and industry players on the opening day of the HORTGRO Science technical symposium 2016. Delegates had reason to be cautiously optimistic as Du Preez gave broad insight into the major political and economic issues facing the industry and South Africa at present. He said South Africa's greatest asset was that it was still an open society "on the level of big Western democracy".

"In the study of failed states... an open society never becomes a failed state."

Du Preez went on to list several "assets" which put SA in a favourable position. "We do not have tribal, ethnic, or regional conflict...we have no terrorism in our society... we have no religious fundamentalism in our society... we have remarkable infrastructure... we have our constitution that is intact... our judiciary is independent and functional... and our military is apolitical and they serve the government of the day."

Du Preez further said that South Africans were "overreacting" to the Land Expropriation Bill. "We are a constitutional democracy. You cannot make an act in Parliament that is contrary to the spirit and letter of the constitution," he said. According to Du Preez the bill might go through the constitutional court where a few definition changes would be a likely scenario.

"It is not bad legislation – it is legislation we need," he said. He emphasized that land was not an agricultural problem, but a political one and that the "give our land back" narrative was a myth.

He said only one-third of black South Africans expressed a desire to own agricultural land. The economic shockwave brought by the 9 December 2015 shuffling of finance ministers was a "bad day for our economy, but a brilliant day for our democracy", according to Du Preez.

"It brought about the realisation that the economy is real, and if you upset it you will feel it the next day."

CLIMATE CHANGE

While Du Preez expressed optimism in terms of South Africa's functioning constitutional democracy, climate change experts were more conservative in their assessment of environmental challenges facing the sector in the future.

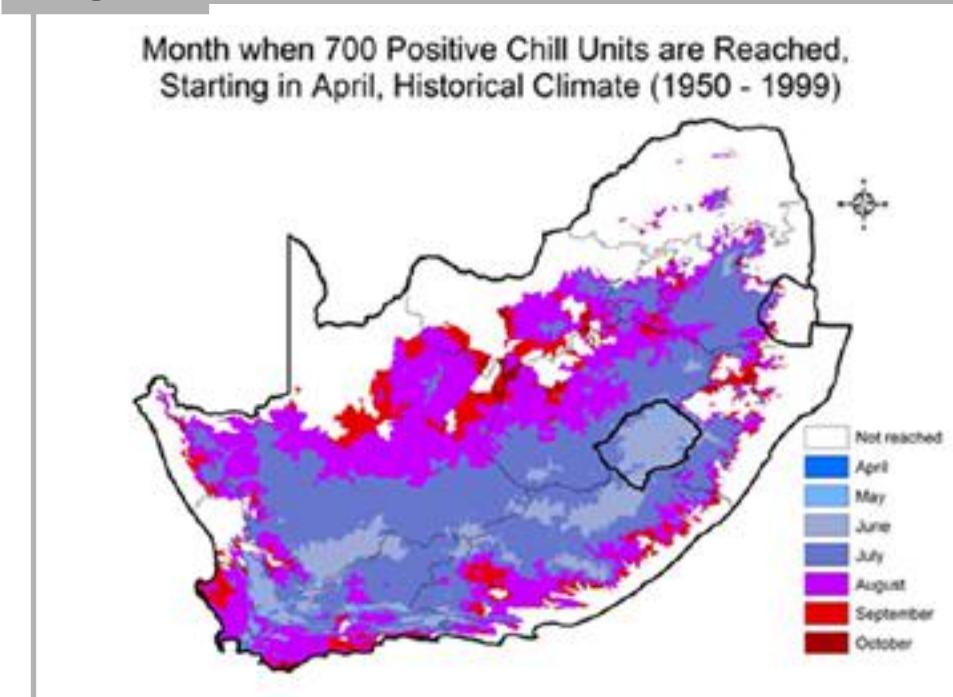
Prof Roland Schulze from the Centre for Water Resource Research at the University of KwaZulu-Natal said that 2015 was the hottest year on record globally, while April 2016 was the hottest April on record.

Schulze said that there was an urgent need for localised climate models and that farmers needed to consider what they would grow and where.

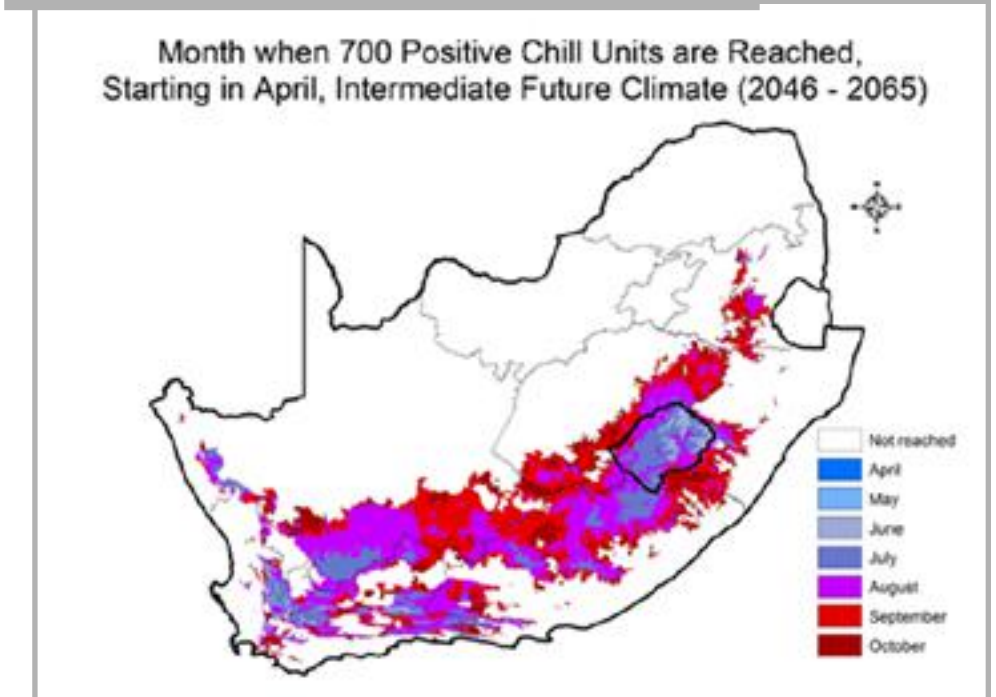
"Push" events would see a shift in the timing and geographical range of rainfall and temperature, while "pulse" events would reduce days with frost, alter times when the critical number of chill units are reached, and cause additional hot days.

Schulze illustrate his argument by comparing the current 'chill unit' situation with what it would possibly look like in forty years from now. The implications are that we could see a shift in production areas and new varieties being planted.

NOW



40 YEARS FROM NOW



"In leaving our carbon footprint everywhere, I hope this is a wake-up call to farmers, researchers, policy-makers and funders alike."

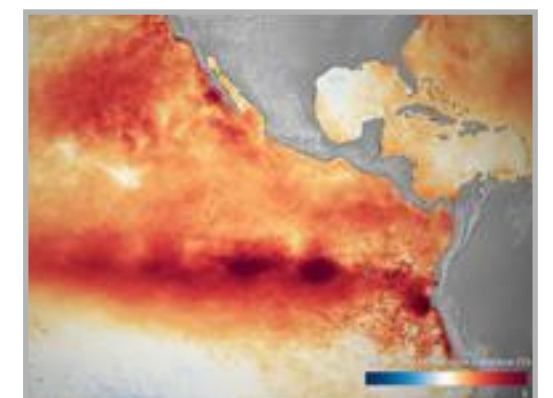
POSSIBLE SIGNS OF CLIMATE CHANGE



More severe storms such as this thunderstorm in Durban on 11 December 2009.



More frequent brushfires such as these in March 2015 in Cape Town.



Global warming cause more intense El Niños.

The Western Cape would see warming of between 1.5-3.0°C by 2050, according to **Prof Stephanie Midgley** from the Department of Horticultural Science at Stellenbosch University.

According to Midgley growers in the region would experience "more hot days, fewer cold days", "reductions in winter rainfall", and a decrease in positive chill units.

This could have consequences for fruit growers who would need to plant heat resistant cultivars and use scarce resources, such as water, more effectively.

Midgley said fruit production would remain viable in the Western Cape, but water was a key issue. "In 2015-2016 we saw the worst drought in 30 years, with unnaturally high temperatures," she said. The drought combined with fire damage resulted in losses of R720 million to the wine/fruit industry.

She then highlighted climate shifts in the Western Cape over the past fifty years such as rising temperatures (1°C warming); a reduction in rainy days from Jan-April and August; an increase in rainy days in Nov-Dec in the west; a shift towards a later start of the rainy season and a wetter late season; a decrease in positive chill units. According to Midgley urgent action was needed in the agricultural sector to adapt to the unavoidable impacts of climate change, and reduce its greenhouse gas emissions.

So what can fruit farmers do to adapt?

Midgley's 11-point list:

- Better site preparation and soil management
- Better cultivar and rootstock choices; plant material
- Efficient training systems and canopy management
- Better water management
- Precision farming and fine-scale mapping: Cape Farm Mapper, FruitLook, drones etc.
- Shade netting
- Rest-breaking agents
- Integrated pest and disease management; understand the importance of bees
- Risk reduction & management
- Monitoring and data management
- Market intelligence: global climate change impacts

She also urged growers to make smart cultivar choices:

- Cultivars with lower chill requirements
- Red/blushed cultivars/strains which are less sensitive to high temperatures
- Cultivars/strains which are more resilient against sunburn
- Cultivars/strains with good fruit size distribution
- Make use of very early or very late cultivars to avoid mid-season climate stress
- Cultivars with markets for Class 2 and 3 fruit
- Genetic stability can be compromised under conditions of stress. Great care should be taken when selecting and propagating red/blushed strains. Resilience to colour loss and sunburn, together with chilling requirement, will become ever more important as cultivar criteria.

"The quality of plant material will become a crucial factor, in negotiating the effects of climate change."

"Growers would be wise to use improved robust strains and stay away from old, sensitive ones. Plant healthy certified trees that have healthy root systems and are disease-free. Remember that poor quality trees are more susceptible to climate stress," she said.

Where water management is concerned Midgley urged growers to: maintain water infrastructure and reduce water loss; pay attention to drainage and run-off management; make sure you manage on-farm wetlands, river banks including alien plant clearing; have a farm drought plan.

"Climate change will have different impacts in different regions," she said. "Therefore, building infrastructure is not always the solution. Adaptation must also include more efficient use and improved catchment management."

Midgley concluded that every production manager and technical advisor needs to engage with the following five fruit business needs:

- Knowledge and strategic research
- Adaptive technologies
- The business case for adaptation
- Forward planning
- Monitoring, analysis and adjustments

To learn more about Midgley's SmartAgri approach for deciduous fruit growing visit www.greenagri.org.za. Read Midgley's article in the June/July edition of the **SA Fruit Journal**, pg. 70-72.

PICTURE FROM LEFT: Anton Rabe (HORTGRO Executive Director), Prof Stephanie Midgley (Department of Horticulture, Stellenbosch University), Prof Roland Schulze (Centre for Water Resource Research at the University of KwaZulu-Natal) and Hugh Campbell (HORTGRO Science General Manager).



“As Darwin said, it is not the strongest of species, nor the most intelligent of species, that survives. It is the one most adaptable to change.”

Make every drop count

DROUGHT 2016: WHAT DOES THE FUTURE HOLD?

“PERCENTAGEWISE the rains received since Easter 2016 have done very little to the drought situation in the Western Cape and to dam levels in the province in particular. This is according to André Roux (photo right), the Western Cape Department of Agriculture’s Director: Sustainable Resource Management.

The Clanwilliam Dam is one of the few that saw a significant increase of almost 7% in its water levels within a few weeks. This is thanks to some good rain in the Cederberg, but also the fact that the dam’s storage capacity is only 25% of the mean annual runoff. By the end of May, however, Clanwilliam Dam was still only 15.3% full.

“Our soils and catchment areas are simply too dry to allow runoff,” says Roux, who highlighted that the drought currently being experienced in South Africa is the worst in 112 years. “We need significant rain spread over a long period to significantly impact our water supply situation.”

He provided the gathering with an informed perspective on the future of irrigation in the Western Cape, and about the water sources that will be available to fruit farming endeavours by 2035.

“Making predictions about water in South Africa can land one in hot water,” he started off on a provisory note. He highlighted that much depends on the percentage of the total water supply that is available that government will allocate to agriculture, and especially in times of drought.

“South Africa is a semi-arid country where water is of critical strategic

importance. It has a potential limiting effect on all future development of the country,” he warned. “High population densities and significant competition of available water resources exaggerates this situation.”

According to Roux, agriculture is at 60% by far the biggest water user in the Western Cape. Urban development uses another 24%. “If there is water shortage, agriculture is the sector where government will come looking first to cut back supply,” he said. He therefore urged the audience to work better with the resources at hand, to react timeously and to be innovative in their approach to water usage and management.

He said that by polluting water and allowing infrastructure networks to deteriorate, humans are further reducing the resources available to them and thus increase the risk of assurance of water supply.

“As Darwin said, it is not the strongest of species, nor the most intelligent of species, that survives. It is the one most adaptable to change.”

Roux noted that according to the Water Act of 1998, a certain amount of water must always be set aside as an ecological reserve to ensure that environmental processes are able to function well.

“By 2025, all our water resources will be fully utilised,” he continued.



“This includes all water that will be stored up in the newly planned dams and transfer schemes.”

“Remember, no new water sources are ever created,” Roux cautioned. “In fact, we are using the same water that was

available the time of the dinosaurs. This limited supply is recycled all the time.” He highlighted the need to improve efficient resource management and use to mitigate the increasing impacts of change.

Working better with water at hand

Innovation is ‘key’ to mitigating the possible impacts of climate change. Roux advises the agricultural sector to:

- Optimise irrigation water to mitigate the impacts of climate change against the need to expand enterprises
- You cannot manage what you do not measure. Know how much water your crops use to ensure high water productivity and ultimately food security.
- Carry out irrigation scheduling as accurately as possible to limit water loss. This could save you up to 20% in water usage.
- Increase the beneficial consumption of water i.e. the water used for crop transpiration and reduce the non-beneficial consumption of water i.e. surface runoff and deep percolation
- Understand the water/yield relationship of their crops. This will allow deficit irrigation.
- Consider a combination of minimum or no-tillage, retaining crop residue on the soil surface, using mulch and crop rotation. These methods help to hold water in the soil and reduce evaporation.
- Try to produce more ‘crop per drop’.
- Work carefully with the sources at hand, and do not pollute these by simply dumping unwanted materials into rivers or streams.
- Save on your electricity consumption. At least 1.35 litres of water is needed to produce 1 kWh of electricity.
- Keep infrastructure in good order. Leaking pipes or broken channels come at a price.
- Remove alien plants in catchments and rivers, which could use up to 7% of our available water resources.
- More than 50% of wetlands have already been destroyed due to irresponsible human activities. Wetlands are important to help clean water. They temporarily store water that is released over time into streams and rivers.
- Start implementing SmartAgri, a combined effort of the Western Cape Department of Agriculture and the Department of Environmental Affairs and Development
- Planning. It aims to inform the agricultural sector about the possible impacts of climate change and mitigating measures. Visit www.greenagri.org.za for more info.

Did you know?

- On average, South Africa receives 465mm of rain per year. The annual world average is 857mm.
- 90% of rain in the Western Cape falls in winter, when the demand is actually for only 25%. The rest falls in summer, when the demand is 75%. Therefore winter surface water runoffs need to be stored in dams to ensure availability for irrigation in summer – and all the more so as the impact of changing weather patterns are being felt.
- Only 1% of all water on earth is available for use and need to be shared across all water user sectors i.e. agriculture, industries, domestic, electricity generation and the ecology. The rest is sea water (97%) or trapped in the polar caps (2%).

“The highest temperature ever recorded on earth for the month of October – a sweltering 48.3 degrees Celsius – was measured in Vredendal on 27 October 2015. It caused an estimated R10 million loss to the local wine and table grape industry.”

The current drought situation: The state of the Western Cape’s dam levels

	30 May 2015	30 May 2016
Greater Brandvlei	31,5%	17,9%
Theewaterskloof	50,6%	29,4%
Voëlvlei	42,3%	21%
Clanwilliam	8,7%	15,3%

SOURCE: Department of Water and Sanitation



‘Intelligent irrigation key’

“THE role of the modern irrigation system is much more than just giving water to fruit trees. Implementing new technologies to make money is a continuous effort for any innovative fruit grower and key to profit is effective water management.”

This was the message from private irrigation consultant, Gerhard Mostert (photo right), who urged growers to seriously consider implementing a Centralised Low Flow Irrigation System (CLFIS).

The CLFIS gives the grower ‘centralised control’, ‘dedicated mainlines’, ‘low flow drippers’, and full automation. Ultra-low drip irrigation technology will not only save water, but it entails applying water to soil at a rate that optimises oxygen and water levels in the root zone – making it more energy efficient. “It could revolutionise the irrigation of fruit trees,” Mostert said.

The low flow dripper is the key aspect of the system and is characterised by the emitter’s ability to release water at a rate of less than 1L per hour which scales to less than 3m³ per hectare per hour.

Mostert says the system provides water at the same rate that the plant is using it and “brings a whole new dimension” to irrigation, as the type of soil now becomes one less factor to be concerned with in the grower’s irrigation plan. Growers who implement a CLFIS will also benefit from complete irrigation flexibility, according to Mostert. Growers have the option to irrigate just one block at a time or the whole farm.

Growers might be faced with a situation where they may want to irrigate 1

orchard block that uses 2.5 m³ of water per hour, while at other times there may be a need to irrigate the entire field with say 100 m³ per hour. Hence the system should be able to handle variation of between 2.5 and 150 m³ of water per hour.

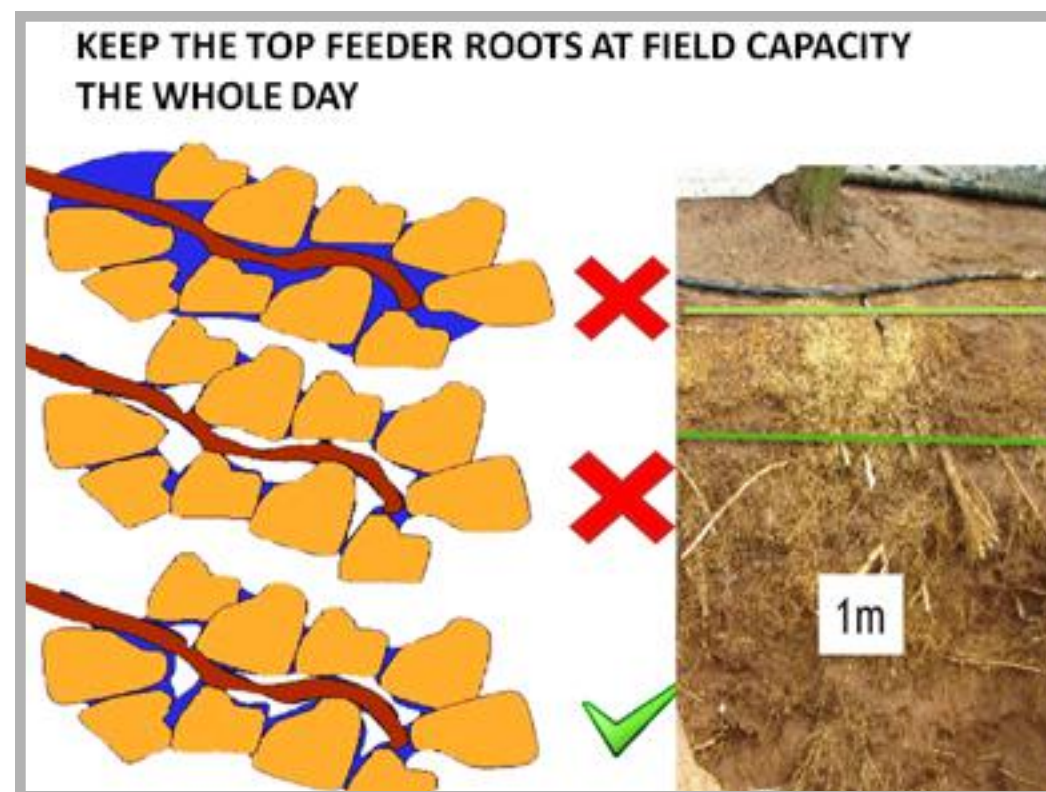


Mostert says this can be achieved by installing systems with three pumps. Despite contrary advice growers may receive from conventional irrigation system designers that using a single pump is more efficient, he says that he only uses a multi-pump system.

“The third pump only runs 20% of the time, the second 40% of the time, and the first 100% of the time,” says Mostert. He said the system worked well in an operation with “dry blocks” and “wet blocks” or fields situated on slopes as opposed to being situated alongside rivers, where different water requirements were needed after rainfall.

Another benefit of the system is complete control of fertilisation. Mostert said that the industry was moving away from the view that an irrigation system’s sole purpose was to carry water. “It makes sense - if you have the system - to also use it to apply fertiliser. It can replace a tractor, a driver, even an entire team to apply fertiliser.” Mostert said the system introduces the highest level of irrigation and fertiliser management and enables implementation by the farm manager and one other person as a pump house attendant.

“The role of the modern irrigation system is much more than just giving water to fruit trees.” - Gerhard Mostert



He says the system gives power to often useless monitoring systems through intelligent implementation with a high level of control. In conclusion, growers can expect:

- Less: runoff; evaporation; leaching; labour; energy.
- Improve: management; water uptake and rainfall efficiency.

‘Technology will never replace a farmer’

“TECHNOLOGY will never replace a farmer. It is the tech-savvy farmer who will be replacing those who still shy away from using new innovations that can make working in agriculture more efficient. This is according to information and communications technology (ICT) specialist, Martin Butler, from the Stellenbosch University Business School.

He believes that some of the most exciting applications of technology worldwide are found within the agricultural sector. However, Butler does not see technology as a solution per se, but rather as part of a package that also includes good agricultural practices and a sound knowledge base.

Butler highlighted a major recent global study done by MIT that included most sectors, including agriculture. It showed that companies that invest smartly in ICT generate more revenue and are more profitable than others. According to Butler, it is not possible to predict what the future for most sectors will hold:

“The reality is that you will help shape the future; you will decide what it is.”

The way in which any organisation embraces technology goes hand in hand with its leadership, and the tools that are available to a particular sector. Adopters of technology are therefore classified into four groups: beginners, conservatives, fashionistas and digital masters.

Beginners are not interested in new technologies, while the conservatives are very careful about investing anything if they do not first know the possible impact it could have on their business. Fashionistas eagerly try out new things, but tend to be very fragmented in the approach they follow. Digital masters have invested in technology, have a clear strategy for doing so and have invested in the capabilities of deploying these.

Butler challenged the audience to not see new technologies such as drones or tablets as mere status symbols or playthings, but to use the full potential of these tools to the benefit of the agriculture sector.

PICTURE FROM LEFT: Peter Dall (Day 2: Session 2 Chair), Martin Butler (University of Stellenbosch Business School), Prof Elias Fereres (School of Agricultural Engineering, University of Cordoba, Spain) and Dr Walter Guerra (Laimburg Research Centre for Agriculture and Forestry).



“The rain in Spain stays mainly on the plain”

LEARNING FROM AN IRRIGATION EXPERT ABOUT WHAT TO DO WHEN IT DOESN'T RAIN IN SPAIN

“WE need new ideas to do more with less.” That was the message from irrigation specialist and agricultural engineer Prof Elias Fereres of the Department of Plant Production at the University of Cordoba, one of the international speakers at this year's HORTGRO Science Technical Symposium.

Fereres believes that modernisation and improvements in the efficient use of water have so far not really “saved” any water on a global scale. “Water is recycled better within the agricultural sector, but is not yet made greater volumes available to other water users,” he said.

In his presentations, Fereres highlighted how changing irrigation methods and improving distribution uniformity when watering crops can ensure the more effective use of this increasingly scarce resource by the agricultural sector. He also shared insights in how remote sensing technology with the help of drones or low-flying aeroplanes can help farmers to irrigate smartly.

SPANISH EXAMPLE

Fereres works for the Spanish Research Council's Institute for Sustainable Agriculture, and has done extensive research in among others California and North Africa. Spain is a water scarce country where water volumes available to agriculture is strictly controlled by government and is often further restricted in times of drought.

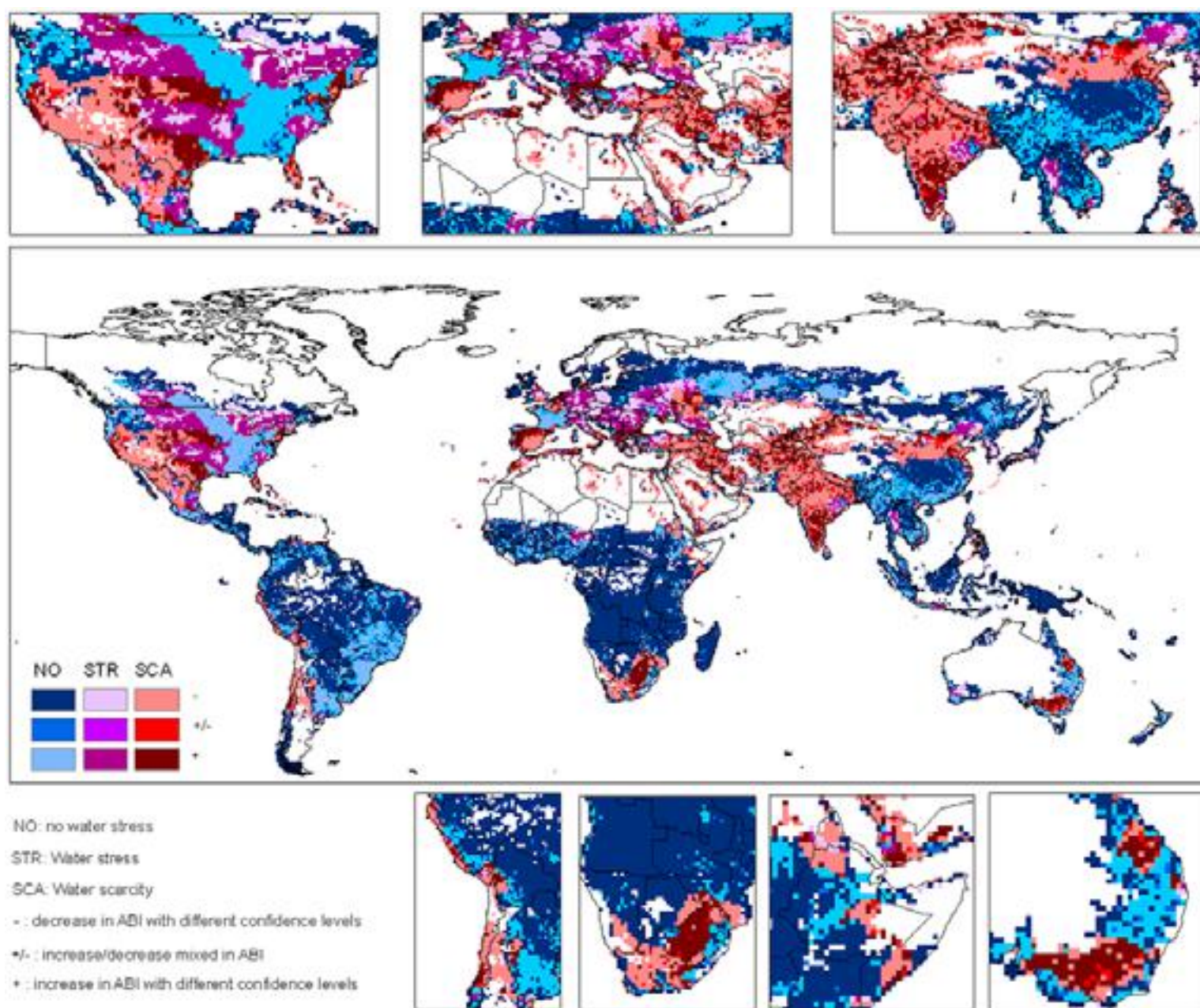
Up to 3.5 million hectares of land is currently being irrigated in this Mediterranean country. Over the past 35 years its producers have changed how they use water on farms, and have dropped their reliance on surface irrigation from 90% to just below 30%. Drip irrigation is now used on 47.8% of all farms, and sprinkler systems on another 22.5% of land. With the exception of Israel, it has the highest percentage of land under drip irrigation.

This shift is a reaction to increased water scarcity and greater demand by more sectors, a realisation that farmers have to work more wisely with the limited resources at their disposal, and better technology options. The shift has however seen a rise in energy costs. "The trade-off is that pressurised systems and the use of sprinklers require more energy, and therefore could cost more money," he adds. "These systems are therefore not always the best economic option, depending on the oil prices."

"We have gone through an extreme case of modernisation and investment in Spain," Fereres told the audience. However, he acknowledges that the country has probably overinvested in changing systems.

"We are not really saving water, just recycling it within agriculture."

Change of irrigation water proportion in the 2030s in relation to water scarcity:



CREDIT: CLiu J, Folberth C, Yang H, Röckström J, et al. (2013) A Global and Spatially Explicit Assessment of Climate Change Impacts on Crop Production and Consumptive Water Use. PLoS ONE 8(2): e57750. doi:10.1371/journal.pone.0057750
<http://www.plosone.org/article/info:doi/10.1371/journal.pone.0057750>

DEFICIT IRRIGATION

In times of drought it is not an option for tree crop farmers to merely reduce the area they irrigate.

"You need to use deficit irrigation to manipulate the limited supply that you have available to obtain the best possible results," said Fereres.

He says the objective when making such decisions in times of water scarcity should be to enhance the productive flow of water yet minimise possible crop losses and maximize yield.

"If you know the response function, you can find the economic optimum that would meet the needs of the farmer and society in terms of production and of water productivity," he said. "There will of course be trade-offs."

Fereres and his colleagues have done much research on the topic over the past fifteen years, with the aim of calculating the water production function of among others citrus, almonds, loquat and olives and how deficit irrigation can be used for these crops.

He says that it is better to withhold water in an orchard and to enforce water stress at times when no fruit growth is occurring. "Then you can up the stress," he added, before noting that this can only be done up to a point.

"If you reduce irrigation during sensitive periods, you could knock your yield with up to 40%," he noted.

Research on citrus has shown that especially mandarin oranges are sensitive to water stress, and that it could reduce fruit size considerably.

REMOTE SENSING

Technology is becoming increasingly advanced allowing a farmer or

horticulturalist to monitor how much water different sections of an orchard is using, and to adjust irrigation scheduling based on these results to ensure greater efficiency and effectiveness. In this regard, aerial remote sensing techniques with the use of drones, small aeroplanes and satellites have made great strides in the past few years.

For Fereres the big question still remains: how much will it cost a farmer to get such remote sensing done regularly, and will it make sense in the long run?

He believes the use of such technology only starts to make economic sense if you are also able to combine it with among others assessments of the nutrient state of a piece of land. It will also make more sense for larger-scale production units, rather than small farm operations.

"It's always better to have more than one approach," he noted, before emphasizing the importance of having a good pair of eyes on the ground to see what is actually happening in an orchard.

He believes that one year's worth of regular remote sensing data will give a producer sufficient information about the state of affairs in a particular orchard, after which more informed decisions without the need for such regular monitoring will be possible.

"Precision horticulture is all about understanding in-field variations," he added.

Local precision farming was illustrated by **Dr Caren Jarmain** who introduced space age technology – **FruitLook**. FruitLook is an online software programme which provides growers with key information describing growth, water, and nitrogen parameters visually with maps and graphs.

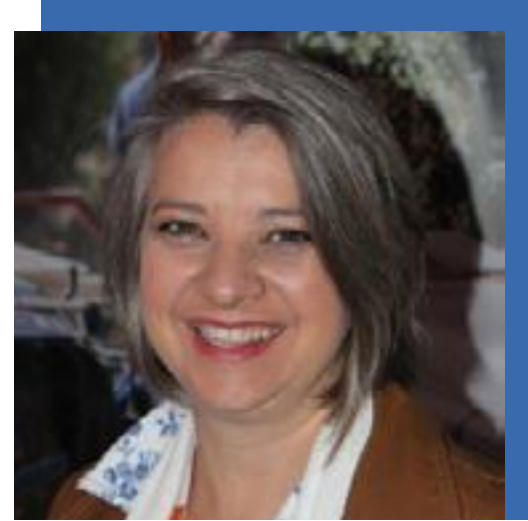
"If you have information you can improve resource management, you can improve production, and you can also improve water use efficiency," she said.

A FruitLook article series is currently running in the SAFJ. Find the latest article in the June/July edition (pg 74-78).

Dam building 101

“BY all means build a dam on your farm to make full use of fast run-offs during the rainy season, but do so responsibly - by the book and according to the water rights that hold for your property.”

This was the strong message from Elkerine Rossouw (photo right), water use specialist of the Breede Gouritz catchment management agency (CMA).



Rossouw confirmed that South Africa urgently needs more dams. “But do your homework before you build your million rand dam, otherwise you may find yourself in a position later where you do not have the correct licencing in place,” she urged. Rossouw highlighted that free advice in this regard is provided by staff of CMAs across the country.

Long before you start excavation work, landowners should have confirmation of registration in place. “You need a licence to dig a hole. You need a licence to put and store water in that hole. You need registration proof from your water authority, or the necessary validation and licencing from either the national Department of Water and Sanitation (DWS) or your CMA,” she noted. She warned that going through the necessary channels could take up to 18 months. “So plan ahead”.

Step by step

- The excavation of new dams must be done according to regulations in the National Environmental Management Act, which is implemented by the Department of Environmental Affairs and Development Planning (DEADP). This for instance includes an environmental impact assessment about the plants and animals occurring on the piece of land. Certain actions triggers listed activities. As these types of applications can become very complex in nature, it is best to first liaise with DEADP.
- Dams holding more than 10 000m³ of water (accumulative volume per property) must be registered at the DWS or the CMA in a particular region.
- Formal authorisation and/or licencing is needed from the DWS to build dams of 50 000m³ (accumulative volume per property)
- Note that “accumulative volume per property” refers to the combined total volume of water stored on a property, and not just in one particular dam.

– For free advice on the processes that need to be followed and be put in place, contact representatives of your local catchment management area:

Darril Daniel/Asla Pieter – Berg-Olifant CMA:
023 346 8000 or info@breedegourtizcma.co.za

– Elkerine Rossouw - Breede Gouritz CMA: 023 346 8000 or erossouw@bgcma.co.za

WHY CMA'S

Catchment Management Agencies were set up according to Chapter 7 of the National Water Act, 1998 (act 36 of 1998) to bring the control, management and the responsibility of looking after this scarce resource to local water user level.

The National Water Act required South African water users to register their water use. The information was captured on the Water Authorisation Registration Management System.

The process of validation and verification has started in some areas within the Breede-Gouritz CMA (and possibly others). This is done to verify that the water uses registered were done correctly. “To be able to make informed decisions about how much water is available to allocate in future for environmental and water user needs, we must know how much water is available in a catchment area and how much is actually being used,” Rossouw explained at the HORTGRO Science Technical symposium.

CMAs are also responsible to:

- **Investigate and advise** on the protection, use, development, conservation, management and control of water resources in a particular water management area (WMA)
- Develop a **Catchment Management Strategy** (CMS)
- **Coordinate** related **activities** of water users and water management institutions within a WMA
- Coordinate plans about integrated development, water services development and other activities performed by local governments such as municipalities
- Promote **community participation** in Integrated Water Resource Management

In search of *the apple*

NOT all apples are created equal and it is only through rigorous testing that the best adapted and potentially most profitable ones can be identified. This was one of the key messages of Dr Walter Guerra, head of the Pomology Department at Laimburg Research Centre in South-Tyrol at the 2016 HORTGRO Science Technical Symposium.

Up to 200 new selections and cultivars are screened and tested at Laimburg every year, mainly to see how well they will potentially perform in South Tyrol's different production regions. This includes over 30 Gala mutations, which are screened for genetic stability, percentage red colour, ripening etc.



For the market, it is the redder the better insofar as Gala mutants are concerned. "Old fashioned clones like Royal Gala and Mondail Gala are just not producing enough colour," Guerra indicated. Newer, redder clones are therefore favoured.

No significant differences between Gala clones have been observed in terms of harvest maturity, inner quality or storability, if harvested at the correct harvest maturity, he indicated. "However, the newest generation of Gala mutants starts to colour much earlier, which can make it tricky to assess the maturity of individual fruit on the tree," he cautioned.

"When it comes to genetic stability, not all the clones in the Gala family are equal," he said. Systematic evaluations since 2014 on more than 2000 Gala orchards in South Tyrol have indicated considerable differences in stability. "Some clones such as Simmons Buckeye, Gala Decarli, Fendeca and Galava are considered 95% stable and can be recommended for planting while some others are more unstable."

Walter and his team don't only evaluate cultivars and selections but they are also actively involved in apple breeding.

NICHE MARKETS

Apart from breeding for the mainstream market, they are also interested in some niche markets, such as those for hypoallergenic apples (2% of the population is allergic to apples), sweet but low sugar apples that could be more suitable for diabetics or people who are fructose-intolerant, and genetically small (50mm) "mini-snack" apples that are ideal for packing in children's lunch boxes. Yellow alternatives to Golden Delicious, 'supersweet' and seedless varieties, as well as scab resistant apples, are also in the future.

Walter sees a gap for red-fleshed apples – "up to 80% consumers indicated a willingness to try such apples".



APPLE PRODUCTION IN SOUTH TYROL

- South Tyrol lies in the Alps in northern Italy and borders on Austria and Switzerland – think Heidi ...
- One in every 10 apples produced in the EU and 30% of all organically produced apples in the EU come from here.
- The main cultivar is Golden Delicious at 42% of production followed by Gala at 16%.
- The 18,400 ha consists of about 8,000 family-run farms with an average farm size of about 2.8 ha.
- Production areas lie from 200m above sea level to 1200m, with very cold winters and hot summers of above 40°C in the low valley.
- Because of this variation, there is a need to test the performance of new cultivars/mutants on different sites, and to find out which ones will be the most suited.

Photo right: Dr Walter Guerra (Laimburg Research Centre for Agriculture and Forestry)



"CURRENTLY only 30% of our apple orchards are adequately chilled," said Dr Nigel Cook (photo above), horticulturist from Propphyta. "This has a significant effect on bud burst and tree growth in the warmer apple producing regions." Many of South Africa's apple trees already suffer from chronic 'sleep disorders' given our mild winter conditions, he says. "Given the absence of enough chill accumulation, more than two thirds (70%) of our apple trees need to be chemically manipulated out of dormancy."

Cook spoke about the hidden costs for local apple growers associated with the lack of winter chill. Local growers produce apples closer to the equator in areas with much milder winter conditions compared to nearly all other production areas in the world. "Apple production at our latitude is only possible because we can plant apple orchards at higher altitudes."

He highlighted the results of a five year long dormancy progression study of "Granny Smith" and "Royal Gala" trees in all our different production regions. The low chilling conditions are having a "significant effect" on the progression of bud dormancy. "This is because sufficient winter chilling is needed for plant growth and to ensure synchronised bud break in spring."

It is believed that cold autumn and winter temperatures enhance both when the plant enters and exits this deep rest period. If the chill requirements of the trees are not met during winter, this has all sorts of knock-on effects. "The bud burst percentage is low, the

Not chilled enough

trees are flowering unevenly and this causes uneven fruit set as well as mixed maturity of fruit on the tree later on," he explained. "It also causes the start of a basal dominant apple tree because it affects which spurs and shoots are dominant."

If left untreated in spring, we would have apples developing while some flowers only bloomed last week and some buds are still waking up – and all of this in the same tree. This is not ideal."

Currently producers use oil and Dormex (cyanamide) as rest breaking agents to try and "synchronise" trees in and out of winter. Dormex, can be hazardous and toxic to both man and plant if not applied correctly, and may in future not be available for use. Many producers changed the way they train the trees as an adaptation to the lack of chilling conditions. Solaxe-training enhances the reproductive efficiency of the tree in warmer areas.

"It is all about creating dominant terminal buds on the branches, also known as spur autonomy. By bending the branches we are developing more, stronger spurs."

Given that Dormex may not be on the market forever, a breakthrough is needed in rest breaking technologies, Cook said. "We urgently need cultivars suited for low chill conditions that will grow normally, have proper colour and be sunburn-resistant."

- Also see Dr Esmé Louw's article on dormancy in the June/July edition of the SAFJ (pg 82-87).

NOT CHILLED ENOUGH

Right: Delayed foliage due to inadequate winter chill.
PHOTO CREDIT: NIGEL COOK



‘Utopian options’ for nurseries

GROWING deciduous fruit trees in pots holds ‘great potential’ to develop healthy nursery material and build the resilience of local fruit orchards.

This was the message from Prof Karen Theron of the Department of Horticultural Science at Stellenbosch University, highlighting issues around nursery tree health and quality at the symposium. “As indicated by research done by Dr Lizel Mostert, we do have problems in terms of health issues in nurseries in our industry.

In addition, one of the biggest problems revolves around the transplant shock bare-rooted nursery trees experience when transplanted into the orchard. I believe that growing trees in containers might offer viable alternatives in this regard,” Theron said.

She also discussed ‘using tissue culture techniques’ as alternatives to produce

clean nursery rootstock material. Some challenges remain, for instance in propagation, as well as cost implications of trying out alternative ways to produce healthy trees for local fruit orchards.

Tissue culture propagation is already viable on a large scale, she said. “This has been proven in many other parts of the world, including in Spain. Some local producers and laboratories are starting to experiment with this as well.” Theron said it is “entirely possible” to produce healthy young trees suited for planting within a year with tissue culture techniques. “We can grow healthy, disease-free trees from start to finish using sterile medium and it can be ready for transplanting in spring or autumn.”

Theron believed transplant shock could be minimised significantly by growing nursery trees in pots or bags. “We know that damage to the root system is one of the greatest risks during the handling

and transplantation of nursery trees. Growing them in bags or pots could help to reduce root loss. We need to keep the root system intact during planting. “We should always be looking at ways to guarantee better quality planting material. In my view our nursery standards needs to be re-evaluated and some alternatives explored in order to offer improved services. Tissue culture techniques might offer one such an alternative.”

Theron compared the very complicated process of making a clonal avocado tree for approximately R85 per tree to the less complex process that would be needed to make a clonal deciduous fruit tree. She says this should cost around R50 to R60 per tree. “Clearly we have some issues to work out, including around costs.” According to Theron the



hidden cost of trees not performing in the orchard should also be factored in when decisions are made about implementing new and or conventional methods. “I believe growing trees in containers offers food for thought for everyone involved in the nursery industry,” she concluded.

Tissue culture takes root

“TISSUE culture potentially offers many advantages to fruit producers,” – this is the opinion of Hannes Laubscher, Director: Technical Services at Dutoit Agri.

Laubscher discussed using tissue culture in the local fruit industry during his presentation at HORTGRO Science’s recent Technical Symposium. “Tissue culture can potentially help to improve the quality of the available rootstocks for local producers,” he believes.

Laubscher considers the first attempts of using tissue culture locally as “promising”. He referred to good results Dutoit Agri has had with a tissue culture cherry orchard established in 2012 near Worcester. Only one of the trees in this orchard has died compared to many others in another nearby orchard established in the same year but on

conventional rootstocks. Dutoit Agri is also now exploring tissue culture to establish new stone fruit and apple orchards, he says.

Tissue culture is widely used to produce clones of plants in a method known as micro propagation and may offer certain advantages over traditional methods of propagation, he explained.

The advantages of tissue culture trees are many, he says. With micro propagation stock plant material can be rapidly multiplied to produce large number of progeny plants, he says. “This is the main advantage of micro propagation. Micro propagation can also be used to produce disease-free and more robust plants.” A great number of plants can also be produced per square meter and the young plants can be stored in a smaller area (in a

laboratory or nursery). "Micro grafting is currently not big in South Africa, yet it is something that we can easily do. In Spain this technique is already employed to produce the majority of stone fruit."

Some challenges will however need to be addressed in order for trees propagated with tissue culture to be used more widely in South Africa, he says. "Currently the cost factor is the most important barrier. These tissue culture trees are currently quite expensive. Regarding the import of tissue culture plants, there are also some issues around import regulations and quarantine of plant materials, as well as around timing of delivery, uniformity and quality. "Laboratories will also have to produce large volumes to make it financially viable for them to



invest in capacity and research. Using trees generated through these new propagation techniques will also require a mind shift for growers."

According to Laubscher another big challenge locally will be to produce the necessary volumes. He reckons the industry needs to give guidance regarding to the choice of rootstock to simplify the process. "Local laboratories are not 100% on 'par' yet, but will quickly need to catch-up. We need to start the process and propagate the idea in South Africa to bring down costs and make it a viable option."

One way of doing this is to focus efforts on only a couple of rootstocks. It will make it easier for nurseries to achieve success he said.



Cantankerous Nursery Trees

A recent study looking at young apple trees in local nurseries has provided new insights into the occurrence of stem canker and wood rot pathogens in apple nursery trees.

Almost two thirds (61%) of nursery trees studied (295 out of 480 trees) harboured canker or wood rot pathogens, said Dr Lizel Mostert, senior lecturer from the Department of Plant Pathology at Stellenbosch University.

Mostert, who has been researching the status of stem cankers in local nurseries since 2015, says it remains "a cause for concern" for the industry. "Ideally we would want to plant entirely healthy trees," she said. This is because the phytosanitary quality of nursery trees plays a large role in how successfully young apple trees can establish themselves and growers can ill afford trees to die-back after planting, considering the cost of planting a new orchard.

Mostert presented her findings at HORTGRO Science's annual Technical Symposium last week. She collaborated with researchers from ARC Infruitec-Nietvoorbij and ProCrop Trust on this project. The researchers looked at stem canker and wood rot pathogens in mother blocks, nursery trees and young orchards. They used Golden Delicious trees from four different local nurseries. In all of the nurseries there were similar levels of trees with stem canker pathogens. "On the outside the nursery trees did not look infected at all, but if you cut through plant material the typical discolouration caused by infections and stem cankers was observed," says Mostert.

It appears that 56% of the mother blocks investigated (140 out of 250 trees) were infected with pathogens. Pathogens were also isolated on the young trees that correspond with those that cause stem cankers in adult apple trees, she says. In a third of the 1-year-old trees studied, the percentage of the infected plant parts was highest for graft unions, followed by 22% for pruning wounds, 17% for scions and 11% for rootstock. Wood rot fungi associated with much older trees were also observed in

nursery and young trees, she indicated. "This is very disconcerting as the kind of symptoms we observed are normally associated with much older trees. Yet we see nursery trees being infected and white rot developing from pruning wounds."

But not all infections on nursery trees led to stem cankers. "Stress seems to play a big role whether or not it develops," Mostert said. "We also need to look closer at the role of areal inoculation and at the pathogen status of some of the fungi we observed on the young trees.

She alluded to the fact that they observed stem cankers on 1-year-old trees growing in a soil with a pH of 4.8 or lower. "It is possible that this can lead to toxicity and that planting on certain soils would put stress on the young trees that could trigger these stem cankers. We need to understand these issues better to help nurseries ensure that wounds made in the nursery are well sealed and do not become infected," she says.

Mostert pointed out that there was a general perception that stressed trees were more susceptible to stem canker than healthy trees.

"The bottom line is that healthy trees are more resistant to disease, than stressed trees. Trees with latent stem canker might perform optimally for years, if the trees are not subjected to stress."

Biological control: Monitoring mites into oblivion

"IN the battle against mite infestations, veteran entomologist Dr Ken Pringle told fruit growers that he was not going to mention chemical control because it was considered "unsustainable".

"Mites have developed resistance to a huge number of chemicals and each time an insect develops resistance to a chemical, it enhances their detoxification system... and the life span of a miticide nowadays is not more than two years," said Pringle, who carries out research at Stellenbosch University.

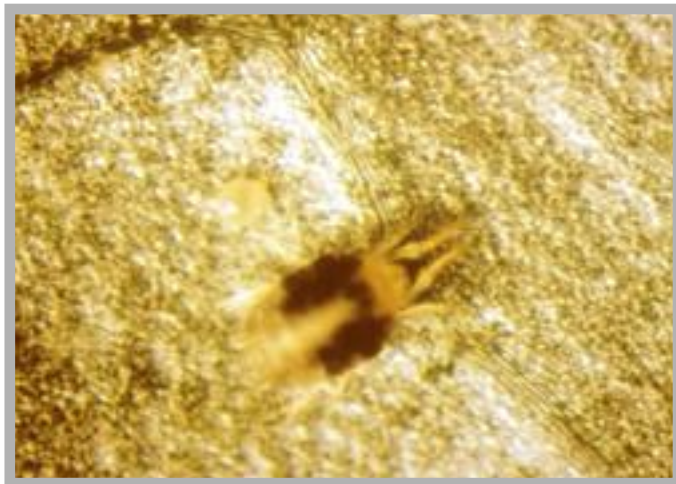
Pringle proposed biological control using natural predators of mites together with a monitoring system. The predatory mites in the grower's arsenal include the multi-chemical resistant californicus (*Neosiulus californicus*) and the indigenous rubicolus (*Euseius rubicolus*).

The monitoring system was based on dividing orchards into blocks of approximately 2 Ha where 25 evenly spaced trees are marked as monitoring

trees in the blocks. "One leaf is taken from the inside and one from the outside of each tree. In the case of apples each leaf is classified as infested or un-infested. In the case of pears the adult mites are counted on each leaf," Pringle explained. "Monitoring is based only on pest mites as the predators are difficult to see. However, if seen, their presence should be noted."

Referring to thresholds in apples Pringle said the chances for biological control increases with higher levels of mite infestation. "There are very few cases of successful biological control when 40% or less leaves are infested, while there is successful biological control in about 50% of the cases when 40-80% of the leaves are infested, and when 80% or more leaves are infested there is a good chance of biological control," he said.

Pringle advised growers not to spray before 40% leaf infestation and if they were "serious" about biological control they should wait until at least 80% of the leaves were infested.



Optimising spray efficiency

"HOWEVER, should growers have a need to spray, the efficiency of their spraying systems was an important factor to consider according to Group Marketing Director at Rovic Leers' Marius Ras.

Ras said the migration to trellised spindle type orchard systems had taken the tree structure to a stage where the depth of the tree has decreased to as little as 0.5-1m.

"Spraying through the target is now the biggest contributor to bad recovery and drift," according to Ras.

The single biggest contributor to the problem was the mismatch of the air momentum and air velocity profile supplied by the spray apparatus with the tree structure.

Despite the absence of final statistical deductions, first trial results have shown that a sprayer with a turret that can deliver a (proven) linear horizontal air velocity profile seemed to outperform all other machine geometries, and could have the ability to be used at higher ground speeds in spindle tree structures with positive results.

Read Ras's full article on the 'Need for Speed' here: <http://bit.ly/1rt8WzY>



Carbon dioxide (CO2) and the story of an apple producer's worst nightmare

IN 2015, Ceres Fruit Growers' Bibbie Potgieter had an apple producer's worst nightmare play itself out in waking day...

Potgieter's voice became slow and measured as she recounted her experience to delegates at the HORTGRO Science Technical Symposium 2016.

"Our Fuji [apples] were packed and shipped on the 2nd of April 2015... and arrived in the Far East on the 25th of April 2015. On arrival the fruit was in very good condition internally and externally, our presentation in the carton was very good, and we even received complementary mails to say that this was fabulous fruit. However, within three days after the fruit was sold we received absolute horrific photographs," Potgieter said, and proceeded to show stunned delegates cartons of what looked more like raw 2-dimensional kidneys in a butchery than half cut Fuji apples.



This event set her off on an arduous journey to determine the possible causes for her ruined consignment.

Her action plan included a series of immediate actions, a research and technical team of no less than 8 people, an evaluation of internal browning types, orchard/fruit variance assessment, an assessment of cooling protocols, internal fruit CO₂, and a series of trials.

Despite all her efforts Potgieter was unable to replicate the extent of internal browning found in that April 2015 consignment, but had a strong hunch that CO₂ was to blame.

According to Prof Michael Reid from the University of California Davis, who delivered the postharvest keynote address, the problems inside apples could have been

solved long ago in the 1800s.

"...If Sir Isaac Newton, instead of worrying about the force of gravity when the apple fell on the ground, had worried why the apple went brown in the bruised area," Reid quipped in his talk on the causes of internal browning.

However, a lot more than Newton's physics is needed to pin down the cause of the post-harvest fiend.

Biochemistry, Molecular Biology, Biotechnology, Cell Biology, and Calculus are all needed to describe a process which tends to be more complex than simple.

In accordance with Potgieter's gut feeling, previous studies in the US also suggest that CO₂ was to blame for internal browning in Fuji apples.

According to Reid CO₂ was toxic for a range of reasons including its ability to alter pH, affect enzyme function, inhibit aerobic respiration, and an ability to stimulate production of alcohol and acetaldehyde.

To make matters worse Fuji appears to be very sensitive to as little as 0.4% external CO₂, this is in contrast to other apples which are often stored at between 0.5-1.5% CO₂.

Reid turned to the mathematical concept of 'calculus' to explain how CO₂ causes mayhem in the inside of an apple.

He likened the apple to a bathtub with water as CO₂, entering at a faucet and leaving at the drain. The main question then is: what would increase "water" levels?

In Reid's apple-bathtub analogy water levels will increase through increased flow into the tub (increased CO₂ production through temperature and ripening), impeded flow from the drain (the peel is a major barrier to gas), and a flooded floor (high external CO₂ through controlled atmospheres and sealed containers or

bags).

So, it is likely that CO₂ levels were to blame for Potgieter's Fuji consignment misfortune but Reid suggested that flesh browning may also result from different stressors, particularly between orchards and seasons.

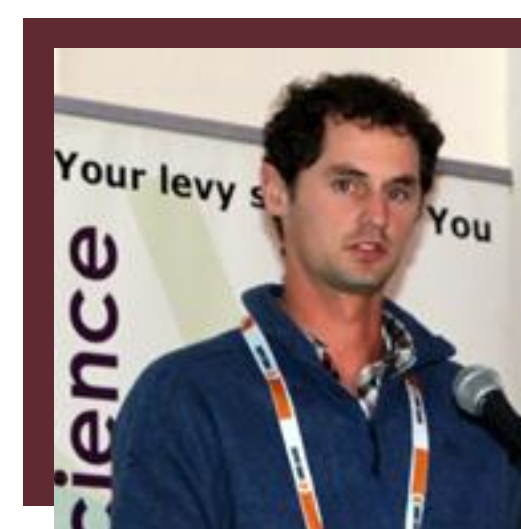
STRATEGIES TO MINIMISE RISK OF INTERNAL BROWNING

- Identify high risk areas and seasons – monitor risk!
- Good crop load management – optimal fruit
- Correct CA management
- Ensure good air circulation in storage rooms
- Postharvest treatments and packaging
- Test new storage regimes and procedures – Conditioning of fruit
- Use of SmartFresh (1-MCP)



PICTURE ABOVE: Richard Hurndall (HORTGRO Science Research and Technical Manager) and Prof Michael Reid (Plant Sciences Department, UC Davis, USA)

Playing it safe with DPA



THE South African fruit industry can be ready, should the maximum level of residue (MRL) of the chemical Diphenylamine (DPA) allowed on apples and pears exported to Europe drop even further in 2017. This is according to researcher Daniël Viljoen (photo) of ExperiCo (Agri Research Solutions), who has conducted relevant tests since 2013 to gauge the lengths to which producers and pack houses should

go to prevent DPA cross-contamination of fruit destined for lucrative European Union (EU) markets.

According to Viljoen, the local industry isn't yet DPA-free, but levels have definitely dropped since strict regulations regarding its use were put in place by the European Commission.

DPA was initially developed to keep rubber stable, but has been used since the 1960s also in South Africa to control unsightly superficial scald on Packham's pears and apples such as Granny Smith, Red Delicious, Cripps' Pink, Cripps' Red

and Goldens during storage.

Because of a possible adverse effect on health, the EU banned the use of DPA in its 28 EU member states in 2012. Since 2014, fruit containing residue of more than 0.1 ppm of DPA are also summarily rejected when imported to the EU – which could be a costly exercise worth millions of Rands to South African exporters found wanting.

CUTTING DOWN ON CROSS-CONTAMINATION

The worry still remains that fruit destined for Europe could in some way become contaminated with impermissible levels of DPA, even though these were not treated with the chemical as such. At the HORTGRO Science Technical Symposium, Viljoen gave exporters peace of mind, by highlighting definitive ways by which they can ensure that their shipments always stay within the DPA limits.

After having been used for decades, DPA residues, accumulated on the exposed surfaces in cold stores, on bins, flumes and pack lines could contaminate untreated fruit even with no DPA on site. In reaction to the EU ban, most pack houses have in the past few years therefore already gone to great lengths to clean contaminated surfaces with, for instance, oxidizing agents such as chlorine, ultra-violet light, peroxides, heat and steam.

Many packhouses have also stopped using DPA and have installed Dynamic Controlled Atmosphere (DCA) cold rooms as a chemical-free way to curb the development of scald. Others techniques include initial low oxygen stress (ILOS) methods, or the post-harvest application of 1-MCP.

Some still however use DPA to treat fruit destined for non-EU countries. "In doing so, they do run the risk of cross-

contaminating apples and pears set for EU countries that are kept in the same facility," warned Viljoen.

He also warned that this could happen when the same scrubber is used for fruit kept in DPA treated as well as untreated cold stores. Flume water used on the pack line was thought to be possible source of contamination, but research showed that risk of contamination was very low.

In another study conducted by Experico, traces of DPA were found on fruit 14 weeks after being stored in old wooden bins. However, residue levels were still well below the MRL of 0.1 ppm. No residue was detected on fruit stored in new plastic bins, old plastic bins or new wooden bins.

Residues above the MRL of 0.1 ppm were also found within four weeks on untreated fruit kept alongside DPA treated fruit in one cold store.

HOW TO PREVENT CROSS-CONTAMINATION

"With the following recommendations in place, it is unlikely that a further reduced MRL will significantly affect fruit exports to the EU," says Viljoen, who is continuing his monitoring work on DPA in the local industry.

- If at all possible, do not use DPA at a site.
- Do not store DPA treated and untreated fruit in the same cold store.
- Do not share a scrubber between DPA treated and untreated cold stores.
- Ensure that sampling for DPA levels is done correctly.
- Keep DPA treated fruit samples separate from others, to prevent the risk of unwanted contamination.

There is life after DPA for 'Packham's Triumph' pear exporters

THERE is life after Diphenylamine (DPA), and there's ample research to prove it. This is according to consultant Kobus van der Merwe (photo), formerly from the Agricultural Research Council (ARC) and Anél Botes, who is now furthering his research on 'Packham's Triumph' pears at Infruitec-Nietvoorbij.

Van der Merwe said that the industry worldwide has responded admirably after the announcement by the European Union that fruit exported to its member states should be practically DPA-free.

"We have lost DPA but we are coming up with solutions," he said.

At the HORTGRO Science Technical Symposium, Van der Merwe presented findings of research conducted by the ARC and postgraduate students at Stellenbosch University. They applied different Controlled Atmosphere (CA) technologies by which to inhibit the development of superficial scald in stored pears. These include Controlled Atmosphere Storage (CA), Initial Low Oxygen Stress (ILOS), and Dynamic Controlled Atmosphere Storage-Chlorophyll Fluorescence (DCA-CF) techniques.

With CA, fruit is stored in a gas-tight room while the concentration of oxygen (O₂), carbon dioxide (CO₂) and the temperature in the facility is controlled. The technique reduces the rate of respiration, as well as retaining firmness and colour.

Dynamic controlled atmosphere storage (DCA-CF) techniques are similar to CA, but fruit is kept at oxygen levels just above its anaerobic fermentation point or the so-called low oxygen limit (LOL). Fruit is therefore stored at the lowest

possible oxygen level before fermentation sets in. This level is determined by the physiology of the fruit.

To ensure that it is done correctly, the stress point of the fruit being stored is continuously monitored using the chlorophyll fluorescence technology.

With the Initial Low Oxygen Stress (ILOS) method, fruit is stored at 0.5% O₂ and 1% CO₂ for 10 to 14 days. Thereafter the fruit is stored further according to the recommended controlled atmosphere storage (CA) regime for pears.

Research conducted by Tlou Melrose Ramokonyane at Stellenbosch University showed that DCA-CF is the most successful option for the long-term storage of "Packham's Triumph" pears. It inhibits the development of scald up to seven months while in cold storage. In turn, the use of ILOS along with CA is more suitable for the short-term storage of these pears for up to five months.

Tests conducted at the ARC showed that pears stored for up to 8 months under DCA and then treated with the ethylene inhibitor 1-MCP (known as SmartFresh) before being shipped were more firm and had a better colour than untreated fruit.

"Smartfresh inhibits respiration and the ripening of fruit by blocking ethylene receptors, thus extending storage life and ensuring that fruit quality is retained better during the storage period," explained van der Merwe.



Thanks to a Postharvest Innovation Fund grant, Botes is now testing the effectiveness of the Repeated Initial Low Oxygen Stress (RILOS) technique on CA stored fruit. RILOS amounts to stress periods every 15 to 25 days during which the ILOS technique is administered. This raises the ethanol level in the fruit to a set threshold. This process needs to be carefully monitored.

Research has been conducted overseas on the Automatic Control of Respiration (ACR) technique, by which the respiration quotient (the ratio between CO₂/O₂) is determined in an entire room full of fruit at once. ACR allows for the storage of fruit above the fermentation point.

WHAT'S THE FUSS ABOUT SCALD?

- It is a physiological condition which develops when some susceptible apple and pear cultivars are kept in cold storage for long periods of time.

- Unsightly brown discolouration appears because of the breakdown of natural anti-oxidants in the skin of the fruit.
- Although not at all harmful, it influences how fruit looks to consumers.
- Symptoms normally appear when fruit have been stored for at least 8 weeks.
- Symptoms are initiated in cold storage and usually develop within 3 to 7 days after the fruit is transferred to ambient temperature conditions.



To cool or not to cool?



QUALITY fruit is what consumers want. Therefore how fruit is handled after picking is an important step in the handling protocols of stone fruit. But what to do, when you are sitting on *Gamoep se vlakte* and cooling facilities are not readily available?

To answer this question Experico researcher, Arrie de Kock (photo left), did some trials and investigated the optimal handling protocols for apricots and plums transported from distant production areas that were far from cooling and loading facilities.

According to De Kock they wanted to determine the effect that different temperatures had on fruit quality from packing to cooling. "We simulated different handling scenarios and obtained different temperature profiles," de Kock said. The three scenarios were: fruit loaded warm, fruit cooled on site before transport and field heat removal (FHR) on site before transport at 2.0°C.

The results for the simulated cold storage of apricots:

- There were no significant differences between fruit loaded cold or warm
- However, cold fruit was firmer after cold storage and had less internal disorders
- Where field heat was removed prior to loading the fruit, the fruit was softer and developed more internal disorders compared to apricots that were loaded cold or warm.

Recommendations for apricots:

- Option 1: Pick, pack and FAC cool within 6 hours of harvest
- Option 2: Pick, pack and transport to cooling facility within 12 hours after harvest. Please note that partial cooling or FHR to 10°C had a negative effect on quality and is thus not recommended, De Kock warned.

Results for plums:

- Fruit loaded warm were significantly softer and tended to have more mass loss and shrivel than fruit loaded cold or where field heat was removed prior to road transport.

Preliminary recommendations:

- Pick, pack and FAC cool within 6 hours of packing; or
- Field heat can be removed prior to or after packing by placing bins or pallets in a cold room at 10°C to 12°C prior to transport in a refrigerated truck.
- A time delay of 12 hours or more between harvest and FAC may lead to softer fruit and more moisture loss and shrivel.

De Kock said that stone fruit growers should take note that if there is a time delay of 12 hours or more between harvest and FAC - apricots and plums do not react the same to FHR.

"In the case of apricots FHR prior to the transport of fruit from areas 6 hours or more from cooling facilities had a detrimental effect on fruit quality, therefore apricots should be cooled to -0.5°C or should not be cooled at all before transport in a refrigerated truck. In the case of the latter cooling should commence as soon as the fruit arrives at the cooling facility.

In the case of plums FHR had a positive effect on flesh firmness and there was a reduction in shrivel. If it is not possible to use FAC immediately after packing, it is recommended that growers FHR before plums are transported.

The good, the bad and how to save us from the ugly...

DECAYED fruit is of no use to retailers or consumers and results in huge economic losses to the fruit industry. Therefore, scientists are continuously searching for the best possible techniques to protect fruit against decay.

Dr Ida Wilson, specialist in crop protection at Experico Agri Research Solutions, evaluated fungicide efficacy for decay control using different spray volumes, product concentrations and methods of application. This investigation was done on plums, nectarines and peaches.

According to Wilson, industry are battling with decay control, since the choice of registered fungicide products are limited, fungi have become resistant to some fungicides and consumers and regulatory bodies are putting pressure on the fruit industry to use less agrochemical inputs, from an human and environmental health perspective.

The aim of the study was to investigate if there are variables, within the application methodology of fungicides that could potentially contribute to greater fungicide efficacy in the control of brown rot and grey mould of plums, peaches and nectarines.

Wilson induced grey mould decay (*Botrytis cinerea*) or brown rot decay (*Monilinia laxa*) in the stone fruit, respectively, and subsequently evaluated fungicide efficacy for decay control. Evaluations were done for two active ingredients, Fludioxonil and

Iprodione, with a dip vs an atomiser application (only for plums), or at two volumes of application. In the interest of testing fungicide residues on fruit, three different product dosages were also tested.

CONCLUSIONS

The conclusions of this study, over both brown rot and grey mould, are summarised in Table 1. For Iprodione a standard volume application was more often more efficient in decay control (1.2L water/ton fruit), whilst for Fludioxonil a high volume application was more often efficient in decay control (3L water/ton fruit). The dosage of application made little difference to general product performance, although the residues responded to different dosages of application. Registered dosages should always be applied as indicated on the product label.

Table: A summary of results over the two decay types, for two methods, two volumes and three dosages of application

	Iprodione	Residue	Fludioxonil	Residue
PLUMS				
Method	Dip	✓	Dip	✓
Volume	Standard/High	×	High	✓
Dosage	As registered	✓ ×	As registered	✓
NECTARINES				
Volume	Standard	✓	High	✓
Dosage	As registered	✓	As registered	✓
PEACHES				
Volume	Standard	✓	High	✓
Dosage	As registered	✓	As registered	✓

IN SUMMARY:

- Method, volume and dosage of product application may influence fungicide efficacy on stone fruit
- Notably, in some instances poor decay control was correlated with high presence of fungicide residue
- In contrast, excellent decay control was also observed in fruit with little fungicide residue
- Dosage had very little impact on general decay control by products, but influenced compliance to MRL's

Wilson said that although the impact of fungicide application methodology was evident, further investigation of these parameters in a commercial environment will be needed to make industry relevant recommendations.

Take-home message

Fungicide efficacy can be enhanced by the right choice of active ingredient, method of application and volume of application.

CATTS, Vapormate® show promise in postharvest pest control

POSTHARVEST industry players have been introduced to two new postharvest mitigation treatments for phytosanitary insect pest control.

HORTGRO Science researcher Dr Shelley Johnson introduced the Controlled Atmosphere Temperature Treatment System (CATTS) and Vapormate®, a non-residual fumigant.

CATTS uses a synergy of atmospheric and heat stress to eliminate its insect pest target.

In terms of atmospheric stress Johnson explained that the low O₂/High CO₂ atmosphere inhibits normal internal functioning of the pest.

"Reduced oxygen levels do not support active metabolism, high carbon dioxide level prevents spiracles from closing and CA (Controlled Atmosphere) conditions inhibit upregulation of heat shock proteins," said Johnson and added that heat stress acts to dehydrate and break down the pest's metabolic systems on a large scale.

Johnson's current research project at Stellenbosch University which looks at "CATTS and chill-sensitive plums cultivars" showed that the banded fruit weevil was least tolerant, false codling moth had intermediate tolerance, and grain chinch bug was most tolerant to CATTS.

The second weapon against phytosanitary pests, ethyl formate (EF), Johnson described as a colourless liquid which was “flammable”.

EF deprives the pest’s body of oxygen through “chemical asphyxiation” by inhibiting the functions of a key enzyme it needs for normal functioning.

Johnson said the insecticide was a historical fumigant for dried fruit pests and has been used since the 1920s.

EF can be applied to produce in liquid form at smaller scales but could be a risk in large-scale applications due to flammability.

“Research was done to look at what gases it could be mixed with to reduce flammability and this is how Vapormate® came into being,” Johnson said.

Vapormate® is a mix of EF combined with CO2, which reduces flammability and also has a “synergistic effect of the insecticidal properties of ethyl formate”.

There is also the benefit of using less EF when applying it as Vapormate®, according to Johnson.

The fumigant was fast-acting and got to work between 1-6 hours on fresh commodities and up to 24 hours on

stored products.

Johnson said Vapormate® was a registered postharvest treatment for phytosanitary pests in Australia, New Zealand, South East Asia, Israel, and the USA.

In the latter countries it was used to control hitchhikers like spiders and ants and pests including mites, mealybugs, apple moth, rose weevil, and scale insects. It was applied using container or tent fumigation techniques.

Johnson is currently carrying out a study which investigates the effectiveness of EF fumigation on pear and plum cultivars, with a focus on grain chinch bug.

Preliminary results show 100% mortality of grain chinch bug with no phytotoxicity.

Despite the potential of the two pest mitigation measures; Johnson highlighted challenges to widespread application which for CATTS included heat damage and the need for CA chambers that could be heated effectively and sufficiently.

The major challenges for Vapormate® fumigation included obstacles in the registration of the product, labour intensive application process, and availability.



PICTURE LEFT: Dr Ida Wilson (ExperiCo) and Dr Shelley Johnson (Stellenbosch University and HORTGRO Science)

FCM: “Full frontal” attack needed

IN the war against the False Codling Moth (FCM), an attack on all fronts is needed, according to Chempac’s Tom Labuschagne.

Labuschagne was speaking to delegates at the HORTGRO Science technical symposium 2016 field day for stone fruit.

“You cannot just [attack] one front and think you will win,” he warned.

Labuschagne said all the various life stages of the FCM need to be targeted for effective pest control.

FCM is an indigenous phytosanitary pest which is a major problem for fruit growers and has an extremely wide host range. This often results in “crop hopping” followed by population increases. Labuschagne said a “mind shift” in the battle against FCM was needed.

The control of FCM populations is only possible if “grandmothers and grandfathers” are targeted. Pest control activities need to be carried out early in the season when the population is at its lowest.

However, before an assault on FCM can be carried out “physical monitoring” is necessary. Labuschagne recommended physical pre-harvest fruit assessments combined with pheromone baited traps.

The first line of attack is on the adult stage using mating disruption (MD) or sterile insect technique (SIT). Labuschagne says MD, which uses sex pheromones to prevent males from finding and mating with females, is available but has not yet been registered for stone fruit. He says that the key to success in the use of SIT is the ratio of wild to sterile males and can only be achieved by combining different control methods (Integrated

Pest Management). The second line of attack is on FCM eggs, says Labuschagne:

“There is very little you can do to the egg because there is nothing registered, we are stuck with what nature gave us – parasitoids and predators”.

The first instar larvae are the most susceptible stage in the FCM life cycle and should be the grower’s third line of attack. This stage can be attacked with several methods including registered traditional pesticides, granulovirus, and natural enemies. Labuschagne says the “window period” is crucial and that the chosen measure should be synchronised with hatching of the eggs.



There is very little one can do about the last front of attack; last instar larvae and pupae in the soil. Nothing is registered to combat the latter two stages and not much is known about potential fungal infections.

"We are getting to a point where this stage will be an important part of the control of FCM; entomopathogenic nematodes for instance could have a major impact. Ants are often underestimated as a FCM and Fruit Fly predator," said Labuschagne.

Sanitation is arguably the most important aspect of a successful FCM management programme, according to Labuschagne, who added that "you have to control alternative hosts and sanitise, that's where the next generation FCM comes from".

"Our whole philosophy should be population management and not damage control."

Become a Pruning Connoisseur

"KNOW growth habit of a plant," - these were pruning expert Gielie Bester's opening words to growers attending the 2016 HORTGRO Science technical symposium stone fruit field day.

Brandishing a brand new pair of pruning shears, the relatively short man with a crop of white hair, ushered the group of around 30 to a Purple Majesty plum orchard at the Allée Bleue farm in Simondium.

Bester said that in trying to get a grip of a cultivar's growth habit it was important to understand that presently there were many cultivars released and that they all had different growth patterns. "Every time a new cultivar is released, you will have to do some research." Only after the third or fourth year would the grower begin to "discover" or understand the cultivar, according to Bester.

He suggested that growers also consider consulting technical advisors on what the actual growth habit of the cultivar was and listed a few important questions: "Is it apical dominant? Is it basal dominant? Can the plant be bent?"

When approaching Purple Majesty from a pruning perspective and as a grower Bester

asks himself three important questions irrespective of what the shoots look like.

Firstly, is the tree bearing fruit? Bester said that one of the cultivar's problems was that it did not produce its full tonnage. He advised that growers had little to benefit by "pruning the tree into oblivion" while the tree was not producing fruit.

Secondly, is fruit size adequate? Bester said that growers often struggled with fruit size with Purple Majesty and highlighted the importance of keeping annual records and building data.

"Know the fruit size that the cultivar is giving you each year, because this will determine how to prune the tree," he said.

Thirdly, Bester raised the issue of "sugars". "There is no point in having 30 tons on the tree but the sugar level in the fruit is below the specification for the specific cultivar to make export possible".

Charl Stander (Franschhoek Marketing-tegniese adviseur), het die volgende nuwe aanplantingsriglyne vir jong bome gegee:

- Berei grond betyds voor en maak chemiese regstellings
- Besproeiing in plek voor plant
- Opleistelsel in plek voor plant
- Maak seker dat wortels van jong boompies nie uitdroog nie
- Behandel wortels met Agrobacterium Ras 84 voor plant
- Maak seker dat geen lug in grond is direk na plant nie – gee water
- Behandeling teen aalwurms indien nodig 4-6 weke na plant – grond temperatuur belangrik
- Hou leier(s) dominant
- Maak seker 3:1 beginsel word gehandhaaf
- Maak bome vas indien in winderige area
- Moet nie sytakke by sekere kultivars te gou plant buig nie
- Bestuur regop groei (rugryers)
- Begin met jong boom bemestingsprogram rondom September en hou vol tot Maart
- Ondersteun boom gedurende eerste paar maande met blaarvoeding
- Ken jou kultivar
- Grondtipe
- Sout gronde
- Besproeiing skedulering
- Besproeiing tipe: drip- en mikro-stelsel
- Vogmeting
- Onderstam vs grondtipe vs kultivar

Basiese beginsels riglyne by die snoei van pruimbome

- Ken die groeiwyse van die kultivar
- Is dit 'n spoordraer of dra dit ook op eenjarige lote?
- Is die kultivar geneig tot uitsterwing/"extinction"?
- Is dit 'n geil of minder geil groeier?
- Is dit 'n kultivar wat geneig is tot siektes?
- Wat is die inherente grootte van die vrug van die kultivar?
- Wat is die dragpotensiaal van die kultivar?
- Wees bewus van die beperkinge van jou gebied, klimaat, koue-eenhede en grond
- Watter opleistelsel gaan jy gebruik?
- Watter onderstam is gebruik?
- Neem elke jaar rekords en bou data op.



PICTURE
LEFT: Pruning Connoisseur Gielie Bester (Capespan).

SUMMARY REPORT CONTRIBUTORS: Dane McDonald, Engela Duvenage, Jorisna Bonthuys, Esté Beerwinkel, and Elise-Marie Steenkamp.

THE DAAN STRYDOM AWARD

This year the award for Best Fourth Year Horticulture Student went to Trevan Flynn (photo below left). Trevan is currently in the United States and received his prize in absentia.

Pictured below right, Stephen Rabe (HORTGRO Science Advisory Council Chair) hands over the prize to Dr Lynn Hoffman from Stellenbosch University. Prof Daan Strydom, after whom the prize was named, shares in the moment.



NETWORKING – SYMPOSIUM STYLE



FIELD DAYS



Pictured left is Graeme Krige (Technical Advisor) and Dr Xolani Sibozu (HORTGRO Science Applied Researcher) at the Oak Valley Field Day site.



Die manne het geluister en geleer. Tobie van Rooyen (middel) verduidelik boordpraktjke.

Xolani aan die woord.

NEW ERA GROWER DAY



ABOVE: Sheila Storey (Nemlab), Jacky Goliath (De Fynne), Henry Allies and Lené van der Walt (Nemlab).

ABOVE: Sewis van der Horst, Adam Mouton, Kevin Maart (DFDC), Jacob Coetzee and Theo van Rooyen.



LEFT: Gerald Swanepoel (Western Cape Department of Agriculture), Yvonne Tema (Western Cape Department of Agriculture) and Jotta Plaatjies (Laasterivier).

THANK YOU TO OUR SPONSORS



AgroFresh

**PRODUKTE WAT WERK
VAN MENSE WAT OMGEE**

PLATINUM



GOLD



SILVER



BRONZE