HORTGRO science

Annual Report

2021

Contents

HORTGRO science
Growing Fruit IQ

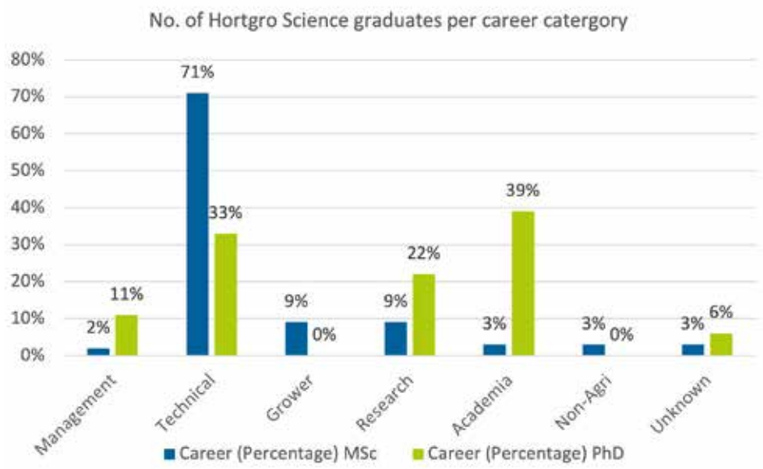
CHAPTER 1

Chairman's Report

STEPHEN RABE | Hortgro Science Chairman

I am glad to report that Hortgro Technical is fulfilling its expanded mandate with Hortgro Science focusing on areas of importance related to research and activities that provide an enabling environment for our levy payers. Hortgro Science participated in a vision of the future foresight study, the outcome of which will be used to calibrate our current efforts and inform future projects.

The success of an industry is directly influenced by the talent it attracts, ensuring a level of scientific and technical expertise, focused on the current and future needs that will ensure sustainability and economic profitability. The chart below indicates the number of graduates, per career category, who have graduated from Stellenbosch University Department of Horticultural Science since 2000.



Professor Karen Theron fulfilled the role of chair in applied pre-harvest deciduous fruit research and assisted in delivering a stream of graduates into the industry. I am confident that this supply will continue into the foreseeable future. This focus needs to be maintained to ensure our industry continues to attract the talent needed.

This is my sixth chairman's report, a fact that sensitises me to the risk of overstaying my welcome. We will be strengthening the advisory council and have invited Dr Ilse Trautmann and Professor Karen Theron to serve on the committee. I am thrilled that they have both accepted and confident that the wise counsel and experience they will bring to the table will guide us through the succession that will need to take place in the next few years.

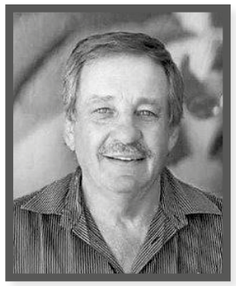
To my fellow council members: thank you for your participation and contributions during the year under review. It is a privilege and pleasure to be part of this group.

To Hortgro Science/Technical management: thank you for your passion and commitment in what you do. Your attitude and positive outlook inspire.

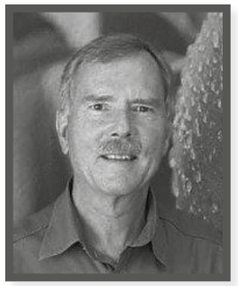
Stay safe.

Hortgro Science Advisory Council

Stephen Rabe
Chairman



Grant Smuts
Vice Chairman



Charl Stander
Member

Wesley Hendricks
Member

Linde du Toit
Member

Frikkie Jacobs
Member

Raymond Koopstad
Member

Anton Rabe
Observer

Thembi Xaba
Observer

General Manager's Report

WIEHANN STEYN | Hortgro Science General Manager

Saying that change is the only constant/the new normal, has become somewhat clichéd. Nevertheless, everybody involved in the fruit industry over the last two seasons would wholeheartedly agree and would in fact insist that the speed of change is ever increasing. On top of the accelerating rate of change, people in the fruit industry also have to contend with "black swan" events and "predictable surprises" in an extremely interconnected, "VUCA" world. In such a world, competition in the market place is becoming fiercer by the year and only the fittest fruit industries will survive.

What will it take for the South African deciduous fruit industry to survive or, preferably, flourish in an increasingly competitive world? There are various global or macro factors beyond our control. We cannot influence the impact of the exchange rate and the cost of agrochemicals on profitability nor can we change the climate. Fortunately, we can soften the impact of some factors like climate change, decreasing water availability, market restrictions on phytosanitary pests and the financial cost squeeze through relevant research, good strategies and good implementation thereof. In terms of the production, storage and marketing of our fruit, we really need to be on top of our game.

In the end, our success as industry, given some of the constraints beyond our control, comes down to the expertise/quality of people we have in place at different levels of our industry. Our highly technical industry is dependent on a steady supply of well-trained graduates who are up to speed with the latest technology and future directions of fruit production to ensure that our product is of a high quality, safe, sustainable and preferred by consumers. We also need access to "knowledge resources", experienced researchers and academics, who can provide direction to industry, lead change and trouble shoot sticky issues. These knowledge resources are becoming increasingly scarce in applied fields.

Prof Karen Theron, the deciduous fruit pre-harvest research chair, retired from this Hortgro-funded position at Stellenbosch University in September 2021. Karen has been a true servant of the industry, the department of horticultural science and Stellenbosch University for her entire career and her retirement will leave a big gap. Fortunately, Karen's expertise is not completely lost to the industry as she will still be serving on various workgroups and also from 2022 on the Hortgro Science advisory council. Joining her as a new member on the advisory council in 2022 will be Dr Ilse Trautmann, Deputy Director-General: Agricultural Research and Regulatory Services (DDG: ARRS) at the Western Cape Department of Agriculture. AC members are traditionally growers or closely associated with deciduous fruit farming. To fulfill its functions in today's increasingly complex operating environment, the AC requires a much wider skills base and depth of knowledge. Dr Trautmann and Prof Theron are vastly experienced individuals with a good understanding of organized agriculture and the research environment in particular. Their appointment to the advisory council will further strengthen its oversight and strategic roles.

Further in terms of capacity, Hortgro Science appointed and subsequently seconded Dr Minette Karsten to the department of conservation ecology and entomology at Stellenbosch University as researcher in applied entomology. Minette has previously, as postdoctoral fellow, conducted research on various insect pests on Hortgro projects. Her appointment will further strengthen our capacity in the field of integrated pest management where developing innovative, preferably biological replacements for undesirable pesticides is a key research drive. During 2022, Hortgro will be building a phytosanitary facility adjacent to the industry-funded insectary at the Welgevallen experimental farm of Stellenbosch University. This facility will allow Hortgro Science to conduct crucial market access-related research on fumigation and cold sterilisation.

The development of the next generations of scientists and technical people who can service the industry is an important product of the research process. Fifty-six post-grad students were funded during 2020/21 of which there were one Honours, 36 MSc's, 10 PhD's and nine Postdocs. Sixty-three percent of the students are female and 43% of the students are black. One quarter of the research budget is directed towards funding research posts seconded to Stellenbosch University.

COVID-19 had a limited impact on research activities during the past funding cycle, aided in part by Hortgro Science migrating project management to a digital platform developed by Winetech. The efforts of Adriaan Oelofse of Winetech, Anita van Staden of Hortgro Science and the various committee members and researchers ensured a relatively smooth transition from paper to cloud. The digital platform facilitates remote review of project proposals and reports, resulting in a considerable time and cost saving for all involved.

The leverage of external funding and access to government funding remains a challenge. Funds sourced from government agencies have become more difficult to access. The South African government as well as industry's level of funding research needs to grow substantially to be on par with some of our competing nations. This aspect has been recognised by both parties, but needs to be acted on if we are to remain competitive internationally. Hortgro Science utilised 19 different university departments and research organisations to conduct its research during 2020/21 with 44% of the total budget being allocated to Stellenbosch University. We have observed an increase in multidisciplinary projects and a broadening of the research scope in alignment with our research strategy. All new projects funded during the current cycle were identified by the fruit growers, technical advisors and researchers forming part of the focus workgroups.

Hortgro Science is continually challenged on the question of "are you focusing on the right stuff?" We are guided by over 200 individuals, made up of technical advisors, growers, researchers, industry experts and retired academics who sit on our 30 focus workgroups, peer work groups and technical advisory committees. We are greatly indebted to our small pool of researchers and the larger pool of technical people who assist us in these endeavours.

I would like to end off by thanking the Hortgro Science advisory council under the dynamic leadership of Stephen Rabe for their strategic leadership of Hortgro Science. Hortgro Science is a small team that links into a much bigger network that is focused on facilitating and driving technological innovation in the pome and stone fruit industry. It is a privilege to serve the deciduous fruit industry in this capacity and to work with the dedicated team at Hortgro Science.

CHAPTER 2

Crop Production Research Programme

Research within the crop production programme addresses current problems experienced by fruit growers, but is also future-directed – research has a long lead time and it is important to start building the capacity and conduct the research for the solutions that we will need in the future. In this sense, the crop production research strategy is directed and aligned with the requirements and key risks to the orchard of the future. Hence, increasing orchard productivity and efficiency as well as improving fruit quality are the main drivers of the crop production programme while climate change, extreme weather, plant material quality and water availability and quality are key risks that are addressed.

The crop production research programme is structured into six themes, namely dormancy, farming technology, irrigation and nutrition, rootstocks and nursery tree quality, growing season climate, and reproductive biology. The research strategy for each theme is determined by a workgroup (one workgroup per theme) consisting of fruit growers, technical advisors and researchers. When considering research strategy, the workgroups always keep in mind the changes we need to make to our orchards to remain internationally competitive as well as profitable. They also consider the major future risks, as identified within the overarching research strategy, which may jeopardise our profitability.

Dormancy

Research in this theme is aimed at understanding the progression of dormancy under mild winter conditions. We also study dormancy release in order to potentially identify new, safer rest breaking chemicals – Dr Xolani Siboza is currently completing field evaluation of potential new rest breaking programmes that were based on laboratory work by Dr Esmé Louw and Laura Allderman.

It is becoming increasingly evident to the dormancy workgroup that the induction of dormancy under mild, local conditions requires further study. It is nearly impossible to apply chill models to our climatic data if we cannot determine when trees went dormant. Hence, the induction of dormancy will be a key focus of future research. The early results obtained in the so-called adaptability project, consisting of 10 genotypes each of apple, plum and cherry varying in chill (and heat) requirement planted at three climatically contrasting sites, have been very promising. The project allows the researchers to tease apart the effect of chill and heat requirements on the adaptability of cultivars to local conditions.

The flowering phenology project is utilising the adaptability project sites and is aimed at correlating the output of the various chill models with vegetative bud break and flowering data so to identify the most suitable model for South African conditions. In terms of completed projects, Dr Esmé Louw established that the shoot assay used to assess the progression and depth of dormancy is reliable and provides a sufficiently good approximation of the dormancy status of intact trees.

Expertise

Dormancy workgroup

Research team

Prof Wiehann Steyn
– crop production programme leader

RESEARCHERS:

Dr Esmé Louw
Dr Xolani Siboza
Ms Laura Allderman
Dr Iwan Labuschagne
Dr Nigel Cook

STUDENTS:

Mr Andrew van Lingen – MSc student
Mr Tristan Dorfling – MSc student
Ms Anika Kock – MSc student
Mr Dian Craven – MSc student

Current projects

- Quantifying the impact of insufficient winter chill on apple fruit quality. (E Louw and A van Lingen)
- Evaluation of alternative rest breaking agents for apples. (X Siboza, K Theron and D Craven)
- Adaptability indexing of new pome (apple) and stone fruit (plum) cultivars in diverse South African growing areas. (I Labuschagne, E Louw, A Kock and T Dorfling) – see Growing season climate
- Leaf defoliation of Cripps' Pink and Granny Smith apples in the EGVV – effect on vegetative and reproductive development. (X Siboza, K Theron and D Craven) – see Reproductive biology
- Investigating the significance of temperature on flowering phenology by establishing a South African apple and plum phenophase-temperature database. (E Louw & I Labuschagne)

Completed projects

- Investigating the effect of different autumn/winter/spring scenarios on budbreak in apple trees. (E Louw and L Allderman)
- Validation of the shoot assay as a proxy to determine progression of dormancy in intact apple trees. (E Louw and L Allderman)
- Scientific and practical guide to climate change and pome/stone fruit production in South Africa. (S Midgley) – see Growing season climate and also Irrigation and nutrition

Publications

- Fresh Quarterly Jun 2021: Mouton, A. Winter dormancy 101.
- Fresh Quarterly Jun 2021: Mouton, A. Know your chill models.
- Fresh Quarterly Jun 2021: Mouton, A. The fundamental flaws of chill models.
- Fresh Quarterly Jun 2021: Mouton, A. Predicting bud-break.

- SAFJ April/May 2021: Mouton, A. From canopy to consumer: p. 92.
- SAFJ August/September 2021: Mouton, A. Winterdormansie 101: p. 67.
- SAFJ August/September 2021: Mouton, A. Ken jou koue-modelle: p. 72.
- SAFJ August/September 2021: Mouton, A. Die fundamentele gebreke van koue-modelle: p. 76.
- SAFJ August/September 2021: Mouton, A. Wat vertel koue-modelle ons van bot: p. 79.
- SAFJ August/September 2021: Mouton, A. Research on rest-breaking agents: p. 82.

Events

- Symposium webinar - The various chill models and how well (or not) they fit South African conditions (1 June 2021)

FRESH QUARTERLY JUN 2020: MOUTON, A.

SAFJ AUG/SEP 2021: MOUTON, A.: P. 82.

Rootstocks and nursery tree quality

Finding more precocious and productive rootstocks adapted to South African conditions is integral to our orchard of the future vision. For this reason, various pome and stone fruit rootstocks are evaluated in an increasing number of industry trials in commercial orchards.

Hortgro Science has appointed Provar to run new rootstock trials with input from Hortgro and the rootstock evaluation committee. Together with the new funding strategy of rootstock evaluation, which involves co-funding by IP owners and licensees, this increases the number of trials that are conducted. More trials mean better data and hopefully earlier and more confident recommendations regarding new rootstocks.

New apple rootstock evaluation sites will be planted to dwarfing rootstocks in the Highveld region where Western Cape results are not applicable due to the milder summer climate, planting under nets and fertile soils. Other rootstock research is aimed at characterising new rootstocks in terms of adaptation and disease and pest tolerance.

Expertise

Rootstock and nursery tree quality workgroup
Rootstock evaluation committee

Research team

Prof Wiehann Steyn
– crop production programme leader

RESEARCHERS:

Dr Xolani Siboza
Dr Iwan Labuschagne
Prof Stephanie Midgley
Ms Louisa Blomerus
Mr Carl Hörstmann
Mr Werner Truter

Prof Adele McLeod
Mr W Visser
Dr Piet Stassen

STUDENTS:
Ms Lindsay Muchena – PhD student
Ms Buhle Ngidi – MSc student

New projects

- New apple rootstock plantings in the Highveld region (X Siboza)

Current projects

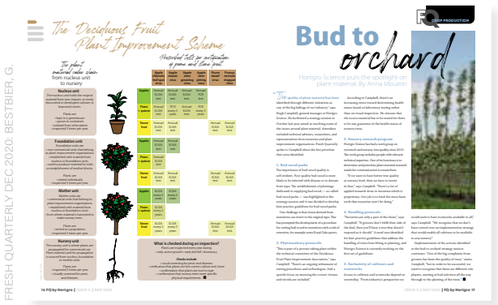
- Evaluation of pear rootstocks for the South African industry. Packham's Triumph in Grabouw. (X Siboza and I Labuschagne)
- Evaluation of pear rootstocks for the South African industry. Forelle in Wolseley (Mostertshoek). (X Siboza and I Labuschagne)
- Evaluation of pear rootstocks for the South African industry. Cape Rose in Wolseley (Mostertshoek). (X Siboza and I Labuschagne)
- Evaluation of peach rootstocks for the South African fruit industry at Vaalwater, Limpopo. (P Stassen and C Hörstmann)
- Evaluation of peach rootstocks for South African fruit industry: Rawsonville planting (Slanghoek). (P Stassen and C Hörstmann)
- Evaluation of plum rootstocks for the South African industry at Simondium (Keunenberg). (P Stassen and C Hörstmann)
- Evaluation of plum rootstocks for South African fruit Industry: Robertson planting (Roodehoogte). (P Stassen and C Hörstmann)
- Evaluation of new apple rootstocks and interstem combinations in Grabouw (Oak Valley). (X Siboza and B Ngidi)
- Evaluation of new apple rootstocks and interstem combinations in Grabouw (Breëvlei). (X Siboza and B Ngidi)
- Evaluation of new apple rootstocks and interstem combinations in the Langkloof (Helderwater). (X Siboza and B Ngidi)
- Evaluation of new apple rootstocks representing two vigour classes in two growing areas (Bokveldskloof and Molteno). (I Labuschagne and X Siboza)
- Evaluation of new apple rootstocks representing three vigour classes at Môrester and Oak Valley. (I Labuschagne and X Siboza)
- Sensitivity of various apple rootstocks to water stress. (S Midgley and L Muchena)
- Evaluation of apple rootstocks tolerance against specific apple replant disease (SARD). (I Labuschagne, A McLeod and X Siboza) – see Plant pathology
- Performance of apple trees derived from tissue culture compared to those from layer beds. (L Blomerus)
- Apple rootstock influence on Granny Smith scion growth, productivity and fruit green colour. (X Siboza)
- Rootstock effect on growth synchronisation of apples planted in low chill areas. (X Siboza)
- Evaluation of new plum rootstocks for South African fruit industry. (C Hörstmann)
- Growth synchronisation of stone fruit rootstocks and scions with different chilling requirements. (C Hörstmann)
- Evaluation of new peach rootstocks for South African fruit industry. (C Hörstmann)

Terminated project

- Testing stone fruit rootstocks for salt tolerance in controlled conditions and in situ plantings. (W Truter)

Publications

- Fresh Quarterly Dec 2020: Bestbier, G. A strong start.
- Fresh Quarterly Dec 2020: Bestbier, G.



FRESH QUARTERLY DEC 2020: BESTBIER, G.

Here's to your tree's health.

- Fresh Quarterly Dec 2020: Bestbier, G. Get a handle on new trees.
- Fresh Quarterly Dec 2020: Mouton, A. To pot or not.
- Fresh Quarterly Dec 2020: Mouton, A. The deciduous fruit plant improvement scheme.
- Fresh Quarterly Dec 2020: Mouton, A. Bud to orchard.
- SAFJ February/March 2021: Mouton, A. Van weefselkultuur tot dubbel-leiers: p. 61.
- SAFJ February/March 2021: Mouton, A. Van ogie tot boord: p. 64.
- SAFJ February/March 2021: Mouton, A. and Kriel, R. Die sagtevrugteplantverbeteringskema – eersteklas boorde begin met 'n blou etiket: p. 66.
- SAFJ April/May 2021: Mouton, A. Rooting for red colour: p. 84.

Events

- Langkloof seminar and Provar pome fruit exhibition (18 May 2021)

Growing season climate

Of the "serious" pome fruit producers, South Africa, together with Brazil, has the production areas closest to the equator. This means higher summer temperatures and generally altogether more plant stress and more fruit downgraded for processing compared to our major competitors.

The great inefficiency of caring for fruit that ultimately ends up in a juice bin would have seriously endangered deciduous fruit production in South Africa if not for the (currently) favourable exchange rate. It should not be surprising that research under this theme is predominantly aimed at decreasing sunburn and internal fruit quality defects brought about by climatic stress.

Prof Stephanie Midgley completed a project that modeled climate change into the future at a regional level. The output of this project will be built into an app that will provide fruit growers with high resolution projections on what to expect in terms of future temperature, rainfall, red colour development, chill accumulation, etc. Building on this project, Prof Midgley will be modelling and mapping early season temperatures in the future, while also assisting Hortgro in developing a climate change strategy.

Another new project will investigate the link between temperature and radial internal browning in Cripps Pink and derivative apple cultivars. The project will hopefully allow us to develop an early warning internal browning prediction tool, which will allow exporters to adjust their marketing strategies according to the risk of developing this disorder.

Expertise

Growing season climate workgroup

Research team

Prof Wiehann Steyn
– crop production programme leader

RESEARCHERS:

Prof Karen Theron
Dr Elke Crouch
Dr Tara Southey
Prof Stephanie Midgley
Dr Esmé Louw
Dr Iwan Labuschagne
Dr Elke Crouch
Ms Heleen Tayler

STUDENTS:

Ms Nasreen Malik – MSc student
Ms Anika Kock – MSc student
Mr Tristan Dorfling – MSc student
Ms I de Jong – MSc student

New projects

- Historic and future modelling and mapping of early season temperature patterns and extremes, and impacts for pome and stone fruit production in South Africa. (S Midgley)
- Climate change response strategy for the deciduous fruit industry of South Africa. (S Midgley)
- Internal browning of 'Cripps Pink' apples – effect of growing region temperature on radial browning and effect of canopy position on long term storage quality. (E Crouch, H Tayler and I de Jong)

Current projects

- Adaptability indexing of new pome (apple) and stone fruit (plum) cultivars in diverse South African growing areas. (I Labuschagne, E Louw, A Kock and T Dorfling) – see Dormancy

Completed projects

- Effect of nets on growth, yield and fruit quality as well economic feasibility in plums. (K Theron and N Malik)
- Scientific and practical guide to climate change and pome/stone fruit production in South Africa. (S Midgley) – see Dormancy and also Irrigation and nutrition
- Climate and terrain tool for the Elgin-Grabouw-Vyeboom-Villiersdorp production area specific to pome fruit. (T Southey) – see Farming technology


SAFJ APR/MAY 2021: STEYN, W.: P. 82.

RAAR
maar waar
Rooi kleur-ontwikkeling in pere

HORTGRO SCIENCE
Tekst Wiehann Steyn

Die waardes van gebloste pere is direk verwant aan die intensiteit en omvang van rooi kleur.

Die waardes van geblooide pere is direk verwant aan die intensiteit en omvang van rooi kleur.

Hoe hoër die donkerkompersie warm dae is, die kleur van Rosemarie-pere van rooi na groen verander.

Publications

- Fresh Quarterly Sept 2021: Mouton, A. Confronting climate change.

- SAFJ April/May 2021: Steyn, W. Raar, maar waar – Rooi kleur ontwikkeling in pere: p. 82.
- SAFJ April/May 2021: Steyn, W. Hoe rooier, hoe mooier: p. 86.
- SAFJ April/May 2021: Steyn, W. Die wenresep vir groen kleur in appels: p. 88.
- SAFJ June/July 2021: Mouton, A. Is nette noodsaaklik: p. 52.
- SAFJ June/July 2021: Mouton, A. Nette in die boord van die toekoms: p. 58.
- SAFJ June/July 2021: Mouton, A. Wat leer die Langkloof ons oor nette: p. 53.
- SAFJ June/July 2021: Steenkamp, E. Nette is ononderhandelbaar: p. 66.
- SAFJ June/July 2021: Mouton, A. Finigas – Nuwe riglyne vir netstrukture: p. 70.
- SAFJ June/July 2021: Mouton, A. Waarom nette plat val: p. 72.

Events

- Plum bloom webinar (6 October 2020)
- Symposium webinar - How climate change may affect RSA deciduous fruit cultivation in future (2 June 2021)
- Symposium webinar - The effects of fixed nets on deciduous crops and best practice installation guidelines (3 June 2021)

Reproductive biology

Research in this field is aimed at obtaining regular high yields of good quality fruit. Hence, projects tend to investigate flower initiation, fruit set, fruit thinning and alternate bearing.

The research is mostly applied and in recent years provided the stone fruit industry with a mechanical thinning option and a new chemical thinning agent that will soon be registered for use on plums, peaches and nectarines.

It became apparent in the 2018 season that high temperatures during the bloom period can have a dramatic impact on the set of plums. Louisa Blomerus' new project will investigate the effective pollination period of various plum cultivars. These results should allow plum producers to assess the potential risk of poor set with various cultivars during heat wave conditions and maybe thereby inform cultivar selection.

Expertise

Reproductive biology workgroup

Research team

Prof Wiehann Steyn
– crop production programme leader

RESEARCHERS

Dr Nicky Taylor
Prof Karen Theron
Dr Xolani Siboza
Ms Louisa Blomerus

STUDENTS

Ms Suzann Oosthuizen – MSc student
Mr Dian Craven – MSc student
Mr Aldo Horne – MSc student

New projects

- The effect of prohexadione-Ca application on regrowth, crop load and yield alternation in 'Fuji' apple (X Siboza and A Horne)
- Screening mainstream plum cultivars for the duration of the effective pollination period and other factors influencing successful fruit set (L Blomerus)

Current projects

- Leaf defoliation of Cripps' Pink and Granny Smith apples in the EGVV – effect on vegetative and reproductive development. (X Siboza, K Theron and D Craven) – see Dormancy

Completed projects

- Carbon partitioning in low chill peach cultivars: the impact on yield in summer rainfall areas of South Africa. (N Taylor and S Oosthuizen)

Publications

- SAFJ October/November 2020: Theron, K., Reynolds, S. and van der Merwe, S. Who's who in chemical thinners and what are best practices for use: p. 92.
- SAFJ October/November 2020: Theron, K. How do the different chemicals thin: p. 94.
- SAFJ October/November 2020: Theron, K. A South African perspective on chemical thinners: p. 96.
- SAFJ December/January 2021: Mouton, A. 'n Produsent se perspektief op pruimset: p. 80.
- SAFJ December/January 2021: Mouton, A. Hitte-uitputting – die swak Japanese pruimoes in 2019/20: p. 82.
- SAFJ December/January 2021: Mouton, A. Vyf faktore wat vrugset beïnvloed: p. 84.

Events

- Plum bloom webinar (6 October 2020)

Irrigation and nutrition

Water availability was identified as one of the top five risks facing our industry in the future. The Western and Eastern Cape provinces are water scarce; climate change is driving a drying trend and competition for water is increasing.

The crop production water strategy involves 1) determining how much water highly productive deciduous fruit trees use, 2) conducting research on various water saving technologies and 3) conducting research to show growers the negative effects of over-irrigation on production and quality.

A Water Research Commission co-funded project was initiated to determine the water requirements of high yielding orchards of two plum cultivars in the Breede and Berg River valleys.

Expertise

Irrigation and nutrition workgroup

Research team

Prof Wiehann Steyn
– crop production programme leader

RESEARCHERS:

Prof Stephanie Midgley
Prof Nebo Jovanovic
Dr Sebinasi Dzikiti
Dr Elmi Lötze
Dr Kenias Chigwaya

STUDENTS:

Mr Edward Lulane – PhD student
Mr Stephen Jordaan – MSc student
Mr Ubaidullah Mathews – MSc student

New projects

- Water use of high-performing full-bearing Japanese plum (*Prunus salicina*) in two major production regions of the Western Cape (N Jovanovic and U Mathews)

Current projects

- Establishing quantitative relationships between water relations, growth, yield and quality of high performing commercial apple orchards. (S Midgley)
- The effect of a water deficit on fruit tree phenology, fruit production, fruit quality and storability of Fuji and Cripps' Pink apples. (K Chigwaya) – See Quality management
- Investigating the potential of fixed and draped netting technology for increasing water productivity and water savings in full bearing apple orchards under micro-irrigation. (S Midgley, S Dzikiti, E Lötze, E Lulane and S Jordaan)

Completed projects

- Scientific and practical guide to climate change and pome/stone fruit production in South Africa. (S Midgley) – see Dormancy and also Growing season climate

Farming technology

Research in this theme focuses on orchard mechanization and technology drivers such as big data, remote sensing, robotics, and GIS that will all contribute to changing the way we produce our fruit in our orchards of the future.

A collaborative study with CRI and KaapAgri developed a best practice guideline for erecting a netting structure that will lead to improved design integrity and mitigate the risk of structure failure.

A new project was initiated to develop a best practice guideline for constructing support structures for orchards on dwarfing apple rootstocks. The results of this new study will also feed into the best practice netting structure guidelines.

Expertise

Farming technology workgroup

Research team

- Prof Wiehann Steyn – crop production programme leader
- Mr Marno van der Westhuizen
  – research implementation manager in charge of the orchard of the future programme

RESEARCHERS:

Mr Mico Stander
Prof Adriaan van Niekerk
Mr Koos Bouwer
Dr Tara Southey
Mr Wouter Visser

NEW PROJECTS

- Quantifying and visualizing inter-tree variability in orchards using satellite and drone imagery (A van Niekerk and M Stander)

CURRENT PROJECTS

- Development of a best practice guideline for the construction of dwarfing rootstock support structures (W Visser) – see Rootstocks and nursery tree quality

COMPLETED PROJECTS

- Development of a best practice guideline for the construction of agricultural netting structures (K Bouwer)
- Climate and terrain tool for the Elgin-Grabouw-Vyeboom-Villiersdorp production area specific to pome fruit. (T Southey) – see Growing season climate

PUBLICATIONS

- Fresh Quarterly Mar 2021: Kriel, G. Back to the future.
- Fresh Quarterly Mar 2021: Kriel, G. Delivering on the Orchard of the Future programme.
- Fresh Quarterly Mar 2021: Kriel, G. Raising the bar.
- Fresh Quarterly Mar 2021: Mouton, A. Apple-growing in Australia.
- Fresh Quarterly Mar 2021: Mouton, A. Bokveldskloof.
- Fresh Quarterly Mar 2021: Mouton, A. Paardekloof.
- Fresh Quarterly Mar 2021: Mouton, A. Graymead.
- Fresh Quarterly Mar 2021: Mouton, A. Oak Valley.

EVENTS

- Langkloof seminar and Provar pome fruit exhibition (18 May 2021)

CHAPTER 3

Crop Protection Research Programme

The crop protection programme, being multidisciplinary in nature, includes both applied and basic research on nematology, entomology and plant pathology. The crop protection technical advisory committee assesses research outputs and research priorities. In addition, the entomology and pathology peer workgroups assess proposed and current research projects and provide guidance to the researchers involved in the programme. Various workgroups also aid in identifying research needs and prioritizing research projects.

Ensuring the sustainability of the fruit production process is a critical aspect in crop protection research and emphasis is placed on biological control, orchard ecology, phytosanitary threats and precision agriculture.

Crop protection research during this season has again been challenging with Covid complicating and delaying a number of projects. However, a number of important projects were completed, and a wide variety of new projects approved.

Industry funding has been approved for the building and operation of a four-room phytosanitary facility to be housed on Welgevallen at Stellenbosch University. Dr Renate Smit has been appointed to conduct phytosanitary research in the new facility. Dr Minette Karsten has also been appointed and will conduct applied research in the industry. Dr Karsten has a long association with the industry and has been involved in industry funded research for a number of years.

Phytosanitary and market access

The threat posed by phytosanitary issues to market access is significant and ongoing. The current spread of the invasive oriental fruit fly and the concerns regarding false codling moth are relevant examples. The current research projects address a number of relevant issues including applied research on fumigation using novel materials. The research programme is aimed at ensuring effective management of phytosanitary pests and diseases and ensuring access to markets.

Expertise

Phytosanitary and biosecurity workgroup

Integrated pest management group

RESEARCH TEAM:

Matthew Addison

– crop protection programme leader

RESEARCHERS:

Dr Shelley Johnson

Prof Pia Addison

Dr Tony Ware

Mr Handré Viljoen

Dr Marelize de Villiers

Mr Thomas Platt

Ms Anél Blignaut

TECHNICAL ASSISTANT:

Mr Terence Asia

STUDENTS:

Dr Leigh Steyn – Post-doctoral research fellow

Mr Nicolas Basson – MSc student

Dr Renate Smit - Post-doctoral research fellow

New projects

- Evaluating the systems approach for fruit flies in stone fruit destined for the EU, focusing on plums (M de Villiers and T Platt)
- Evaluation of cold storage protocols for plums for efficacy of cold sterilization of false codling moth and fruit fly (T Platt)
- Rearing technology and taxonomy of the Cape fly Ceratitis quilicii (P Addison and N Basson)
- Improving integrated control measures against the grain chinch bug, Macchiademus diplopterus (S Johnson)

Current projects

- Academic support for the development of a pest diagnostic company. (P Addison and L Steyn)
- Updating the quick identification guide for phytosanitary pests of South African deciduous fruit. (S Johnson)
- Comparison of cold disinfestation treatments of Thaumatotibia leucotreta (Lepidoptera: Tortricidae) in peaches, plums (Prunus spp.) and media. (T Ware)
- Disinfestation of Bactrocera dorsalis fruit fly-infested apples, pears, nectarines and plums using cold treatment. (T Ware)
- Upscale and customise ethyl formate fumigation from shipping container to cold room capacity for the control of key phytosanitary pests. (S Johnson & R Smit)
- Effect of irradiation as a mitigation treatment on storage quality of early peaches and nectarines for airfreight consignments. (H Viljoen) – see Quality management.
- Confronting climate change initiative. (A Blignaut)

Publications

- Fresh Quarterly Sept 2021: Bonthuys, J. Converting to Organic.


FRESH QUARTERLY SEP 2021: BONTHUYS, J.

New insights into producers' perceptions of organic farming

What holds South African fruit growers back?

Main Content

Lack of knowledge and the need to learn novel practices were the most significant challenges identified by respondents.

Nematology

The research programme on nematodes continues to be highly productive. The development of a number of potential biological control agents has precipitated interest from commercial biological control companies. Negotiations are underway regarding the supply of the agents and the registration thereof.

Both plant parasitic and entomopathogenic nematodes are being researched. Entomopathogenic fungi are also being integrated into the research programme. The completed research on entomopathogenic nematodes and fungi on mealybug is a good example of this.

Expertise

Integrated pest management group

Soil health workgroup

RESEARCH TEAM:

Matthew Addison

– Crop protection programme leader

RESEARCHERS:

Prof Antoinette Malan
Dr Nomakholwe Stokwe
Dr Rinus Knoetze
Mr Thomas Platt
Ms Lené van der Walt
Mr Sonwabo Booi

STUDENTS:

Ms Letodi Mathulwe – MSc student
Mr Murray Dunn – PhD student

Current projects

- Control of the mealybug, Pseudococcus viburni, using entomopathogenic fungi in deciduous fruit orchards. (N Stokwe and L Mathulwe)
- Screening of apple rootstocks for resistance against the most prevalent Pratylenchus species affecting orchards in South Africa. (R Knoetze)
- Mass culture and formulation of entomopathogenic nematodes for improved field application against key insect pests. (A Malan and M Dunn)
- Evaluating the ability of entomopathogenic nematodes (EPNs) for their ability to control populations of the obscure mealybug (Pseudococcus viburni) on apple foliage in field conditions. (T Platt)
- Identification and characterisation of naturally suppressive soils specific to ring nematodes (Criconemoides xenoplax). (R Knoetze)
- Ring nematode (Criconemoides xenoplax) resistance of South African bred rootstock selections in potted plant trials and high pH soils. (S Booi)

FRESH QUARTERLY SEP 2021: BONTHUYS, J.


CROP PROTECTION

Research reveals new facts about nematode pests

The highlights

from three Hortgro -funded projects

Reproduction of the most common lesion-nematode species, *P. hippeastri*, is minimal on most cover crops in winter.

Completed projects

- Biological control agents currently available for plant parasitic nematode control. (L van der Walt)

Publications

- Fresh Quarterly Sep 2021: Bonthuys, J. Plant-parasitic nematodes in orchards.
- Fresh Quarterly Sep 2021: Bonthuys, J. Research reveals new facts about nematode pests.

Soil health

Research on soil health and orchard floor ecology is an emerging theme in agriculture as it is an important component of sustainability. Current research is focused on cover crops and their effects on soils, soil biota and fruit production. New research is focused on the role of collembola (small primitive insects living on and below soils) in orchard soil ecology and the effect of plant diversity in planted cover crops. The effects of mulches on pests and soil ecology are due to be researched in the new season.

Expertise

Soil health workgroup
Integrated pest management group

RESEARCH TEAM:

Matthew Addison
– Crop protection programme leader

RESEARCHERS:

Dr Charlene Janion-Scheepers
Dr Nomakholwe Stokwe
Mr Matthew Addison

STUDENTS:

Ms Ansuli Theron – MSc student
Mr Abdul Jacobs – MSc student

Current projects

- Orchard floor management and soil health in deciduous fruit orchards. (M Addison and A Theron)
- Soil health in orchards: the role of collembola as key indicators (C Janion-Scheepers and A Jacobs)

Publications

- Fresh Quarterly Jun 2021: Bestbier, G. The benefits of soil health.


SAFJ JUNE/JULY 2021: STEENKAMP, E. : P. 74.


SAFJ JUNE/JULY 2021: STEENKAMP, E. : P. 74.

- Fresh Quarterly Jun 2021: Bestbier, G. Put your soil to the test.
- Fresh Quarterly Sept 2021: Mouton, A. Carbon jargon.
- Fresh Quarterly Sept 2021: Mouton, A. Organic matter matters.
- Fresh Quarterly Sept 2021: Mouton, A. A new agricultural revolution.
- Fresh Quarterly Sept 2021: Mouton, A. Soil health in Washington State.
- Fresh Quarterly Sept 2021: Mouton, A. Life in earth.
- Fresh Quarterly Sept 2021: Mouton, A. Everything counts in large amounts.
- Fresh Quarterly Sept 2021: Mouton, A. Cover crops in orchards.

- SAFJ June/July 2021: Steenkamp, E. Cover crop trials: p. 74.

Events

- Langkloof seminar and Provar pome fruit exhibition (18 May 2021)

Plant pathology

The plant pathology research programme continues to address a number of important industry issues. On-going research on the incidence and distribution of fungal pathogens in young trees is highly relevant, as is the integrated management of apple scab and post-harvest rots. Apple replant disease and various aspects of post-harvest pathology, including the development of alternative fungicides, are also receiving attention.

Expertise

Pre- and postharvest pathology workgroup
Integrated pest management group

Pre-harvest pathology

RESEARCH TEAM:

Matthew Addison
– Crop protection programme leader

RESEARCHERS:

Prof Lizél Mostert
Prof Adele McLeod
Dr Pieter Louw
Dr Iwan Labuschagne
Dr Xolani Siboza
Mr Werner Truter
Prof Hano Maree
Dr Rachelle Bester
Dr Yolanda Petersen

STUDENTS:

Mr Vernon Jacobs – MSc student
Ms Reshika Kallideen – PhD student
Ms Doré de Villiers – MSc student
Ms Elzane Froneman – MSc student
Ms Rochelle Janse van Rensburg – PhD student
Dr Lindani Moyo – Post-doctoral research fellow

New projects

- Tolerance of apple rootstocks against Phytophthora root rot (A McLeod and L Moyo)
- Confirm the involvement of Alternaria sp., as possible causal agent of fruit spot on apples in South Africa, and identify potential control strategies, by investigating disease phytopathometry (P Louw)
- Evaluating the effect of yeast-extract, other compounds and treatment combinations as an alternative to chemical control of Venturia inaequalis on apples (P Louw)
- Characterisation of the association of apple stem pitting virus (ASPV) with pear stony pit disease (R Bester)

Current projects

- The influence of climatically different seasons on the reproductive strategy of Venturia inequalis and the RIMpro disease forecasting model. (A McLeod and E Froneman)
- The effect of organic amendments on the severity of apple replant diseases in subsequent apple orchard replantings. (A McLeod and R Janse van Rensburg)
- Evaluation of apple rootstocks tolerance against specific apple replant disease (SARD). (I Labuschagne, A McLeod, X Siboza and W Truter)
- Determining the risk of mulches in the spread of canker pathogens in apple orchards. (L Mostert, V Jacobs and R Kallideen)
- Bacterial disease survey of major pome fruit production areas in South Africa. (Y Petersen)
- Determine the occurrence of fungicide resistance against pyrimethanil and fludioxinol in Monolinia laxa and Botrytis cinerea populations from stone fruit orchards. (P Louw)

Completed projects

- Investigating the relationship of pathogens, particularly Alternaria, in causing fruit spot symptoms/lenticel damage on apples. (P Louw)
- Development of a hybridisation-based detection assay for PVdI. (H Maree and R Bester)
- Evaluation of PVdI transmission through top working infected trees. (H Maree and R Bester)
- Evaluation of pruning wound protectants on nursery apple trees. (L Mostert)
- Alternatives for the management of apple replant disease. (A McLeod and D de Villiers)
- Establishing the cause of marbling and corky flesh in plums (H Maree and R Bester)
- Determine fungicide efficacy using qRT-PCR for

FRESH QUARTERLY DEC 2020: MOUTON, A.

FRESH QUARTERLY DEC 2020: MOUTON, A.

FRESH QUARTERLY JUN 2020: MOUTON, A. BESTBIER, G.

detection and quantification of Botrytis cinerea inoculum and viability on pear leaves as a substrate, before and after fungicide application. (P Louw)

Publications

- Fresh Quarterly Dec 2020: Mouton, A. Getting to grips with plum marbling.
- Fresh Quarterly Dec 2020: Mouton, A. What is pear stony pit?
- Fresh Quarterly Dec 2020: Mouton, A. Figuring out the cause of pitted pears.
- Fresh Quarterly Jun 2021: Mouton, A. Apple replant disease.
- Fresh Quarterly Jun 2021: Mouton, A. The pot test.
- Fresh Quarterly Jun 2021: Mouton, A. Alternative control of apple replant disease.
- Fresh Quarterly Jun 2021: Mouton, A. Fundamentals of fumigation.
- Fresh Quarterly Jun 2021: Bestbier, G. Replant research overview.

- Fresh Notes 183 – 15 December 2020: Plum marbling poster.

Events

- Plum marbling webinar (25 January 2021)
- Plum marbling workshop (30 September 2021)

Post-harvest pathology

RESEARCH TEAM:

Matthew Addison
– Crop protection programme leader

RESEARCHERS:

Dr Cheryl Lennox
Dr Julia Meitz-Hopkins
Dr Robbie Pott
Dr Oluwafemi Caleb
Dr Pieter Louw

STUDENTS:

Dr Zinash Belay – Post-doctoral research fellow
Ms Nandi Nyamende – MSc student
Ms Kirsten van Niekerk – MSc student
Dr George Teke – Post-doctoral research fellow
Ms Sinovuyo Magwebu – MSc student
Ms Inge Block – MSc student
Ms Miche Kotze – MSc student

New projects

- Postharvest mould of pome fruit stems and calyx sepals – an investigation into the incidence, cause and management (C Lennox and I Block)
- Emerging postharvest diseases of pears (J Meitz-Hopkins and M Kotze)
- Continued pursuit of sanitiser products for potential use in the apple and pear industry (P Louw)

Current projects

- Lipopeptides Fengycin and Iturin A as postharvest fungicide on pome fruit. (C Lennox, J Meitz-Hopkins and S Magwebu)
- Thermal and non-thermal treatments of stone and pome fruit: Towards efficient phytosanitary measures. (O Caleb, Z Belay and N Nyamende) – see Quality management

Completed projects

- Bioreactor and process development for the production of antimicrobial lipopeptides produced by Bacillus spp. for biological control of postharvest phytopathogens in the perishable fruit industry. (R Pott, K van Niekerk and G Teke)
- Pursuit of sanitiser products for potential use in the apple and pear industry. (P Louw)

Integrated pest management

The IPM research programme deals with a wide variety of crop protection issues. The research is aimed at allowing for the more efficient and sustainable control of pests and diseases. Invasive insects and phytosanitary concerns have influenced the research programme significantly.

Expertise

Integrated pest management workgroup

RESEARCH TEAM:

Matthew Addison
– Crop protection programme leader

RESEARCHERS:

Prof Pia Addison
Prof John Terblanche
Mr Thomas Platt
Prof Francois Roets

TECHNICAL ASSISTANT:

Mr Terence Asia

STUDENTS:

Dr Minette Karsten – Postdoctoral research fellow
Mr Francois du Preez– PhD student
Ms Mignon de Jager – MSc student
Mr Steffan Hansen – MSc student
Ms Mia Vermaak – PhD student

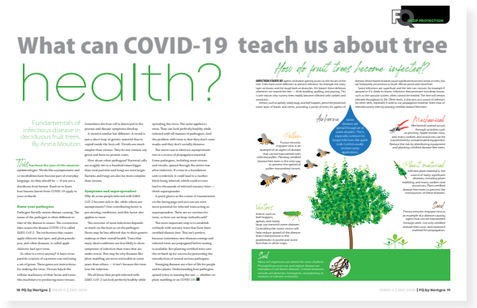
New projects

- Phlyctinus callosus species complex and post-harvest control (S Johnson and CA Kruger)

Current projects

- Implementation of biological control options against false codling moth in laboratory and field trials. (P Addison and F du Preez)
- Assessment of management methods against pome fruit mites. (T Platt and P Addison)

FRESH QUARTERLY DEC 2020: MOUTON, A.


What can COVID-19 teach us about tree health?

How do fruit trees become infected?


Crop protection in the Orchard of the Future

A changing strategy for a changing world

- Sequencing the genome and transcriptome of false codling moth, Thaumatotibia leucotreta, for pest management. (J Terblanche and M Karsten)
- False codling moth population genetics: gene flow in agricultural environments. (J Terblanche and M Karsten)
- Maintaining and rearing of insect cultures. (M Addison and T Asia)
- Assessing the threat of the Polyphagous Shot Hole Borer beetle (PSHB, Euwallacea whitfordiodendrus) and its symbiotic fungus (Fusarium euwallaceae) to deciduous fruit trees in the Western Cape Province of South Africa. (F Roets and M de Jager)
- Phlyctinus callosus taxonomy and field management. (P Addison and S Hansen)
- Trophic ecology of predaceous mites in apple and pear orchards. (J Terblanche and M Karsten)

Publications

- Fresh Quarterly Dec 2020: Mouton, A. What is pear stony pit?
- Fresh Quarterly Mar 2021: Louw Coetzee, M. Crop protection in the Orchard of the Future.

- SAFJ June/July 2021: Steenkamp, E. Integrated pest management – are we there yet: p. 80.
- SAFJ June/July 2021: Storey, S. Know your bio-products: p. 84.

ELSE-MARIE STEENKAMP | HORTGRO.

Dr Ken Pringle established the "Monitoring for mites and other insects" programme in SA

SAFJ JUNE/JULY 2021 STEENKAMP, E. - P. 80.


INTEGRATED PEST MANAGEMENT

Are we there yet?

Precision agriculture

The application of new technology in integrated pest management and the industry in general is critical. The development of more efficient spray application and evaluation methods is central to pest and disease control. Coupled to this is the use of predictive models and various decision support methods that allow for the accurate application of management methods. Current research addresses a number of these issues and new technologies are emerging. The integration of industry data into an industry wide data base is an example of this.

Expertise

Spray application workgroup
Integrated pest management group

RESEARCH TEAM:

Matthew Addison
– Crop protection programme leader

RESEARCHERS:

Prof Pia Addison
Dr Gideon van Zyl
Dr Francois Bekker

STUDENTS:

Mr Quintus Deacon – MSc student

Current projects

- Evaluation of spray application techniques on pome and stone fruit trees for improved spray deposition parameters for the control of late season red spider mite. (G van Zyl)
- Artificial intelligence for managing economic fruit pest efficiently. (P Addison, F Bekker and Q Deacon)

CHAPTER 4

Post-Harvest Research Programme

Post-harvest supports and enhances the processes throughout the supply-chain critical to ensuring that intrinsic product integrity is maintained and that a quality product is available to the end-consumer in local and distant global markets. Post-harvest covers producers, packhouses, marketing co-ordination, logistics and shipping, receivers/wholesalers and end-consumers. The post-harvest research programme is structured into four themes, namely quality management, physiological defects, storage techniques and packaging and logistics. Research strategy for each theme is determined by a workgroup (one workgroup per theme) consisting of exporters, pre- and post-harvest technical specialists, industry consultants and researchers. Additional workgroups are formed as and when needed.

When considering research strategy, the workgroups always keep in mind the objectives of the post-harvest research programme, which are the following:

- To increase the marketable tons of fruit delivered per ton of fruit loaded;
- To present clients all along the post-harvest value chain extending up to the consumer with a safe product of reliable, good quality;
- To reduce wastage and losses from defects and pathogens (see the crop protection programme for post-harvest pathology research);
- To increase efficiencies throughout the post-harvest value chain;
- To increase the sustainability of post-harvest practices;
- To reduce risk within the post-harvest value chain.

Research needs relating to pre-harvest factors that affect post-harvest quality and storability are addressed within the crop production programme. The post-harvest and crop production programmes share a programme manager with the effect that research is very well integrated over the two programmes.

Quality management

Quality management refers to maintaining quality throughout the logistical chain to the end-consumer. With reference to stone fruit, shrivel due to moisture loss is the main post-harvest defect and therefore the key research focus area. Prof Olaniyi Fawole has been conducting very interesting research on the use of edible coatings to prevent moisture loss and maintain fruit keeping quality. During the last season of research, he showed that the commercial implementation of the technology will require some more thought and further experimentation.

Pome fruit projects are aimed at optimising the Forelle Early Market Access (FEMA) programme in terms of release criteria and marketing protocol. Daniël Viljoen found that pears from FEMA designated orchards that are harvested two to three weeks after normal release but do not qualify for FEMA release can be treated with FEMA rate 1-MCP. This will avoid excessive ripening during storage. The fruit should be cold stored for 12 weeks as part of the normal Forelle post-harvest programme.

Expertise

Quality management workgroup

RESEARCH TEAM:

Prof Wiehann Steyn
– Post-harvest programme leader

RESEARCHERS:

Ms Anél Botes
Mr Daniël Viljoen
Mr Handré Viljoen
Prof Olaniyi Fawole
Dr Oluwafemi Caleb
Prof Stephanie Midgley
Dr Elke Crouch
Ms Heleen Tayler
Dr Kenias Chigwaya
Dr Alemayehu Tsige

STUDENTS:

Ms Shannon Riva – MSc student
Ms Taongashe Majoni – MSc student
Ms Nicole Jenneker – MSc student
Ms Nandi Nyamende –MSc student
Ms Makiwe Nkohla – MEng student
Dr Zinash Belay – Postdoctoral research fellow

Pome fruit projects

New projects

- Artificial intelligence-based quality monitoring in the pome fruit cold chain management (A Tsige)
- The effect of relative humidity during cold storage on water loss and lenticel damage incidence of apples (K Chigwaya)

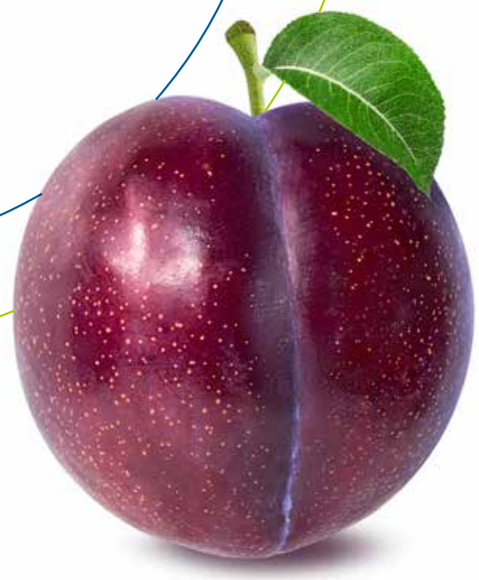
Current projects

- Assessment of malic acid equivalents of Forelle pears on the storability and taste thereof. (D Viljoen)
- The effect of a water deficit on fruit tree phenology, fruit production, fruit quality and storability of Fuji and Cripps' Pink apples. (K Chigwaya) - see Irrigation and nutrition
- Moisture loss studies in pears. (A Botes and E Crouch)
- The use of Harvista™ (pre-harvest 1-MCP) application to prevent green colour loss and reduce blush of Granny Smith apples. (D Viljoen)
- To develop marketing protocols for FEMA designated orchards that are harvested two to three weeks after normal release but do not qualify for FEMA release. (D Viljoen)
- Thermal and non-thermal treatments of stone and pome fruit: Towards efficient phytosanitary measures. (O Caleb, Z Belay and N Nyamende) - see Pre- and post-harvest pathology
- Revision of FEMA release standards when fruit do not make FEMA firmness or sugar criteria. (D Viljoen)
- Integrated post-harvest ethylene management along the value chain: From the farm to the consumer. (O Caleb, Z Belay and M Nkohla)

Stone fruit projects

Current projects

- Technology testing for the ability to control shrivel in cold-stored plums and nectarines. (H Viljoen)
- Effect of irradiation as a mitigation treatment on storage quality of early peaches and nectarines for airfreight consignments. (H Viljoen) – see Phytosanitary and market access



- Profiling sugar metabolism in plums as related to maturity, cultivar difference and post-harvest storage regimes. (O Fawole and T Majoni)
- Thermal and non-thermal treatments of stone and pome fruit: Towards efficient phytosanitary measures. (O Caleb, Z Belay and N Nyamende) - see Pre- and post-harvest pathology

Completed projects

- Application of post-harvest edible coatings to alleviate shrivel in plums and nectarines. (O Fawole and S Riva)
- Evaluation of the 8 mm penetrometer plunger to determine harvest maturity on plums. (H Viljoen)
- Preharvest and postharvest applications of edible coatings to alleviate shrivel and maintain quality in stone fruit. (O Fawole) – Also Packaging / Logistics

Publications

- Fresh Notes 185 – 22 February 2021: Forelle Early Market Access (FEMA) programme.

Physiological defects

The main internal quality defects receiving research attention are heat damage in plums and lenticel breakdown, mealiness, superficial scald and internal browning in apples and pears. Research is aimed at understanding the underlying causative factors (both pre- and post-harvest) and biochemistry of these defects to allow the development of technology to limit or prevent their occurrence. In this regard, an ambitious new project of Dr Elke Crouch will aim to identify the climate factors during early fruit development that gives rise to radial internal browning in Cripps Pink apples and cultivars derived from it.

Other aims are to generate best practice guidelines for handling of fruit both pre- and post-harvest and to develop indicators to predict the risk of the various defects in a given season. Handré Viljoen confirmed that rapid cooling can exacerbate internal heat damage in pre-disposed Laetitia plums. Cooling Laetitia plums over a longer period of 48 and 72 hours decreases internal heat damage, but a longer cooling period increases the risk of shrivel. The rapid cooling of Laetitia plums over six hours followed by three days' storage at -0.5 °C, followed by two days at 20 °C can be used to determine the risk of developing internal heat damage in a batch of fruit.

Expertise

Physiological defects workgroup

RESEARCH TEAM:

Prof Wiehann Steyn
– Post-harvest programme leader

RESEARCHERS:

Dr Elke Crouch
Dr Elmi Lötze
Dr Ian Crouch
Dr Ashwil Klein
Ms Anél Botes
Mr Daniël Viljoen
Mr Handré Viljoen
Dr Kenias Chigwaya

STUDENTS:

Dr Letitia Schoeman – Postdoctoral research fellow
Ms Liza-Marie Dippenaar – MSc student
Ms Nolubabalo Mzizi -MSc student
Mr Alone Hlungwani – PhD student
Ms Monja Gerber – PhD student
Dr Thirupathi Pandian - Postdoctoral research fellow

New projects

- Influence of fruit micro-structure on gas exchange and tissue damage. (E Crouch)
- Internal browning of 'Cripps Pink' apples – effect of growing region temperature on radial browning and effect of canopy position on long term storage quality. (E Crouch, I Crouch, H Tayler)
- Assessment of a lenticel breakdown prediction method for the South African pome industry. (D Viljoen, K Chigwaya)
- Assessment of fruit density as an indicator for internal browning susceptibility in Fuji apples. (D Viljoen, K Chigwaya)

Current projects

- Compilation of a database of high-quality images of pome fruit disorders from South African growing and storage conditions to contribute to the further development of software-based determination (APP) for the detection and reduction of bearing damage in fruit (Frudistor) in an international context. (I Crouch)
- Quantifying the role of vapour pressure deficit in the development of lenticel breakdown in Braeburn apples. (E Lötze, D Viljoen and N Mzizi)
- Superficial scald on Granny Smith - understanding the mechanisms and limitations of the storage protocols used by industry and assess risk indicators in storage for scald development. (E Crouch, A Botes, A Klein, D Viljoen, T Pandian, M Gerber and A Hlungwani)

Completed projects

- Detection of internal heat damage and identification of techniques to prevent the expression of the disorder in plums. (H Viljoen) – also Storage techniques
- Determining 'Forelle' pre-harvest mealiness / cavity development stage, due to environmental factors and exploring prevention of mealiness developing after storage and ripening. (E Crouch, L Schoeman and L-M Dippenaar)

Events

- Best practice protocol for preventing internal browning in Cripps Pink webinar (6 April 2021)

Storage techniques

Non-chemical scald control and prevention of internal browning are major focusses of the evaluation of storage technologies and protocols. A major outcome of research in this theme is the development of protocols to prevent or reduce the incidence of disorders and to maintain fruit quality. Dr Elke Crouch and team found that preventing scald development in Granny Smith apples relies on minimizing total cumulative oxygen exposure. Therefore, oxygen levels below 1% should be in place as soon as possible after harvest and correct temperatures were reached. Equipment that can deliver this as soon as possible and maintain these levels provided the best results (0.2- 0.4% O2, depending on safety limits).

Expertise

Controlled atmosphere storage group

RESEARCH TEAM:

Prof Wiehann Steyn
– Post-harvest programme leader

RESEARCHERS:

Ms Anél Botes
Dr Elke Crouch
Mr Daniël Viljoen
Dr Asanda Mditshwa
Mr Handré Viljoen
Dr Pieter Louw
Ms Heleen Tayler
Dr Ian Crouch

STUDENTS:

Mr Braam Mouton – MSc student
Ms Zinhle Shezi – Honours student
Mr Jason Ladegourdie – MSc student
Ms Anmari Kriegler – MSc student
Ms Ineke de Jong – MSc student

New projects

- Internal browning of 'Cripps Pink' apples – DCA-CF and long-term storage with best practice protocol. (E Crouch and I de Jong)

Current projects

- Investigate the effect of step wise cooling on superficial scald and internal browning in apples. (A Botes, E Crouch and A Kriegler)
- Soft scald development and management in apples. (A Botes, E Crouch and J Ladegourdie)
- Studies on the effect of ozone on postharvest quality of apples. (A Mditshwa and Z Shezi)

Completed projects

- Performance evaluation of three controlled atmosphere storage equipment / techniques on Granny Smith apples. (E Crouch, I Crouch, A Botes and B Mouton)
- The effect of OTFLOW system on temperature distribution in containers specifically for cold steri protocols. (H Viljoen)
- Survey of commercial stone fruit cold room relative humidity and temperature to ascertain possible impact on moisture management. (H Viljoen)

Publications

- SAFJ October/November 2020: Viljoen, H.W., Lemmer D. and Taylor M.A. Six-week bin storage protocol for Angeleno plums subsequently exported by sea: p. 98.

Events

- Controlled Atmosphere meeting (3 November 2020)
- Controlled Atmosphere Engineers meeting (25 May 2021)

Packaging / logistics

Logistics projects focus on the optimisation of shipping container space utilisation while packaging projects are aimed at reducing plastic packaging or finding alternatives to non-recyclable, single use plastics without jeopardising fruit quality or the structural integrity of the packaging. The plastic workgroup of the pack house action group provides direction in terms of where industry needs to go with regard to plastic packaging.

Dr Tarl Berry completed a project aimed at introducing a new packaging system (design) that could present the industry with a unique opportunity to utilize the refrigeration system of containers more effectively. This would enhance fruit quality preservation, reduce fuel consumption of the refrigeration unit (lower shipping costs) and enable the improved application of various temperature treatments (e.g., intermittent warming, ambient loading and cold treatments.) Dr Berry's results showed that the use of packaging systems that fully utilize the container floor area, not only significantly improve packing density, but also drastically improve cooling performance.

Expertise

Packhouse action group
Plastics workgroup

RESEARCH TEAM:

Prof Wiehann Steyn
– Post-harvest programme leader

RESEARCHERS:

Dr Tarl Berry
Dr Alemayehu Tsige
Ms Heleen Tayler
Mr Handré Viljoen
Ms Anél Botes
Mr Daniël Viljoen

STUDENTS:

Mr Adewale Nuryan Tiamiyu – MSc student

Current projects

- Evaluation of logistic alternatives in container transport of apples and pears. (A Tsige)
- Development of knowledge to react to possible banning of single-use petroleum-based plastics that impact on post-harvest management of stone and pome fruit quality knowledge. (H Tayler & H Viljoen)
- Evaluating the effects of different plastic liners and pallet shrouds on internal and external quality on pome fruit. (A Botes & D Viljoen)
- Artificial intelligence-based quality monitoring in the stone fruit cold chain management (A Tsige)

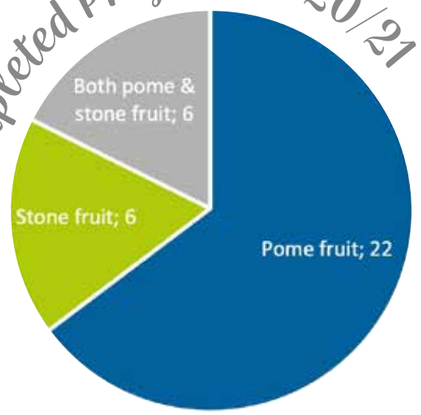
Completed projects

- Implementation of next-generation packaging systems in high cube refrigerated containers for efficient cooling and improved volume usage. (T Berry and A Tiamiyu)

CHAPTER 5

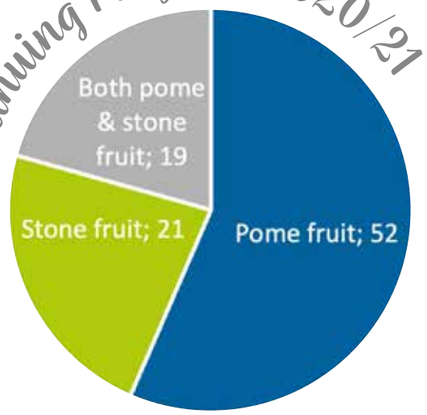
The year at a glance

Completed Projects 2020/21

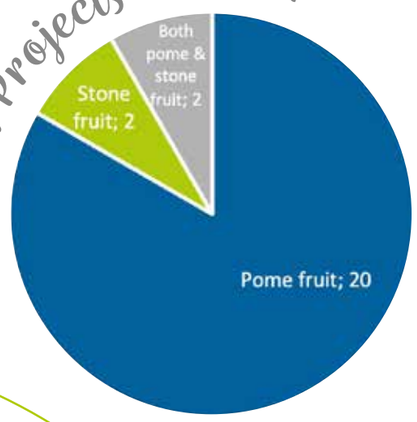


This is a summary of the research projects in 2020/21 and includes market access projects.

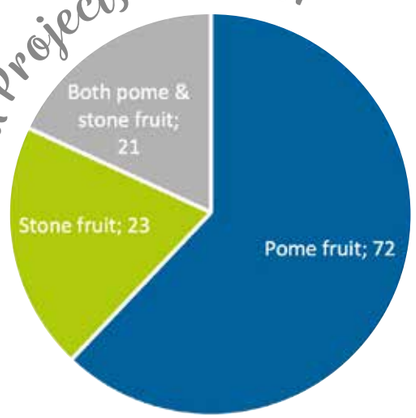
Continuing Projects 2020/21



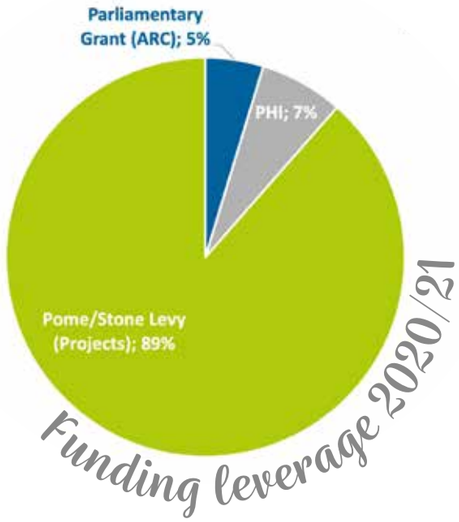
New Projects 2020/21



Total Projects 2020/21

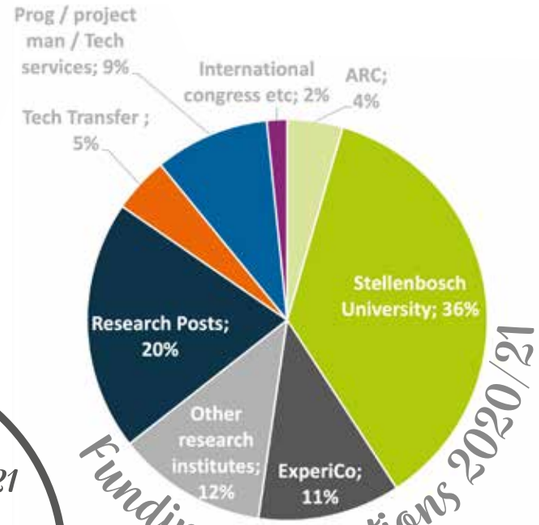


Funding leverage 2020/21



The chart below illustrates the distribution of the industry's funding

Funding allocations 2020/21

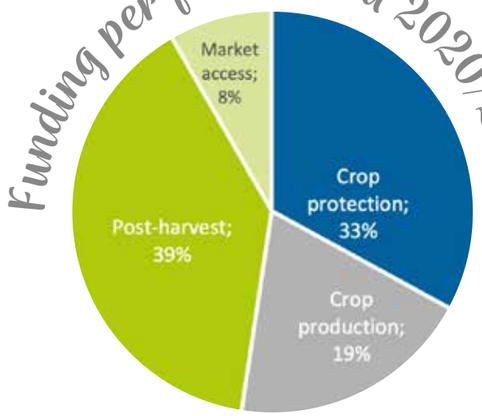


Funding allocation per institution 2020/21

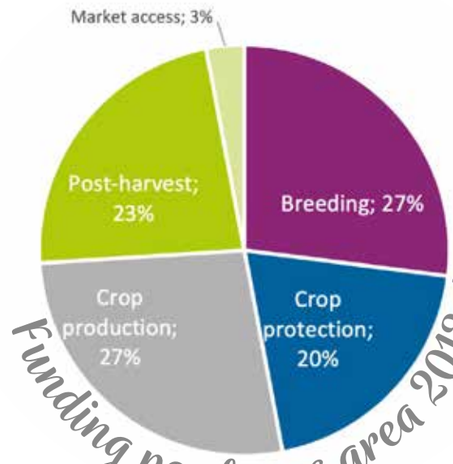
16 entities
7 Stellenbosch University departments
25% SU posts
44% SU research
69% SU TOTAL
0.7% Other units

These two graphs below show the shifts in funding allocation per research programme from 2013/14 to 2020/21

Funding per focus area 2020/21



Funding per focus area 2013-14



Research projects by research institution

RESEARCH INSTITUTE	PROJECTS								
	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
ARC Infruitec-Nietvoorbij	36	36	30	29	24	20	6	12	14
ARC Breeding	21	21	21	20	16	15	0	0	0
ARC Research Projects	15	15	9	9	8	5	6	12	14
Stellenbosch University	38	39	34	33	36	49	48	56	64
Dept Horticulture	15	16	14	12	12	15	22	23	25
Dept Pathology	5	5	5	5	7	8	9	7	10
Dept Entomology	18	18	14	14	16	21	12	17	20
Dept Engineering			1	1		2	2	2	2
Dept Soil Science				1	1	1	1	1	1
Dept Genetics							1	3	3
CREST						1	1	1	
Dept Geography								1	1
SARChi								1	2
Hortgro Science Technical Services	20	20	15	18	20	4	0	0	0
ExperiCo	15	16	19	18	21	17	22	22	21
Nemlab	1	1	1	2	2	1		1	1
Blue North	1	1	1	1	1	1	1	1	1
University of Kwazulu-Natal							1	1	1
University of Western Cape									2
Western Cape Dept Agriculture									1
Provar					5	12	14	12	19
Procrop								1	1
Consultants			5	4		6	3	4	4
C Jarmain			1			1	1	1	
P Stassen			3	3	3	3	3		
MBB Consulting			1	1				1	2
SAPO						1	1		
T Ware						1	1	2	2
	114	**116**	**110**	**109**	**116**	**116**	**96**	**110**	**129***

* This number is higher than the total number of projects because some projects are shared between institutions.

The number of multi-institutional projects (projects shared by more than one research institution)

2010/11	2015/16	2020/21
2	1	16

Average cost of project per year 2010-2021

Transformation

% Projects with a female project leader

2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
37	53	44	42	39	37	48	45

% Projects with a black project leader

2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
13	22	22	22	20	19	28	23

% projects with a postgraduate student

2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
35	33	34	29	44	46	50	30

Students 2020/21

Postgraduate students working on projects funded by Hortgro Pome and Hortgro Stone.

DEGREE	BLACK MALE	BLACK FEMALE	WHITE MALE	WHITE FEMALE	TOTAL
Hons		1			**1**
MSc	4	10	10	12	**36**
PhD	2	3	2	3	**10**
Postdoc	2	2	1	4	**9**
TOTAL	**8**	**16**	**13**	**19**	**56**

CHAPTER 6

The Hortgro Science Team

Prof Wiehann Steyn
General Manager, Crop production programme manager, Post-harvest programme manager

Matthew Addison
Crop protection programme manager

Marno van der Westhuizen
Research implementation manager

Anita van Staden
Research administrator

STELLENBOSCH UNIVERSITY:

Prof Karen Theron
Chair in applied pre-harvest deciduous fruit research at Stellenbosch University

COMMUNICATIONS SUPPORT BY HORTGRO:

Elise-Marie Steenkamp
Group communications manager

Thea van Zyl
Events coordinator

Carmé Naudé
Communication specialist

Taryn Hodgson/Thomas Davidson
Digital media specialist

STAFF SECONDED TO STELLENBOSCH UNIVERSITY:

Dr Xolani Siboza
Department of Horticultural Science

Laura Allderman
Department of Horticultural Science

Dr Shelley Johnson
Department of Conservation Ecology and Entomology

Dr Minette Karsten
Department of Conservation Ecology and Entomology

Dr Marelize de Villiers
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Terence Asia
Department of Conservation Ecology and Entomology

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HORTGRO science
Growing Fruit IQ