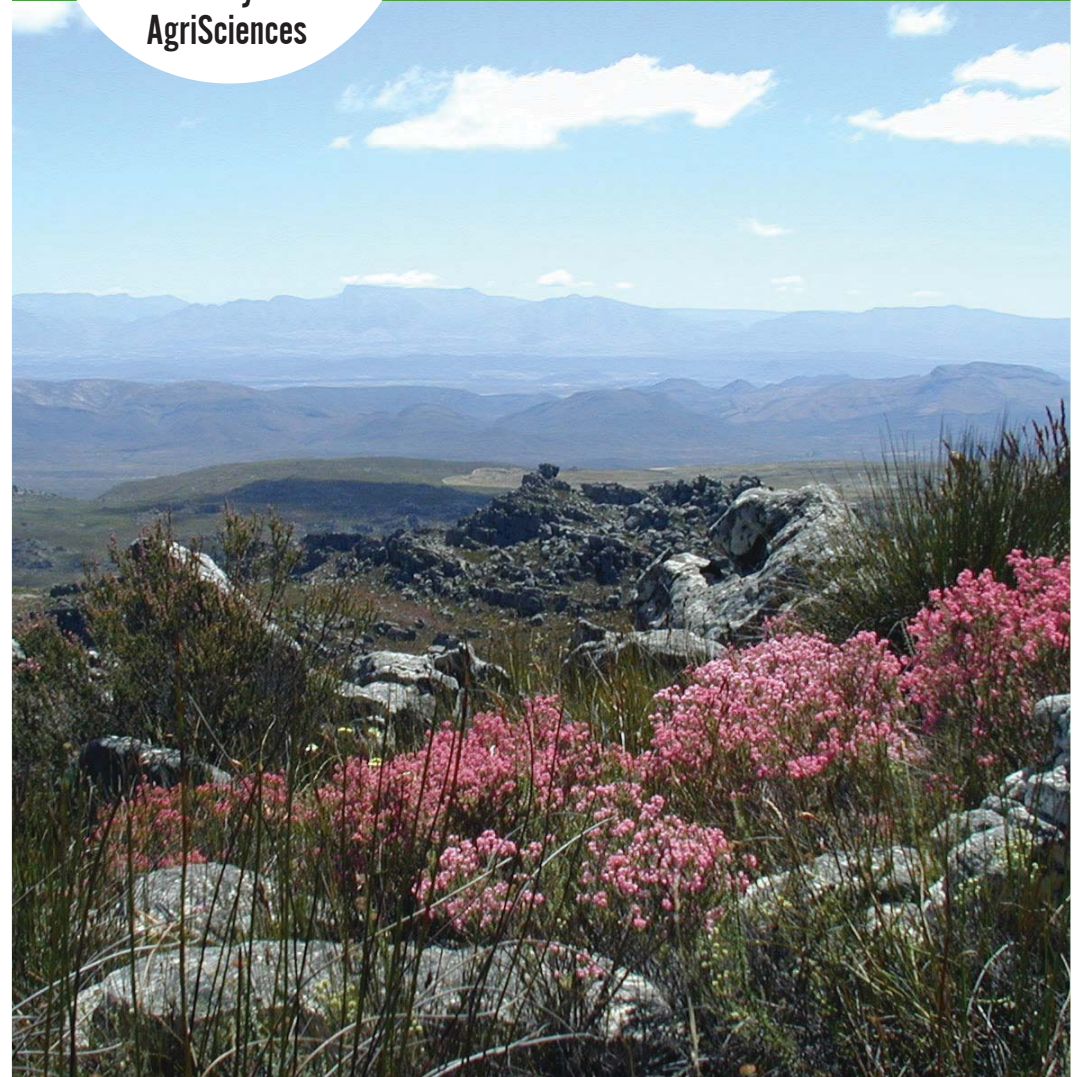




ANNUAL REPORT 2016





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Prof Danie Brink
Acting Dean: Faculty of AgriSciences



The Faculty of AgriSciences is a key stakeholder in addressing the growing challenges of South African agriculture and forestry, and ensuring that the country's natural resources are utilised and managed both ethically and scientifically. AgriSciences is still acknowledged as the top faculty for studies in agriculture and forestry on the African continent, 27th among the BRICS countries, and among the top 50 globally on the 2016 QS world rankings. This acknowledgement strengthens the Faculty's resolve to continue to offer quality education and applied research in agricultural sciences.



DECEMBER GRADUATION 2016

Fitr: Prof Danie Brink (acting Dean), Drr Carolina van Zyl, Sylvanus Mensah, Trevor Koopman, Irene Idun, Ilse Kotzee, Mahlatse Baloyi, Tanya Kerr, Elleunorah Allsopp, Margretha Wang and Jeff Muntifering



MARCH GRADUATION 2017

*Fitr: Tlou Samuel Masehela, Letitia Schoeman, Providence Mayo, Mukani Moyo, Plaxedis Zvinorova, Omowumi Binyotubo, Stephen Amiandamhen
2nd row: Luke Mugode, Lelani Mannetti, Samuel Adu-Acheampong, Eliah Munda, Bernard Effah, Louwrens Theron
3rd row: Sarah Erasmus, Maxine Jones, Edson Ncube, Tara Southey*

STUDENT STATISTICS 2016

* 2016 statistics based on the degrees awarded at the December 2016 and March 2017 graduation ceremony

Degrees awarded 2016*

Programme	Total	Programme	Total
B Agric	71	MSc Conservation Ecology	6
B Agric Admin	6	MSc in Forestry and Wood Sciences	9
BSc Conservation Ecology	35	MSc in Food Science	9
BSc in Forestry and Wood Sciences	22	MSc Agric	53
BSc in Food Science	37	PhD	28
BSc Agric	118	Post Graduate Diploma	4
Hons B Agric Admin	3		
Hons BSc	10		
MSc	16	TOTAL	427





Class of 2016 (photo: C Langeberg)



Photo 1: Shepherd Mudavanhu busy with his fieldwork (photo: L Sishuba)



Photo 2: Chateaux de Pichon-Longueville, Bordeaux (photo: N Vink)



Photo 3: A group of hard-working wine economists (photo: N Vink)

AGRICULTURAL ECONOMICS

FOCUS AREAS

- **Agricultural policy**
- **Resource economics**
- **Farm management**
- **Production economics**
- **Structural change in agriculture**

OVERVIEW

The Department has succeeded in attracting a growing number of undergraduate and postgraduate students over the past few years, with the result that a lot of time and effort have been devoted to teaching. However, the research effort has not been neglected, nor has our social impact initiatives. In 2016, staff of the Department were responsible for a total of 17 publications in accredited journals, while 10 students completed their Master's studies. The Department also, for the first time, had more than one full-time PhD student.

The Department remains firmly embedded in the agricultural sector of the Western Cape in particular and of South Africa

and the continent of Africa generally. During 2016 the strong link with the Bureau for Food and Agricultural Policy was maintained and even strengthened through our collaboration with our counterparts at the University of Pretoria and the Western Cape Department of Agriculture.

Highlights of the year include the election of Professor Nick Vink to the board of the South African Reserve Bank as a non-executive director, the appointment of Jan C Greyling as junior lecturer in production economics following the retirement of Dr Jan Lombard in 2015, as well as the appointment of a new administrative officer for the Department in the person of Ms Elizabeth von Wechmar. Mr Greyling also spent time on study leave at the University of Minnesota, while Prof Vink was asked to lecture in the Wine Marketing course at the Free University of Bolzano.

RESEARCH

Lulama Traub, along with Prof Thom Jayne from Michigan State University, had two articles published in the prestigious Foreign Affairs journal. The first was on the megatrends that are transforming Africa's food systems, and the second on the role

of the youth in African agribusiness. The first of these was also presented to Bill Gates in his capacity as co-chair of the Bill and Melinda Gates Foundation, a key donor to the activities of BFAP in Africa.

We are also proud of our PhD student, Shepherd Mudavanhu, who co-authored no fewer than three articles during 2016. Originating from his Master's thesis of 2015, these articles focus on the economics of the clearing of invasive alien vegetation species from South Africa's water catchment areas (Photo 1).

Extraordinary Prof Jeff Gow was also prolific, with no fewer than eight publications that cover an eclectic range of topics, most of which focus either on governance issues in developing countries in Africa, or the uses of information and communications technology in development.

Prof Nick Vink again attended the annual conference of the American Association of Wine Economists in Bordeaux in June (Photos 2 and 3). Apart from enjoying an excellent social programme, he read three papers at the conference. These

addressed different issues of importance to the South African wine industry. The first two focused on supply-side issues: the efficiency of grape growing, with colleagues Colin Thirtle and Jenny Piesse (both Professors Extraordinary in the Department) and Beatrice Conradie from University of Cape Town. Then there was a paper, with Britta Niklas, from the University of Bochum in Germany, on the impact of changes in the weather on grape yields in South Africa. The third paper addressed the demand side, looking at the effect of expert opinions on the perceived quality of Pinotage wines among millennials in Stellenbosch. This paper was based on the Master's thesis of Margaux Vannevel.





Photo 4: Prof Johan van Zyl



Photo 5: Prof Jeff Gow



Photo 6: Brian Meyer
(photo: J. Greyling)



The AEASA Conference in Johannesburg
(photo: J. Greyling)

Departmental Professors Extraordinary in focus

Johan van Zyl (Photo 4) holds a PhD and DSc in Agricultural Economics from the University of Pretoria, where he also served as dean of the faculty of Biological and Agricultural Sciences. During his academic career he also worked as a researcher at the World Bank and at Michigan State University. In 1996 he was appointed as the deputy vice-chancellor of the University of Pretoria, and subsequently as vice-chancellor. Taking time out of academia, Van Zyl joined Sanlam in 2001 as CEO, a position from which he stepped down in 2015.

In addition to serving as Extraordinary Professor in Agricultural Economics at Stellenbosch University, Van Zyl currently serves as non-executive Chair of Sanlam's board, and is CEO of Ubuntu-Botho and joint CEO of African Rainbow Capital. He also serves on the supervisory board of Steinhoff International Holdings and as director on several other boards.

Jeffrey Gow (Photo 5) is Professor of Economics at the University of Southern Queensland, Toowoomba, Australia. Gow

obtained his PhD at Monash University and his BSc Agric and MSc Agric at the University of New England in Armidale, Australia. From 1990 to 2007, Gow held various lecturing and research positions at the University of New England, from where he moved to the University of Southern Queensland as associate professor and then professor. Gow has a keen interest in health economics and serves on various associations and boards specifically involved with HIV/AIDS. These include: Board Member of the HIV Foundation Queensland, the Ministerial Committee on HIV/AIDS Research Associate in the Health Economics and HIV/AIDS Research Division (HEARD), University of KwaZulu-Natal, South Africa. He is also a member of the International AIDS Economic Network. Since 2012 Jeff is serving as Extraordinary Professor in Agricultural Economics at Stellenbosch University. On a personal level, Gow enjoys watching rugby and playing golf, and he has a preference for red wine from the personal cellar of Prof Nick Vink.

Department of Agricultural Economics says farewell to Brian Meyer after 43 years

After a lifetime at the Department of Agricultural Economics, Brian Meyer (Photo 6) retired in September. Brian joined the Department in 1973, shortly after finishing school, and in the subsequent years the University, the people and the country have changed a lot: "In the beginning we did not get a payment advice or even an envelope. We simply had to report to the safe at the end of every month and the faculty manager gave us cash in hand. In 1973 I earned R30 a month – it wasn't a little, as I could take my girlfriend to the bioscope and live from it. We usually received less than the R30 because the faculty manager also sold sweets – monkeys, snakes, toffees and those sorts of things – he first subtracted your debt before you got your money."

About the people: "I still remember when Nick (Vink) and Theo (Kleynhans) arrived at the University as first-year students. They were just children and Theo and I once ran races in the passage." "I also remember the time when Prof Karaan was one of the first black

students to enrol in the Department. Everyone asked him why he was studying agriculture, but when they saw his marks they stopped asking." On the changes in the country, Brian says: "Although things were different outside the Department I never felt that it was a case of us and them. I remember the day when Prof Kassier asked me to help out in another department. One of their staff members came to pick me up that morning but he made me sit on the back of the bakkie. He apparently also had to pick up someone else. It was very cold that day, so cold that my ears ached from the wind. When we got to Coetzenburg and it still was only the two of us, I got off the back and walked back to the Department. I explained the situation to Prof Kassier and he phoned them and said that I could not help. He also added a few other things that I cannot repeat."

After 43 years all of us want to thank Brian most heartily for his eternally positive presence. "We will really miss you. We are looking forward to regular visits, particularly by way of your business as a painting contractor and wish you every success in this endeavour."



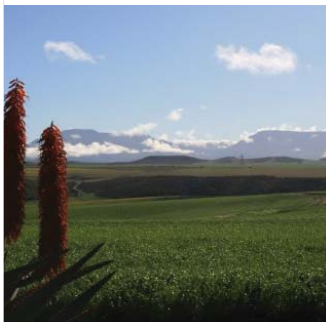


Photo 1: Wheat in the Overberg
(photo: PJ Pieterse)



Photo 2: Claas tractor
(photo: PJ Pieterse)



Photo 3: Agronomy students with shirts sponsored by AGT Foods Africa
(photo: P Swanepoel)

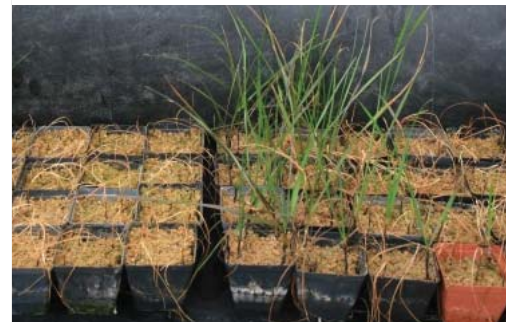


Photo 4: Effect of glufosinate ammonium on ryegrass at cool (left) and warm (right) temperatures (photo: PJ Pieterse)



Photo 5: PhD student with Amaranthus seedlings in Maputo (photo: PJ Pieterse)

AGRONOMY

FOCUS AREAS

- Coolweather- and pasture crops
- Vegetable production systems
- Weed management

OVERVIEW

The research in the department focuses on soil-less as well as open-field production systems of vegetables, herbs and flowers (Dr Estelle Kempen); sustainable production systems for winter cereal-, oilseed- and planted pasture crops (Photo 1) (Prof Nick Kotze, Dr Pieter Swanepoel and Dr Marcellous le Roux); and the management of weeds in agronomic crops (Dr PJ Pieterse).

Drs Pieter Swanepoel, Marcellous le Roux, Estelle Kempen and PJ Pieterse travelled abroad to attend congresses and visit research partners. Dr Kempen resigned at the end of December 2016.

Staff and students excelled in various aspects. Dr Pieter Swanepoel received two awards for the best paper presented at the congress of the Grassland Society of

Southern Africa. He was also selected as South African representative on the Scientific Advice Board of CIHEAM (International Centre for Advanced Mediterranean Agronomic Studies). MSc student Charné Viljoen was selected as one of 50 students from over the world to attend a scientific course in Brazil while Albert Coetzee reached the top ten in the BVG competition to manage risk on the JSE. The department received a Claas tractor sponsored by Overberg Agri, Claas and Kempston Agri (Photo 2). A Stone rake and -collector was donated by Radium Engineering. AGT Foods Africa sponsored T-shirts for the students (Photo 3).

RESEARCH

Weed management

Ms T Mucheri investigated the effect of plant size and temperature on the efficacy of glufosinate ammonium on ryegrass. It was found that the size of ryegrass plants had a small effect on efficacy of glufosinate ammonium applied at low dosage rates. A surprising finding was that glufosinate ammonium was much more efficient at cool temperatures (10/15 °C night/day) than at warm (20/25 °C night/day) temperatures,

contrary to most findings in literature (Photo 4). Efficacy of glufosinate ammonium was enhanced at high temperatures when ammonium sulphate was added to the tank as an adjuvant. It is suspected that calcium concentrations in the plants are higher at higher temperatures and that it may hamper the action of glufosinate ammonium. Addition of ammonium sulphate to the tank mixture probably counteracts the effect of the calcium. Variable results were obtained under field conditions with application of ammonium sulphate compared to the excellent results obtained under greenhouse conditions. The effects of temperature, application rates and water quality on the efficacy of glufosinate ammonium will be investigated in a follow-up study.

Vegetable production

In a study carried out in Maputo in Mozambique, PhD student JEMM Ribeiro investigated the effect of varying soil water levels and different harvesting methods on the yield and quality of two amaranth species (Photo 5). The southern parts of Mozambique suffer from regular droughts that prohibit the

dryland production of commercial leafy vegetables. Amaranths however are hardy, usually indigenous plants with relatively high calcium and crude-protein levels. The amaranth plants were grown with soil water levels varying from 20% of available soil water to 80% of available soil water levels. The plants were harvested at 25% and 50% of their height at frequencies of two or three weeks. The effect of temperature and day length on the initiation of flowering (and therefore the termination of good leaf production) was also investigated. The results of the study indicated that amaranth species, in particular *Amaranthus hybridus*, can be grown successfully as leafy vegetables during the whole season in the southern parts of Mozambique with minimal irrigation during the dry months.

Dairy-pasture production systems

Since 1990, dairy production in South Africa has increased by 56%. Currently, South Africa has 1.37 million dairy cows and the trend towards more pasture-based dairy production (Photo 6) is ever increasing. However, more pressure is placed on these dairy sys-





Photo 6: Pasture based milk production
(photo: P Swanepoel)



Photo 7: Canola fertilizer trials
(photo: P Swanepoel)



Photo 8: Evaluation of medic pastures in summer
(photo: P Swanepoel)



Photo 9: Good weed control in vineyards in the North Cape
(photo: PJ Pieterse)



tems to be managed more environmentally-friendly. Cultivated pastures for dairy production are often kikuyu-based, a grass which requires high levels of nitrogen (N) and water (applied through irrigation). Nitrogen can be an environmental pollutant if fertilisation and irrigation are not well managed. Recommended N fertilisation rates for these pastures were developed when these systems were still conventionally tilled, and soils had low organic matter contents. The aptness of these guidelines is questionable in the current milieu. Dr Pieter Swanepoel is collaborating inter alia with animal and pasture scientists from Department of Agriculture Western Cape to develop strategic N fertilisation programme for grass and N-fixating forage crops.

Crop-pasture rotational cropping systems

Preliminary results from a study by Mr Albert Coetzee indicated that in a low rainfall year, the application of fertiliser N as a topdressing, made no difference in Canola (Photo 7) yield in the Swartland. In the southern Cape, where temperatures were lower, and rainfall better distributed, N fertilisation is advised to be

split into two applications at planting (20 kg N ha⁻¹) and 30 days after emergence. Similar results were found by Mr Derick Becker for 2016, but more research is, however, required before rigid fertiliser guidelines could be constructed.

A study by Mr Flackson Tshuma, highlighted the severity of dryland salinity and its effects on pasture production (Photo 8). Saline soils had the lowest medic seed numbers, seedling establishment and herbage yield compared to the medium and high productivity (non-saline) soils. The use of gypsum was not effective in the alleviation of soil salinity. Such mitigation strategies by farmers, may lead to secondary problems and imbalances of nutrients in soil. Follow-up studies will evaluate salt tolerant legumes as an alternative to soil ameliorants.

SOCIAL IMPACT

Commercial farming

The world is becoming more aware of environmentally sustainable practices and the impact farming systems have on natural resources. Dairy production in particular is being scrutinised and many incentives are currently emerging

to support environmentally sustainable farming practices. To this end, Dr Pieter Swanepoel extended work on soil quality and pastures to farmers at two independent forums (Environmental Stewardship Symposium of the Woodlands Dairy Sustainability Project, and a Nestle farmer's day). This extension work motivates farmers to follow more sustainable soil and pasture management practices.

The increasing use of herbicides is necessary to protect crops from competition by weeds. Unfortunately, this results in possible pollution problems as well as the risk that weeds may develop resistance to herbicides. Dr PJ Pieterse visited the Kakamas area in the Northern Cape to participate in a Philagro farmer's day to inform producers about the dangers of herbicide resistance. A few farms were visited where ideas were exchanged and advice was given to prevent herbicide resistance from developing (Photo 9).

Urban vegetable production

The postgraduate students of the Department of Agronomy belong to a

departmental society called DVG (Developing Vegetable Gardens) who aims to train people living in communities around Stellenbosch to initiate and manage their own vegetable gardens. In 2016 the DVG under the leadership of Ms T Mucheri trained children who have been admitted to Lindelani Place of Safety to develop skills to produce vegetables in small gardens. Some of the work was done at Lindelani but sometimes the children were brought to the department on Welgevallen experimental farm where they were supplied with food and they could experience first-hand how seed and seedlings should be handled to produce healthy plants. DVG is proud to be able to provide children like this with skills that can help them later in life but also to attempt to address the immediate needs with regards to development of a healthy self-image and sound social interaction.



Photo 1: Marna Smith-Stofberg receiving her Bronze medal at the 49th SASAS congress (photo: G van Wyk)



Photo 2: Lise Sandenbergh receiving her Bronze medal at the 49th SASAS congress (photo: G van Wyk)

ANIMAL SCIENCES

FOCUS AREAS

- **Animal Physiology**
- **Animal Breeding**
- **Animal Nutrition**
- **Meat Science**

OVERVIEW

Our Department centres on the three pillars of Animal Physiology, Animal Nutrition and Animal Breeding. An integrated approach ensures the holistic training of the Animal scientists of the future. Research focuses on enhancing the efficiency, profitability and sustainability of animal production industries, nationally and internationally. Postgraduate projects encompass studies on various livestock species including dairy and beef cattle, sheep and goats, swine, poultry, ostriches, marine and freshwater aquaculture species, as well as wildlife. Scientific findings are converted into industry-friendly formats and propagated on scientific and producer platforms to ensure that our research stays current and is of relevance to animal production industries.

Researchers and students attended the 49th annual SASAS (South African Society for Animal Science) Congress and 6th International Ratite Symposium, presenting in total 56 oral

and 20 poster presentations. Marna Smith-Stofberg (Photo 1) and Lise Sandenbergh (Photo 2) received SASAS Bronze medals for their doctoral research, and Dianca du Plessis received the SASAS Merit bursary for the best final year Animal Science student. At the 62nd ICoMST (International Congress of Meat Science & Technology) congress held in Bangkok, Thailand, Tersia Needham (Photo 3) and Maxine Jones received awards for the best oral and 2nd best poster presentation, respectively. Other meetings attended by researchers included the Joint Annual Meeting of the American Society for Animal Science and the American Dairy Science Association (Utah, USA) as well as the South African Wildlife Management Association (SAWMA) symposium (Tzaneen).

Dr Emiliano Raffrenato visited Benin to establish long-term collaboration with the University of Abomey-Calavi and the Department of Livestock of the Italian Ministry of Agriculture (Photo 4). Prof Louw Hoffman was again selected as honorary member of the SAWMA council (Photo 5). Dr Helet Lambrechts facilitated the first ever SAWMA Quiz. Final year Aquaculture students were invited for the first time to visit the MozTilapia Fish Farm in Tofu, Mozambique, and to establish potential research projects (Photo 6).



Photo 3: Tersia Needham received an award for best oral presentation at ICoMST2016 (photo: T Needham)



Photo 4: Dr Emiliano Raffrenato presenting a lecture at the University of Abomey-Calavi (photo: E Raffrenato)

RESEARCH

Karoo lamb can be traced back to its origin

The research of PhD student Sarah Erasmus (Photo 7) verified the link between diet and meat and showed that Karoo lamb is a product unique to its origin. In 2013, when Sarah's studies commenced, South Africa did not yet have the legal framework that could provide protection to indigenous products such as Karoo lamb. Karoo lamb received domestic protection in 2013 under the Merchandise Marks Act (Act 17 of 1941). Sarah conducted her research under the expert guidance of Prof Louw Hoffman, South African Research Chair (SARChI) in Meat Science: Genomics to Nutriomics, in the Department of Animal Sciences and food sensory expert Ms Nina Muller of the Department of Food Science. Different analytical methods were used to confirm the regionally specific authenticity of Karoo lamb, including isotopes and by doing a descriptive sensory analysis. Sarah confirmed that Karoo lamb has a unique sensorial quality that differs from other types of lamb meat. The research has also been taken to an international level with analyses performed at RIKILT at Wageningen University and Research in the Netherlands, where a state-of-the-art method known as proton transfer-reaction mass spectrometry was

used under guidance of food authenticity expert, Prof Saskia van Ruth. Volatile compounds detected in Karoo plants were also identified in the lamb meat and fat. These results verified the link between diet and meat, and showed that Karoo lamb is a product unique to its origin.

Assisted reproduction in ostriches

Information on the potential to use assisted reproductive techniques in long-term breeding objectives of ostriches, was provided by the research of Dr Marna Smith-Stofberg (Photo 8). She has established a protocol by which to cool ostrich semen successfully for up to two days, or to store it indefinitely after freezing until it is required for the artificial insemination of female birds. The long-term preservation of ostrich semen makes it possible to artificially inseminate females with frozen semen during their most important reproductive months. Such samples should preferably be collected during periods when semen production is at its best. These cycles do not always overlap in nature.

The technology also makes it feasible to establish a biobank where semen from ostriches with good genetic traits can be stored in the long term. It is not only important for the storage of seminal plasma





Photo 5: Prof Louw Hoffman was selected as an Honorary board member of the SAWMA council (photo: A Jordaan)



Photo 6: SU Aqua students visit Mozambique for the first time (photo: K Salie)



Photo 7: Sarah Erasmus, busy with sensory analysis of Karoo lamb (photo: E Duvenage)



Photo 8: Marna Smith-Stofberg busy with laboratory studies during her PhD project (photo: E Duvenage)

of genetically superior animals, but can also be indispensable when colonies must be built up again following a disease like bird flu, during which affected animals have to be destroyed. Further progress of the protocol will lead to improved assisted reproduction (AR) techniques for application in ostriches.

RESEARCH

Magretha sheds light on genetic traits that make Nguni cattle unique

In mammals, copy number variations (CNVs) play an important role in generating necessary variation in a population as well as disease phenotype. Through her PhD research, entitled “Copy Number Variations in South African Nguni cattle: prevalence, characterization and genetic diversity”, Magretha Wang of the Department of Animal Sciences, recently shed more light on the adaptability of Nguni cattle in Africa. Nguni cattle are recognized for their ability to endure harsh environmental conditions while exhibiting enhanced resistance to diseases and parasites. The breed comprises of up to nine different ecotypes. In the first part of her study, 492 Nguni cattle obtained from different regions in South Africa were genotyped using the Illumina BovineSNP50 bead chip, with five sub-populations identified. Illumina BovineSNP50 bead chip data ob-

tained for 59 Nguni genotypes were used to investigate the occurrence of CNV regions (CNVRs) using PennCNV software. A total of 356 unique CNVR's were identified. Specific genes were identified to be unique to the respective five sub-populations. Gene ontology analyses demonstrated a number of pathways to be represented by the respective genes, including amongst others processes involved in the immune response, response to abiotic stress and regulation of certain biological processes.

Her study concluded that the CNVs may explain part of the phenotypic diversity and the enhanced adaptation evident in Nguni cattle. The significance of the CNVRs identified and the possible effect on the adaptability of Nguni cattle needs to be ascertained, and it may hold interesting insight into the functional and adaptive consequence of CNVs in cattle.

SOCIAL IMPACT

The various research groups within the Department are closely involved with animal industries throughout the country, and technology/information transfer of research findings normally assumes the form of farmers' days and industry information days.

The majority of the academic staff members serve on various University and/or scientific committees. Prof K Dzama is a panel member of the SADC Drought Monitoring Centre (Livestock Committee) and convenor of the Animal Breeding and Genetics Forum. He serves on the South African Society of Animal Science Awards and the South African Red Meat Research and Development Trust Project committees. He further serves on the Red Meat Project steering committee of the NAMC (National Agricultural Marketing Council) and is convenor of the Cape Town Urban Agriculture Forum. He also serves on the University's Employment Equity Forum. Prof LC Hoffman serves on the University's Research Committee. He is lifetime member of the Southern African Wildlife Management Association, Associate Editor of the *Journal of the Science of Food and Agriculture*, and serves on the Editorial Board of *Meat Science*. Prof CW Cruywagen is a member of the Faculty of AgriScience's Faculty Committee and the Academic Programme Committee. He serves on the Editorial Committee of the *South African Journal of Animal Science* and is a member of various international committees. He is the current Vice-Chair

and incoming Chair of the Agricultural Microscopy Division of the American Oil Chemists' Society, and serves on the International Awards Committee of the American Dairy Science Association. He is also registered with the American Registry of Professional Animal Scientists. Dr H Lambrechts is a sub-editor of the *South African Journal of Animal Science*, is the chairperson of the Western Cape branch of the South African Society for Animal Science, serves on the HEQC (Higher Education Quality Committee) new course accreditation evaluation committee, and is the secretary of the South African Reproductive Research Group. Dr E Pieterse serves as Vice-Chairperson of the Western Cape branch of the South African Society for Animal Science and on the Faculty of AgriScience's Timetable Committee. Dr E Raffrenato serves on the SU Research Ethics Committee. Ms A Davids serves on the Faculty of AgriSciences Marketing Committee, and is the secretary of the Western Cape branch of the South African Society for Animal Science.





Dept. of ConsEnt Research Day 2016
(photo: A Jordaan)

CONSERVATION ECOLOGY & ENTOMOLOGY

FOCUS AREAS

- Conservation Planning and Management in Agricultural Landscapes
- Restoration and Landscape Ecology
- Conservation of Symbioses
- Vertebrate Conservation
- Invertebrate Conservation
- Area-wide Pest Management on Tree Crops

OVERVIEW

Conservation Ecology and Entomology bring together teaching and research in the rapidly growing and important field of the conservation of utilised landscapes and their surrounds. The expertise ranges from integrated pest management, conservation of natural communities and the management of living resources to conservation policy formulation and technology transfer, with the aim of developing a forward-thinking, dynamic department with a distinct agricultural and forestry address. The year 2016 was productive for the Department, with many new research projects starting and several prestigious awards having been made to its staff members. The Integrated Pest Management (IPM) group's research on biological control and the sterile insect technique was featured on a CNN *Inside*

Africa report, the group co-hosted several workshops (e.g. *Bioacoustics* – presented by Prof R Balakrishnan of the Indian Institute of Science), and Dr N Stokwe and PhD student, Ms C Kapp received awards from HORTGRO for their work in nematology. The Applied Physiological Ecology group co-hosted workshops on *Methods and techniques for dormancy management of insects* and *Stable isotopes in invasion biology* (co-hosted by ConsEnt, the Dept. of Botany and Zoology, and the Centre for Invasion Biology at Stellenbosch University). The Mondi Ecological Networks Programme (MENP), funded by the Mondi Group in Europe, won the 2016 NSTF/GreenMatter Award. Prof M Samways also received the Gold Medal from the South African Academy of Arts and Science, and the Chancellor's Award from Stellenbosch University. The Biodiversity and Symbioses lab initiated an exciting initiative involving citizen science (see Social Impact section), and Dr F Roets co-hosted a workshop on *Dealing with molecular data in R* in collaboration with Charles University (Czech Republic). New avenues of research on ecological restoration were also forged when the SCENNET Project awarded funding to Prof K Esler to present a plenary at the international conference "Scenarios and Models of Biodiversity and Ecosystem Services in Support of Decision-making" (Montpellier,



Photo 1: The Natal fruit fly – *Ceratitis rosa* Karsch (photo: AP Malan)

France). The Conservation Parasitology group established research collaboration with Dr Alexandr Stekolnikov (Zoological Institute at St. Petersburg, Russia), a world leader in the taxonomy of chigger mites, to focus on the diversity of chigger mites of small mammals in South Africa. Dr A Leslie's Majete Wildlife Research programme in Malawi received a boost when she was awarded the prestigious IUCN-CSG Castello award for her contribution to crocodile conservation in Africa. She also represented Stellenbosch University and the Department as part of the organising committee for the IUCN-CSG Symposium held at Skukuza in the Kruger National Park in June 2016.

RESEARCH

Invasion biology and pest management (Photo 1)

How do we know if a pest insect is likely to become invasive and a threat in the future? A recent study, led by Dr M Karsten and Prof J Terblanche, has warned of the looming threat of the lesser-known Natal fruit fly, *Ceratitis rosa* (Tephritidae) outside of its native range. Although the fly's geographic range is currently restricted to South-eastern Africa, it appears to have traits that may predispose it to being highly invasive. Karsten et



Photo 2: Blaauwberg Nature Reserve (photo: City of Cape Town)

al. (2016) collected hundreds of fruit flies, and measured and genotyped them to investigate patterns of population structure and to determine genetic connectedness of pest-occupied sites. Surprisingly, the team was unable to detect any signs of differences between the populations. A novel analysis of the genetics indicated that the populations are presently expanding. The results of this study suggest a high invasion potential of Natal fruit fly unless there is urgent intervention (Karsten et al. 2016, *Molecular Ecology*, 25, 3019-3032).

Ecological Restoration (Photo 2)

The recently proclaimed Blaauwberg Nature Reserve is where you will find some of the last patches of critically endangered Cape Flats Sand Fynbos (only 5% left within the Cape area). However, this reserve is overgrown with invasive species, in particular the woody Australian Acacias. Since South Africa is committed, through global targets and international agreements, to protect and restore the remaining natural habitat, these remnants and those of other threatened habitats have been a focus of conservation attention and research done at the Department. We are particularly interested in scaling up the work being done on differ-





Photo 3: Cover of the new manual of freshwater assessment (photo: M Samways)



Photo 4: A large-scale conservation ecological network (photo: M Samways)



Photo 5: Citizens engaging in science (photo: J Hulbert)



Photo 6: Members of the Honeybush Knowledge Partnership (photo: E McCloen)

ent restoration methods. That is, ecological restoration brings with it a message of hope; by repairing habitat suited to other living organisms, the services provided by these habitats are also restored, such as the provision of clean water or pollination services. An interview with PhD student Stuart Hall, describing some of this work, can be found at <https://soundcloud.com/user-374791551> (Hall et al. 2016, *Austral Ecology*, 42, 354-366).

Conservation management (Photos 3 and 4)

There has been debate globally on the value of interconnecting conservation corridors as ecological networks (ENs). We have shown definitively that ENs do work in practice, making South Africa a global leader in this field. These ENs not only maintain all hydrological processes, but also retain grassland biodiversity that is equivalent to that in neighbouring protected areas. Natural forest patches in these ENs provide remarkable additional biodiversity, which complements the grasslands and the riparian corridors. Nonetheless, while both the design and management of ENs play important roles in integrating agro-forestry and conservation, we must be vigilant and use validation methods to ensure that all is functioning

well. To this end we explored a completely new technique, ecoacoustics, an assessment tool for conservation action. We also showed that grazing by native game is critically important. Furthermore, we developed a new manual for freshwater assessment (Samways & Simaika 2016, *Manual of Freshwater Assessment for South Africa: Dragonfly Biotic Index*, SANBI, Pretoria; Samways & Pryke 2016, *Ambio* 45: 161-172; Grant & Samways 2016, *Conservation Biology* 30: 1320-1329; Pryke et al. 2016, *PLoS ONE* 11: e0164198).

Integrated pest management (Biological Control)

Biological control agents employed in the control of pest insects by our local industries (viz. deciduous fruit, grapevine and citrus) include parasitoids, entomopathogenic nematodes and entomopathogenic fungi. During the year, three new species of entomopathogenic nematodes were isolated and described – *Steinernema jeffreyense*, *S. nguyenii* and *S. fabii*. Students currently are actively involved in isolating new entomopathogens and testing their potential as biological control agents as part of a number of industry-funded projects. Furthermore, research on the control of codling moth in apples and pears using entomopathogenic nematodes has

delivered positive results. Future research includes the mass culture of *S. jeffreyense* and using combinations of different biocontrol agents (Malan et al. 2016, *Journal of Helminthology* 90: 262-278; Malan et al. 2016, *Nematology* 18: 571-590; Odendaal et al. 2016, *African Entomology* 24: 61-74).

SOCIAL IMPACT

Cape Citizen Science (Photo 5)

It is exciting when research interfaces with society, as this is where social impact can be at its greatest. The Biodiversity and Symbioses lab of the Department is involved in an exciting new research initiative with the Forestry and Agricultural Biotechnology Institute (FABI, University of Pretoria) that involves citizens from all walks of life in the research process (Cape Citizen Science; www.citsci.co.za). The project is headed by Mr J Hulbert as part of his PhD studies on tracking plant-killing pathogens in the Cape Floristic Region and is partly funded through international crowdfunding. As part of this project, the lab and FABI have joined forces with Vision Afrika (<http://visionafrika.com/>) and have launched a successful campaign to engage disadvantaged learners from

Kayamandi in the scientific process, from fieldwork excursions to obtaining hands-on laboratory experience (<https://experiment.com/projects/engage-kayamandi-youth-in-cape-citizen-science-with-vision-afrika>). The success of this campaign demonstrates that there is considerable public support for engaging disadvantaged youth in research and this gives these learners a chance to show the world that they can be scientists.

Honeybush knowledge partnership (Photo 6)

Postgraduate students and two members of the departmental staff drive the Honeybush Knowledge Partnership, an initiative at Genadendal (Overberg) that involves research and postgraduate training opportunities with local small-scale farmers. In 2016, the project registered with the Division of Social Impact, which has resulted in a conference presentation, a case study for undergraduate training in Sustainable Harvesting for 36 third-year Conservation Ecology students, and co-facilitated farmer workshops with external experts (e.g. Nemlab, WWF, CapeNature) to provide information and advice based on land-user requests





Photo 1: S'coolBeans team in Dublin (photo: W Knowler)



Photo 2: Self-Evaluation report (photo: M Manley)

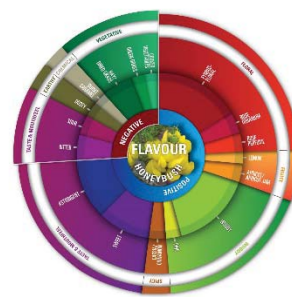


Photo 3: Honeybush flavour wheel (photo: TBND Designs)

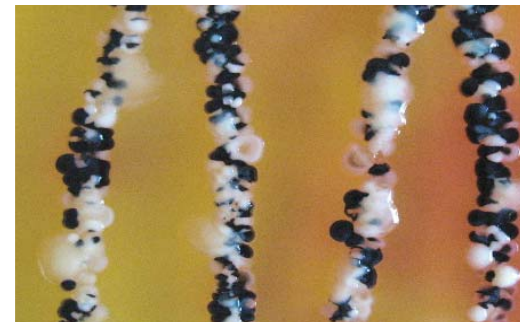


Photo 4: Salmonella (photo: A Lombard)

FOOD SCIENCE

FOCUS AREAS

- Sensory Science
- Vibrational Spectroscopy
- Food Microbiology
- Environmental Management
- Food Safety
- Cereal Quality

OVERVIEW

One of the stand out accomplishments was that of S'CoolBeans (Photo 1) (the product development project of a 2015 Final Year group) that took the "world" by storm and the second place they achieved at the IUFOST World Congress of Food Science and Technology. These achievements earned them much media coverage and we're hoping to see S'coolBeans on the market soon.

The department also grew in terms of human capacity, with Dr Maricel Krügel joining the department on the 1st July 2016. Further good news on the staff front, is the nGAP lecturing position that the department was awarded by the DHET. This is a capacity building initiative – the first three years the position is fully funded by DHET, and thereafter

the University takes over a larger share of the cost, until in year seven the position is funded completely by the University. Dr Diane Rip was appointed in this position commencing on 1 January 2017.

The department was fortunate to receive funding through the Western Cape Government, Department of Agriculture to commission a pre-feasibility study into a New Technologies Pilot Plant. Watch this space in 2017 for further interesting news and prospects.

Another highlight was the department being awarded a *Certificate of Approval* from IUFOST for our BSc Food Science degree for having met *International Guidelines in Food Science and Technology Programmes of Study* (2016-2021). This is indeed an honour and verification that our food science degree meets international criteria.

The year ended with the External Evaluation (Photo 2) of the department (a DHET requirement every five years). This process kicked off with a Self Evaluation Report, which had to cover all the aspects of the department's activities. A huge thank you to Prof Marena Manley who

took charge of the report, culminating in what was described as the "best self-evaluation report" ever and "the new gold standard" by people in the know! Indeed, the External Evaluation Panel was also extremely impressed with the report and the department. We look forward to their Final Report which sounds as if it will have several commendations and some very constructive recommendation.

RESEARCH

Although all researchers conduct innovative research using state-of-the-art scientific technology and methodology in a sustainable manner, two of the department's flagship research programmes warrant mentioning in more detail.

Sensory science and sensometrics

The sensory science and sensometrics research programme has developed into a renowned unit in terms of research, as well as service (including contract research) to the food industry. One of the aims of this research programme, headed by Ms Muller, is to collaborate across departments within SU, but also internationally. This includes active involvement in postgraduate re-

search projects with the Departments of Horticulture, Viticulture and Oenology and Animal Sciences at SU. Similarly, significant research collaboration with the Agricultural Research Council (ARC) Infruitec-Nietvoorbij, Stellenbosch (Prof Elizabeth Joubert) and Nofima, Norway (Prof Tormod Næs) strengthens postgraduate research.

This research group, in close collaboration with Prof Joubert, developed aroma and flavour wheels (Photo 3) for evaluating rooibos tea quality (funded by Rooibos Council, THRIP and the Northern Cape Province) but also species-specific aroma wheels for evaluating honeybush tea quality (funded by the Department of Science and Technology (DST) via the NRF). These quality control tools are currently being tested for applicability in industry, i.e. to determine product quality for both the national and international export markets.

The sensory science and sensometrics research group is currently involved in researching new sensory profiling methods that are rapid and easy to use in research and development programmes.





Photo 5: Water sampling in the Eerste River (photo: A Lombard)



Irrigation and Food Processing wastewater research (photo: A Lombard)



Jungle Bunches overall winner of the Oct 2016 Product development presentations (photo: A Lombard)



Popsi COCO and Holey Moley, newly developed products (photo: A Lombard)

Water quality and wastewater management

In a country facing serious water scarcity, water has thus become a core research area within the Department. These are food safety related to the use of contaminated irrigation water in food production, water use minimisation and the treatment of food and beverage processing wastewaters by anaerobic digestion.

This research has focused on the types and levels of microbial contamination (Photo 4 and 5) found in South African rivers used for irrigation, the carry-over onto fresh produce and survival of the microorganisms as well as potential on-farm treatment of these waters.

Research into the treatment of food and beverage processing wastewaters and the production of usable biogas, headed by Prof Sigge, has resulted in highlighting solutions to these industries. These technologies enabled the the reduction of water usage, treatment of wastewater to environmental discharge or irrigation guidelines or a reduction in the cost of disposal to municipal sewers, while producing a renewable energy source in the form of methane gas. Two prominent

wineries have adopted anaerobic digestion as a treatment method as a result of research trials conducted at the department – one system has been in operation since 2007.

Overall, the water research group has graduated 14 MSc's and 1 PhD since 2011, and secured in excess of R4m worth of funding since 2011 (nearly half of this towards student bursaries). The Water Research Commission (WRC) and Winetech have been major funders of the water research group, resulting in 7 peer-reviewed articles and 26 conference presentations.

SOCIAL IMPACT/COMMUNITY INTERACTION

All the academic staff are actively involved in community interaction within their research fields, nationally and internationally. Some serve as external moderators of undergraduate and postgraduate modules and programmes for national and African Universities (e.g. University of Namibia, University of Mauritius, University of Pretoria, Cape Peninsula University of Technology, Makerere University). Most also act as examiners of master's theses and doctoral dissertations for various national

and international Universities. All academic staff regularly review manuscripts for high-impact scientific peer-reviewed journals and project proposals for national (NRF) and international (e.g. Research Foundation Flanders, Belgium) funding bodies.

Academic staff members are internationally acknowledged within their fields and regularly serve on scientific and/or organising committees of national and international conferences:

Prof Marena Manley

- Immediate Past Chair: Cereal Science Technology – South Africa (CST-SA)
- Chair: Committee for Evaluation of Wheat Breeding Lines, South Africa
- Editorial Board, Acta Alimentaria: An International Journal of Food Science, Akadémiai Kiadó, Hungary.
- Committee Member: South African Spectroscopy Society (SASS)

Prof Pieter Gouws

- South Africa's representative on the International Commission of Food Microbiology and Hygiene

Prof Gunnar Sigge

- Past President, Council Member, Exco member and Cape Branch Chairperson - South African Association for Food Science and Technology (SAAFoST), 2015 - 2017
- Institute of Food Technologists (IFT) – Chair: Annual Meeting Scientific Programme Advisory Panel (AMSPAP). (2017). IFT 17, Las Vegas, USA, 25-28 June 2017
- Member of the Professional Advisory Committee (PAC): Food Science for the South African Council for Natural Professions (SACNASP), 2009 – present



FOREST AND WOOD SCIENCE

FOCUS AREAS

- Silviculture
- Forest Growth and Yield
- Forest Economics
- Remote sensing
- Forest Engineering
- Wood mechanics
- Wood physics and bioenergy
- Wood degradation and preservation
- Wood chemistry and anatomy
- Wood composite materials

OVERVIEW

The Department has set itself the goal to supply of world-class forestry education, research and outreach in Africa to the benefit of society, with a primary focus on sustainable management of tree-based natural resources and the processing thereof. It is thus geared to service the entire forestry value chain from forest to wood products. The Department has been highly productive in 2016, collectively publishing 36 articles, two book chapters and registering one patent. Two PhD's and ten MSc degrees had also been awarded. Staff news for 2016 includes the departure of Dr Melanie Blumentritt (a post-doc researcher on Wood Product Science) and the arrival of Dr Abdelmoneim Ahmed (a post doc-researcher in Forest Science). At the end of 2016, Dr Ben du Toit was promoted to the rank of Associate Professor. During 2016, the Dept. of Forest and Wood Science increased its international collaboration with several Universities in Africa and on other continents. This has also led to an increase in staff and student mobility with eight overseas visits by academic staff and five opportunities for senior postgraduates to travel and learn overseas. As part of their international mobility, collaborators and/or students under the supervision of the following staff members presented papers (at international symposia): Dr Wessels,

Mrr Froneman & Erasmus (Quebec); Effah, Raatz, van Reenen & Prof Meincken (Chile); Ham, Lindner & Dr Drew (Chile); dr Blumentritt, Pröller & Dr Wessels (Hungary), S & Dr P Ackerman + Prof T & Dr S Seifert (British Columbia); and Effah, van Reenen & Prof Meincken (Port Elizabeth). In turn, the Department have several short-term visits from international academics, but two long-term collaborators deserve special mention: Prof Ben Spong (USA, Forest Engineering) and Mr José Rocha (Brazil, Silviculture), who contributed significantly to the local research effort.

The Department served the Forest industry through conducting a number of short training courses in 2016: Dr Dave Drew hosted two well-attended industry workshops in 2016. The first in January around forest modelling, with Prof K von Gadow. The second in October, with guest lectures from Prof J van Aardt (Rochester IT, New York) and Prof C Kleinn (Göttingen, Germany) was around applications of remote sensing. Dave also convened the inaugural meeting of a new working group around forest panning in Johannesburg in November. Dr Brand Wessels conducted Several Simsaw courses through the year to members of the Sawmilling industry. Cori Ham led a course titled "Forest Finance and Valuation: What every forester should know" during November in Pietermaritzburg.



Photo 1: Estimating C sequestered in a virgin *Cryptosepalum* forest, Zambia (photo: M Kambayi)



Photo 2: MScFor students doing financial simulations on ForEntSim (photo: C Ham)

RESEARCH

Climate Change, Adaptive Land Management and Carbon sequestration

The DFWS is starting to reap the rewards from an extended research project funded by the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL). The DFWS developed a Dryland Forestry specialisation as part of its MSc Forestry programme, and the first two SASSCAL students are currently finalising their MSc theses. Bechani Nyawali investigated market orientation effects on honey production in Zambia's dryland forests while Martin Kambayi focussed his research on estimating C sequestered in an undisturbed *Cryptosepalum* forest in North-Western Zambia (Photo 1). Namibian PhD student Werner Mbongo started a project in 2016 investigating the "Effects of thinning intensities on the growth of *Burkea africana* and *Pterocarpus angolensis* in the Zambezian-Baikiaea woodlands" with Prof Ben du Toit as leading supervisor.

Forest Enterprise Simulator (Photo 2)

The "Forestry Enterprise Simulator" (For-

EntSim) project is a joint initiative by the Department of Forest and Wood Science at Stellenbosch University, the Institute for Commercial Forestry Research (ICFR) and Forestry Economic Service (FES). The aim is to provide an online financial tool with which the feasibility and profitability of forestry enterprises and the efficiency of value chains can be tested. This tool can be used by small scale forest enterprises and is also used by MScFor students who are busy with forestry operations research. This project is funded by the Sector Innovation Fund of the Department of Science and Technology, through a grant administered by Forestry South Africa. The Simulator can be accessed at www.forentsim.com

Forest operations productivity development for the SA forest industry (Photos 3 and 4 on next page)

Improving forest operations' efficiency is an on-going need for all industries, including the forest industry. The South African forest industry faces unique challenges and addressing efficiency in this context is complex. Hence a standardised time study protocol was developed for the industry which includes experimental design requirements, time models and time





Photo 3: Systematic pine sawtimber clear-felling operations (photo: D Scheepers)



Photo 4: Forwarder operations in pine sawtimber clearfelling (photo: D Scheepers)

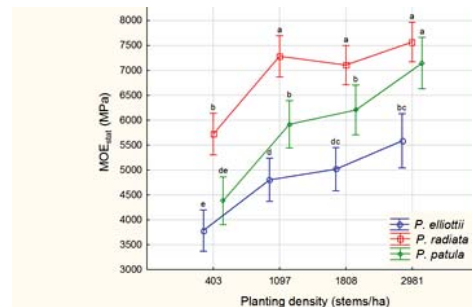


Fig. 1: Higher stand density improves stiffness properties of pines (photo: B Wessels)



Photo 5: Trainees at the KwaNothemba workshop, Khayelitsha (photo: P Crafford)

concepts, time study methods specific for forest operations, statistical analysis guidelines and more importantly, a data suppository for industry managed and maintained by Stellenbosch University. The aim is to develop productivity and time models that will drive improved productivity and wood utilisation, enhanced wood quality from forest operations and machine emission benchmarks.

Improving wood properties of SA Pine through silvicultural interventions

Improved growth rates and shorter rotation ages have caused a reduction in the stiffness of structural lumber from South African-grown pine plantations. In this project we aim to understand the influence of environmental and management variables on wood formation and some important wood properties such as stiffness. The results of the study will be used to adapt silvicultural regimes to produce trees with improved wood quality. Exceptionally positive initial results were obtained from trials evaluating the potential of higher planting densities to improve the poor stiffness properties of some pines (Figure 1). Future work will focus on a better understanding of the basic growth and cell development processes of a tree that affect the drivers for mechanical

properties (density, microfibril angle and ring width).

Green Building Materials

Buildings are responsible for about 33% of global anthropogenic carbon dioxide emissions. Wood and wood based composite materials generally display a far lower environmental impact than competing materials such as steel and concrete. In this programme we aim to quantify and compare the environmental impact of different building materials using the life cycle assessment (LCA) method and also to develop wood based building materials. Results from an LCA study comparing wood and steel roof truss systems showed that the environmental impact of wood trusses are far less than that of their steel equivalents. Magnesium and calcium phosphate cement binders, produced from acid-base reactions, were investigated for use in developing green natural fibre composite products. These were found to be durable and are comparable with current cement bonded products. Wood plastic composites made from invasive wood, different compatibilisers and low density PE were investigated with regards to the adhesion properties between the individual components and their macroscopic properties. It was found that different wood species required different compatibilisers

and if the system is chosen correctly, the mechanical properties are comparable to commercial WPCs.

New research projects

Subsequent to the preliminary projects described under point 5 above, Prof Martina Meincken started a new research project on wood plastic composites as sustainable building material with University of Hamburg. Prof Ben du Toit, in partnership with Mondi, started a new project on fuel load management in eucalypt forests that includes controlled burning and soil tillage. He participated in four regional workshops with foresters on fire and fuel load management in KZN and Mpumalanga, where the status quo was investigated and the research focus was established.

SOCIAL IMPACT

(Example: KwaNothemba workshop - Photo 5)

The DFWS is heavily involved in projects aimed at community development within its realm of expertise. To date, 30 projects undertaken by staff members of the Department have been registered on the Stellenbosch University community interaction database. One example of a project in which the Department is cur-

rently involved is described here: DFWS has partnered with the KwaNothemba Woodwork Centre in Khayelitsha, an NGO that was established in 1998 to give people with disabilities an opportunity to support themselves. Although the workshop has successfully supported a number of people over the years, it was closed down due to the lack of adequate management. The newly instituted workshop covers a large area ($\pm 200 \text{ m}^2$) and houses a number of large industrial woodworking machines. The machines are now in good operating condition after the initial special project grant by the FP&M Seta in 2014. The project involves woodwork skills training and management coaching. The goal of this community interaction project is to assist the KwaNothemba Woodwork Centre to become a sustainable and profitable business. By achieving this, the workshop can become a cornerstone of the community, teaching woodworking and production skills to the disabled as well as the youth, and generating income for those involved in production. Dr Brand Wessels and Mr Philip Crafford are responsible for managing this project on behalf of the DFWS. See video link for more info: <http://youtu.be/yWLVrY6W4I0>.

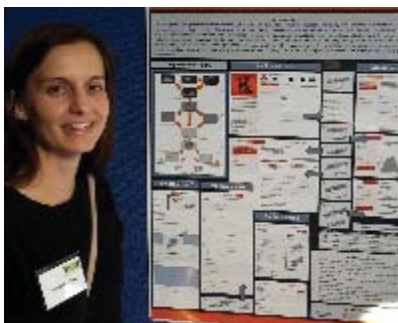


Photo 1: Ms R Bester at International Organization of Citrus Virologists (photo: R Bester)



Photo 2: MBB lab at the SASBi-SAGS 4th Joint Congress (photo: A van der Merwe)



Photo 3: Animal Genetics laboratory (photo: A van der Merwe)



Photo 4: Pharmacogenetics laboratory (photo: N McGregor)



GENETICS

FOCUS AREAS

- Animal,
- Human &
- Plant Genetics

OVERVIEW

The vision of the Department of Genetics is to develop and promote Genetics as a cornerstone of biological science at Stellenbosch University through quality research, creative teaching and outstanding and responsible service delivery to our community and environment.

Two new academic staff members were appointed – Dr Nathan McGregor and Mr Stephan van der Westhuizen. A total of 27 postgraduate students graduated, including 18 BSc(Honours), 8 MScs and 1 PhD.

Stellenbosch University was well represented as students and researchers travelled to places such as Chongqing, China, Verona, Italy and Bangor, Wales to attend conferences, as well as to collabo-

rate and share knowledge with various institutions. International conferences attended, included the 20th Conference of the International Organization of Citrus Virologists (IOCV) (Photo 1), the International Symposium on Grapevine Physiology and Biotechnology and the Fisheries Society of the British Isles Symposium (FSBI2016).

Ms Nicola Kirsten received the Hofmeyr van Schaik medal for the best fourth-year Genetics student in 2016. The South African Genetics Society annually makes this award to the best fourth-year student in Genetics (BSc Honours or BScAgric).

RESEARCH

The research focus areas of the Department follow the matrix structure according to which the Department operates. Focus areas within animal, human and plant genetics include studies in the molecular (biotechnology), population and quantitative (breeding) genetic fields.

Animal Genetics

The Molecular Breeding & Biodiversity (MBB) (Photo 2) group has a primary disciplinary foundation in molecular population- and -quantitative genetics. As such, the group maintains a diverse research portfolio, which aims to investigate various micro and macro-evolutionary processes that influence the genetic makeup of animal populations (Photo 3). The research focuses mainly on conservation and fisheries management and sustainable animal production through molecular breeding. Several projects are being done in the group, viz. the population genetic structure and demographics of various shark species, including *Mustelus mustelus* and *Galeorhinus galeus* across the Atlantic and Indian Oceans, as well as the population genomics of the South African abalone species *Haliotis midae*.

Human Genetics

The Pharmacogenetics group focus predominantly on neuropsychiatric genetics and pharmacogenomics (Pho-

to 4). Specific focus is placed on (i) characterising the variation present in pharmacogenes, (ii) schizophrenia / antipsychotic pharmacogenetics / anxiety disorders, (iii) HIV/antiretroviral pharmacogenetics, (iv) elucidating the molecular aetiology of neuropsychiatric disorders (by considering gene-gene, gene-environment and gene-gene-environment correlations and interactions, and (v) metabolic syndrome and comorbid psychiatric disorders (MRC SHARED ROOTS Flagship Project).

Plant Genetics

There are currently four research groups involved with plant genetics studies:

- Cereal Genomics
- Molecular Breeding & Biodiversity
- The Plant Breeding Laboratory (SU-PBL)
- Vitis Laboratory

Specific research is conducted at the four groups: Cereal genomics (Photo 5) focuses on Russian wheat aphid resistance, as well as water quality and



Photo 5: Cereal genomics laboratory
(photo: F Burger)



Photo 6: IPB laboratory
(photo: C van der Vyver)



Vitis laboratory
(photo: M Engelbrecht)



Dr J Lloyd at the Frontiers Editors' Summit
(photo: J Lloyd)



food security, while the MBB group focuses on fruit tree molecular breeding. The PBL focuses on small grains that involve triticale and rye breeding programs as well as the national wheat pre-breeding platform. The Vitis laboratory (Photo 6) focuses on perennials like vines, citrus and pome fruit.

The Institute for Plant Biotechnology (IPB) specialises in the characterisation and manipulation of primary carbon metabolism in plants. Their ultimate goal is to manipulate the relevant metabolic pathways, either to improve yield and/or quality, or to produce novel, high-value products in plants. Some projects are aimed at the genetic manipulation of carbon partitioning within plant organs, such as sugarcane culms, grape berries and potato tubers. The approach is to first get a better understanding of the control of carbohydrate metabolism in these important sink tissues and then to genetically manipulate apparent key enzymes to investigate the effect of these modifications on metabolic flux. In addition to their work on the partitioning of

endogenous compounds, they also focus on the improvement of these compounds and the introduction of completely new ones. As part of several international collaborative projects, the IPB has, for example, developed transgenic plants that produce novel, high-value products, i.e. nutraceuticals and pharmaceuticals or biopolymers for industrial application. Finally, they are trying to understand plant growth in relation to abiotic stress factors with the aim of breeding or engineering plants that are more productive with less input.

SOCIAL IMPACT

Staff members of the Department serve on several boards and committees, for example the Advisory Committee on Genetically Modified Organisms. Community-based services include the following: the plant- (PBL's) marker-assisted selection (MAS) service for wheat breeding programs, forensic DNA analysis of confiscated material related to abalone poaching, and a diagnostic service (Vironostix) by Mandi

Engelbrecht of the Vitis- group samples for viruses and phytoplasmas test. Several staff members of the Department participated in workshops (eg. Forensic sciences) to promote the teaching of Genetics as a subject. During the year, students visited the Department for work experience where they were mentored by staff of the Department.



Postharvest research in Proteaceae
(photo: L Hoffman)

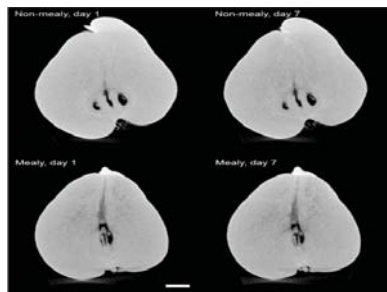


Photo 2: Mealiness in “Forelle” pears (photo: E. Crouch)



Photo 3: Alternate bearing in citrus (photo: J Stander)

HORTICULTURAL SCIENCE

FOCUS AREAS

- Deciduous fruit
- Citrus
- Ornamental cut flowers
- Alternative fruit crops
- Postharvest technology research

OVERVIEW

The Department boasts a number of achievements by both its staff and students. Numerous subsidised articles and international congress proceedings were published, local and international conferences were attended, and technology transfer took place. The 6th Postharvest Physiology and Technology short course on fresh horticultural crops was hosted by Dr Elke Crouch from 21 to 23 June 2016.

Prof Linus Opara, who holds the DST-NRF South African Research Chair in Postharvest Technology in the Department of Horticultural Science, was elected the incoming President of the International Commission of Agricultural and Biosystems Engineering (Photo 1). Dr Olaniyi Fawole, a researcher in this SARChI, was elected a Young Affiliate of The World Academy of Science (TWAS) for a period of five years.

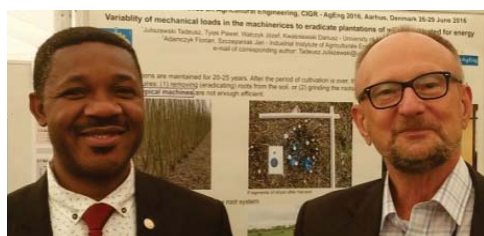


Photo 1: Prof Linus Opara (left) with the immediate past president of CIQR, Prof Tadeusz Juliszewski of Poland. (photo supplied)

Career opportunities are being created for both teaching and research. Dr Michael Schmeisser presented a teaching and learning seminar titled “Digital stories in a science-based plant propagation course. Is there a place for it?” Furthermore, various postgraduate students received awards for their excellent oral and poster presentations at local and international symposia. Prof Wiehann Steyn and Prof Karen Theron travelled to Spain, Italy, Belgium and the Netherlands to attend symposia and to present at workshops in their fields of expertise. Mr Jakkie Stander received local as well as international recognition for presenting the best PhD paper and received a student grant award at the International Citrus Congress, Brazil. Dr Paul Cronje was invited to address the 37th Annual Postharvest Pest Control Conference in California.

RESEARCH

The Department of Horticultural Science conducts dynamic research for the deciduous fruit, citrus, ornamental cut-flower and potted plant industries, providing value-adding technology for industry partners and lending support to new horticultural industries focusing on alternative crop production. A few of the highlights from 2016 were:

Detection of mealiness in ‘Forelle’ pear by means of X-ray computed tomography (CT) (Muziri, T, Theron, KI, Cantre, D, Wang, Z, Verboven, P, Nicolai, BM and Crouch, EM) (Photo 2)

Forelle is South Africa’s pear cultivar with the second biggest area under plantation. However, mealiness causes the fruit to ripen with a soft and dry texture. No technique currently exists to detect mealiness non-destructively. Studies were conducted to determine the potential of macro-CT to detect mealiness in ‘Forelle’ pears non-destructively, and to establish cellular differences between mealy and non-mealy fruit using X-ray micro-CT. Large pores (56 µm) were associated with the neck of mealy fruit and were present at the end of cold storage, before the fruit became soft and mealy with low expressible juice after ripening. X-ray CT appears to be a

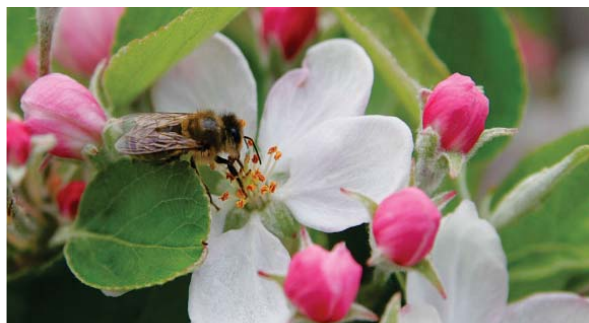
promising technology for the non-destructive determination of mealiness at an early stage.

Mr Jakkie Stander initiated and is leading a multi-seasonal research project on alternate bearing in citrus in which specific production problems resulting from this phenomenon are being addressed (Photo 3).

Alternate bearing is a major problem in citrus production. To understand the role of carbohydrates, leaf and root carbohydrate concentrations were determined at monthly intervals, and tree phenological responses in non-bearing and full-bearing ‘Nadorcott’ mandarin trees were measured. Flowers and fruit load correlated negatively with return bloom, while return bloom flowering was positively correlated with summer vegetative flush and root sugars of the previous spring. A profuse number of flowers in full-bearing trees restricted carbohydrate partitioning to the roots. In severe cases of alternate bearing and in the absence of both fruit and active root growth, carbohydrates accumulated in the leaves, resulting in the development of symptoms of leaf chlorosis. In non-bearing shoots, the higher levels of leaf starch increased flowering intensity during the subsequent spring.



Photo 4: *Punica granatum*
(photo: O Fawole)



Pollination by bees
(photo: K Theron)

Dr Elmi Lötze has continued her research on the root growth dynamics of apple trees to quantify the effects on nutrient uptake, tree growth and fruit quality.

The timing, duration and magnitude of white root growth flushes were quantified on different cultivars cultivated in two contrasting soil types in the Elgin-Vyeboom region: a young, bearing 'Fuji' and a mature, bearing 'Golden Delicious' on a clay loam and 'Cripps Pink' on a sandy soil. The white root peaks followed a biennial pattern, confirming existing reports from the Northern Hemisphere (NH). The timing of root growth flushes were similar, irrespective of the different scions, but the duration and magnitude of the flushes differed due to crop load and harvest date. However, the first peak occurred after full bloom (later than in the NH), and the second peak, in the winter, lasted from approximately May to August, which is unique to local conditions.

Making every harvest count through value addition: (Photo 4) A cosmeceutical perspective for pomegranate fruit
(Dr AO Fawole and Prof UL Opara)

The production of pomegranates, an exciting new entrant into the South African horticultural industry, shows great potential. Dr Fawole, Postharvest Technology re-

searcher, conducted the following study on this nutrient-rich product:

Sunburn renders 15% of pomegranate fruit production unmarketable in the fresh fruit and juice industries. Uses for these damaged fruit are scarce and their disposal represents an environmental problem. This work presents a comparative study on the composition of oils extracted from pomegranate seeds of sunburned fruit (SBF) and healthy fruit (HF) for the value-adding potential of fruit that would represent harvest losses. A total of 17 compounds were identified in the oils, the predominant being 9,12,15-octadecatrienoic acid, a conjugated linolenic acid, which constitutes 70% to 72% of the total essential oils. In general, oils from seeds of SBF and HF had good antioxidant activity and tyrosinase enzyme-inhibition ability. These properties are of interest in the skincare industry, where there is rising consumer interest in and demand for natural products. This study indicates that the seeds of sunburned pomegranate fruit could be exploited for their high-quality oil.

SOCIAL IMPACT

All academic and research staff are actively engaged in the transfer of technology by presenting seminars during technical field days and producer days. Staff are also members of various industry bodies and professional



Undergraduate students receiving training in citrus fruit quality (photo: P Cronje, Citrus Research International)



Darwin 300™ mechanical thinning of pears (photo: K Theron)

societies, for example the Southern African Society for Horticultural Sciences (SASHS), Citrus Research International (CRI), Agribusiness in Sustainable Natural African Plant Products (ASNAPP), the Pomegranate Producers Association of South Africa (POMASA) and Cape Flora SA.

- As part of the Post-harvest Innovation Programme and the Fresh Produce Exporters' Forum (FPEF), Dr Elke Crouch presented two short courses for new entrants to farming:
 - 17–18 August 2016 at Stellenbosch, on Cape flora, citrus, pome and stone fruit, pomegranates and table grapes, and
 - 24–25 August 2016 at Tzaneen, on avocado, citrus, mango and tomatoes.
- Dr Lynn Hoffman presented a lecture on indigenous plants and their practical uses at an international school for American students.
- Prof Wiehann Steyn shared his motivational life story to students at the HORTGRO bursary function (19 October 2016).
- Dr Fawole was nominated as a future global leader to participate in the Science and Technology in Society (STS) Forum in Kyoto, Japan from 2 to 4

October 2016.

- Ms Asanda Mditshwa, a doctoral student in Horticultural Science, received a special award from the Agricultural Sector Education and Training Authority (AgriSETA) for continued excellence and achievements.
- Ms Micheline Inamahoro (PhD student under the supervision of Dr Esme Louw) participated in the Fifth African Higher Education Week and RUFORUM Biennial Conference 2016, held in Cape Town from 17 to 21 October. Her poster, "Respiration dynamics of apple buds exposed to hydrogen cyanamide", was among the top five prize-winning posters.
- Dr Elmi Lötze attended the PMA Exposition and Pack Family Career Pathways Program with two final-year students, Mr. Philemon Sithole and Ms Anouska Cameron, at the Department of Food Science in Orlando, Florida, USA from 12 to 16 October 2016.
- Mr Jakkie Stander presented at a training workshop at the Letsitele and Nelspruit citrus growers study group in November 2016.





Photo 1: Dr Lizel Mostert
(photo: A Jordaan)



Photo 2: Training in Mozambique (photo: A Viljoen)



Photo 3: Fusarium wilt
(photo: A Viljoen)



Photo 4: Banana farm in Nampula, Mozambique
(photo: A Viljoen)

PLANT PATHOLOGY

FOCUS AREAS

- Preharvest Disease Management
- Postharvest Pathology
- Molecular Plant Pathology



Personnel and postgraduate students 2016
(photo: A Jordaan)

OVERVIEW

The mission of the Department of Plant Pathology is to be recognised nationally and internationally as an academic department noted for quality training and research in Plant Pathology. We achieved this in various ways in 2016.

Dr Mostert received a C2 NRF rating. This was her second NRF rating application, following her first rating of Y1 (Photo 1). Fourteen research articles were published, four postgraduate students obtained their PhD degrees, seven students their MSc degrees and three students their BScHons degrees in Plant Pathology in 2016. Staff and postgraduate students attended various national and international meetings during 2016. At the 38th SASEV (South African Society

for Enology and Viticulture) Conference, four oral and seven poster presentations were made. Madeleine Sieberhagen received the best student presentation for 'Susceptibility of grapevine rootstocks against fungal trunk pathogens: Results from a nursery field trial', and Annabella Baloyi received the best poster presentation entitled 'Pathogenicity of *Phaeoacremonium* species recently found in Western Cape vineyards'. Three workshops were presented: 'Banana Fusarium wilt containment workshop', Namialo, Mozambique (Photo 2); 'Australia-Africa Plant Biosecurity Partnership workshop', Arusha, Tanzania; and 'FAO regional Training Workshop on 'International Sanitary and Phytosanitary Measures (ISPMs) and eminent pest threats to the SADC region', Arusha, Tanzania. Dr Antonia

Carlucci from Italy visited the Trunk Disease research group in February for two weeks. Herself and Dr Chris Spies gave presentations at the annual general meeting of OLIVE SA that was held at Klein Joostenberg.

RESEARCH

Research in the department falls under one of the following programmes: Fusarium research, fruit and postharvest pathology, grapevine and fruit tree pathology, citrus pathology and oomycete and soilborne pathogens. The following two projects are highlighted:

Fusarium wilt of bananas

Containing a devastating outbreak of a wilting disease (Photo 3) to only two Cavendish banana export farms in Mozambique, is about more than just saving the companies involved. It could ensure that Africa and its smallholder farmers, in particular, are not deprived of the benefits of local banana varieties that provide year-round staple food for many of the continent's people. Prof Altus Viljoen and his research group are part of a consortium working together to contain a fungus introduced into the African continent from Asia, called *Fusarium oxysporum* f. sp. *cubense*

'tropical' Race 4 (Foc TR4). It causes Fusarium wilt (also known as Panama disease). It attacks most types of bananas, including the Cavendish banana commonly found in supermarkets around the world. Prof Viljoen's laboratory became involved in the Fusarium wilt outbreak in 2013 when they tested samples collected from a farm in northern Mozambique. They subsequently confirmed the first case of Foc TR4 in Africa. The disease has since spread to another nearby farm.

Fusarium wilt does not only have a social and economic impact on the Nampula province in which the infected farms are located. This is of global concern, as Cavendish bananas make up almost 45% of all bananas produced worldwide. More disturbing is that Foc TR4 might also affect local varieties such as cooking and beer bananas being produced by small commercial and subsistence growers for local markets, also in Africa. Local cooking and beer bananas make up 70% of all bananas grown in Africa and were so far resistant to another Fusarium wilt strain present on the continent, namely Foc Race 1. Research focuses on sanitation methods and further farming endeavours





Photo 5: Canker on one-year-old apple tree (photo: M Havenga)



Photo 6: Canker in a persimmon branch (photo: P Moyo)



Photo 7: The Plant Disease Clinic team (photo: A Jordaan)



Photo 8: White rust on *Lampranthus* sp. (photo: Disease Clinic)

(Photo 4). Disease resistance is the most effective way to manage Foc TR4, but the challenge is to find or develop resistant varieties of which the fruit is acceptable to both producers and consumers.

Healthy nursery trees

As part of a HortgroScience funded project focussing on apple tree health, a popular publication was published in the *Fruit Journal*. The article describes the process of testing and certification of plant material under the Deciduous Fruit Plant Certification scheme. Different fungal pathogens were found, associated with cankers of young apple trees (Photo 5). Dr Mostert also gave a presentation at the Hortgro Technical Symposium on 'Stem cankers associated with apple nursery trees', 30 May – 3 June 2016, at Groot Drakenstein.

(Mostert, L, Ferreira, J, Van Zyl, F & Havenga, M 2016. What is the phytosanitary status of nursery trees? *Fruit Journal* Feb/March: 53-55)

Trunk disease pathogens of persimmon

Persimmon trees with dieback symptoms and cankers were observed in three

production areas in the Western Cape Province in South Africa. Isolations were made from diseased branches, cankers, and pruning wounds as well as from fungal fruiting bodies on dead branches and old pruning wounds (Photo 6). Several trunk disease pathogens were identified based on morphological characteristics and by molecular methods, including *Diaporthe* spp., *D. infecunda*, *Eutypella citricola*, *E. microtheca*, *Phaeoacremonium parasiticum*, *P. sclolyti*, *P. australiense*, *P. minimum*, *Fomitiporia capensis*, *Fomitiporia* sp., *Fomitiporella* sp., and *Inocutis* sp., which were isolated from persimmon for the first time in the world. Other first reports from persimmon in South Africa include *D. foeniculina*, *D. ambigua*, *D. mutila*, *Diaporthe* sp., *Neofusicoccum australe*, *N. parvum*, *Diplodia seriata*, and *Eutypa lata*. Pathogenicity tests conducted with all species, except the basidiomycetes, confirmed their status as possible persimmon pathogens. This is the first study to determine and identify fungi associated with diseased persimmon in South Africa. The knowledge gained in this study forms the basis for further research to determine the impact of these fungi on persimmon productivity. (Moyo, P, Mostert, L, Bester, M & Halleen, F 2016. *Trunk disease fungi associated with Diospy-*

ros kaki in South Africa. *Plant Disease* 100: 2383-2393).

SOCIAL IMPACT

The Plant Disease Clinic (Photo 7) is a service laboratory situated at the Department of Plant Pathology that started its activities in October 2000. All types of fungal, bacterial and virus diseases on various crops are diagnosed. The Plant Disease Clinic has grown substantially over the past 10 years. From handling 363 samples in 2006 to a total of 1053 samples that were received, analysed and reported on in 2016. The Plant Disease Clinic also did some smaller projects and completed a contract project for Janssen Pharmaceutica NV. Two new disease reports (White rust on *Lampranthus* sp. (Photo 8) and *Ramularia collo-cygni* infecting barley in South Africa) were published in peer reviewed scientific journals. Two MSc students submitted their research work from projects that were spin-offs from work that the Plant Disease Clinic did over the last couple of years. A survey conducted in the 2010/11 season by the Plant Disease Clinic on three farms in the Koue Bokkeveld, revealed that the in-

cidence of onion post-harvest disease can vary substantially among farms, and the main post-harvest diseases in this area are *Fusarium* basal rot, *Botrytis* neck rot, black mould and bacterial storage rots. Lonette Kleinhans completed her thesis on 'Characterisation of onion post-harvest pathogens and factors associated with post-harvest disease incidence in the Koue Bokkeveld region of South Africa'. The Plant Disease Clinic over the past couple of years recorded losses occurring on newly planted apple trees (between ages one and three years) in orchards that have died due to stem cankers and wood rot. The deciduous fruit industry of South Africa also observed a high incidence of mortality in young apple trees due to dieback, thus, launching an investigation into the possible influence of specific rootstocks. As part of this initiative, Minette Havenga completed her thesis on the 'Occurrence of stem canker and wood rot pathogens in young apple trees and possible inoculum sources'.





Photo 1: Soil science students, Luan le Roux, Marilee Carstens and George van Zijl, receiving awards at the 2016 combined congress (photo: SSSSA)



Photo 2: Industry delegates attending the soil science open day organized by Prof Johan van Zyl. (photo: E Hoffman)



Photo 3: Agronomists attending soil classification workshop (photo: P Brink)



Photo 4: Andrei Rozanov, Liesl Wiese, Ailsa Hardie and Cathy Clarke in the Tmiryazev Agricultural academy soil museum, Moscow (photo: Y Melnikova)

SOIL SCIENCE

FOCUS AREAS

- Soil Classification
- Soil nutrition
- Carbon stocks
- Biochar amelioration
- Soil Physics
- Irrigation scheduling
- Soil organic matter

OVERVIEW

The Department of Soil Science got off to a good start in 2016 with three of our students receiving awards from the Soil Science Society of South Africa for the best presentations/publications in their respective categories at the combined congress (Photo 1). In terms of staff, the Department's research capacity has been bolstered by the addition of Mr Vink Lategan and Dr John Simaika who joined the Department as research associates, their respective focus areas being soil water management and water quality. Vink is in the process of setting up a Winetech project to investigate the anisohydric effect of different winegrape cultivars, while John is finalising his WRC project looking at the



Staff and postgraduate students of Soil Science (photo: A. Jordaan)

nutrient addition of invasive Acacias in Cape Streams.

The Department was active in industry engagement in 2016 hosting an industry interaction day where current and proposed research was showcased to various governmental departments and private industry (Photo 2). A short course on soil classification was also presented to employees of Yara, Netafim and Vinpro (Photo 3).

In December Ailsa Hardie, Andrei Rozanov and Cathy Clarke were invited to the World Soil Day celebrations in Moscow by The World Bank (Photo 4). Here they gave presentations on the Department's educational and research offering on the topic

of food security and gave an overview of the role of soil science in sustainable food production. Liesl Wiese, a PhD student in the Department, delivered a keynote address on behalf of the FAO-Global Soils Partnership at the Moscow World Soil Day celebrations.

RESEARCH

The Department produced 13 scientific publications, 1 book and 1 popular publication in 2016 on numerous topics including winery waste water irrigation, grapevine vigour, vineyard compaction, soil carbon accounting, copper mineral stability, computer tomography techniques in soil science, grassland ecology and a Dragonfly Biotic Index. Details of these and other publications can be found on our website.

Numerous research projects were started in 2016, only a selection of these are described in more detail below.

Rooibos Nutrition

A second rooibos research project was initiated in 2016 to look at optimal macronutrient nutrition and soil water bal-

ance of rooibos tea plants from seedling to mature stages in the Clanwilliam region. This research follows on from the findings of an earlier project showing that overuse of phosphate in soils results in poor rooibos growth. Two MSc students are working on this new project under the supervision of Ailsa Hardie and Eduard Hoffman (Photo 5).

Peri-urban small holder farming

An MSc research project investigating peri-urban small holder farmer practices was initiated in 2016 in collaboration with the Sustainability Institute, Stellenbosch. The aim of the research is to compare small holder farmer soil amendment practices with that of commercial vegetable farmers in terms of yields, soil quality and overall economic sustainability. The MSc research is being conducted on a small holding near Raithby just outside of Stellenbosch under the supervision of Ailsa Hardie (Photo 6).

Irrigation scheduling for young apple trees

A new Hortgro project on the effect of irrigation on the performance of young



Photo 5: Setting up the rooibos tea field trial on a farm near Clanwilliam (photo: A Hardie)



Photo 6: Small-holder farmer, Aren Mbunda (left) and soil science MSc student, Sikho Gobozi (right) At the experimental site where soil amendments for vegetable production are tested. (photo: A Hardie)



Photo 7: Dr Hoffman, Prof van Zyl and Mr Lategan busy installing the manifold for the new Apple project (photo: JE Hoffman)



Photo 8: SASSO and Western Cape Soil Discussion group meeting at Vergelegen Estate (photo: C Clarke)

apple trees in newly established orchards was initiated in 2016. Young apple trees must fill their allotted space as soon as possible in order to be profitable. Soil water status and root growth are believed to be major determining factors in achieving such a favourable effect. The objective of this project is therefore to determine the most effective irrigation schedule for the optimum performance, including root growth and root distribution of young apple trees in newly established orchards on gravelly soils, which are wide-spread in apple-growing regions of South Africa (Photo 7).

Optimisation of agronomic trial layout in variable soil conditions using high-precision remote and proximal sensing methods

The project is conducted jointly with the department of Agriculture, Western Cape. Soil survey, in preparation for long-term trial, and precision harvesting of wheat in the year prior to the trial start have shown a substantial variation in soil conditions and wheat yields within the farm. The project focusses on optimisation of block layout to minimise the detectable differences in production system performance.

Water dispersible clay as a discriminator between soil types

Water dispersible clay (WDC) is used as a proxy for clay stability which, in turn affects crust formation, hardsetting and erodibility of soils. As a result WDC is used as a discriminator in certain international classification systems. This project looks at the suitability of WDC as a discriminator in the South African classification system and also looks at easy laboratory tests to measure WDC.

SOCIAL IMPACT

The Department initiated the Western Cape Discussion Group in 2016 which brings together soil scientists from the Western Cape four times a year to discuss relevant research developments and technologies in soil science. The final meeting was combined with the South African Soil Surveyors Organisation (SASSO) which involved excursions to Vergelegen and Gra-bouw, hosted by Agrimotion (Photo 8). Dr Eduard Hoffman is very active with knowledge transfer within the farming community, and in 2016 presented at numerous farmers' days in Southern Africa. He was invited to give a talk on soil preparation to

150 farmers in Zambia, and has also presented at farmers days in the Swartland and Southern Cape. In October 2016 Eduard Hoffman and Vink Lategan presented modules in a grapevine irrigation course that was organised by VinPro and held in Robertson.

Various staff members of the Department made important contributions to industry- and subject-related organisations. Eduard Hoffman is Chairperson of the Winetech technical working group assessing soil research projects, a member of the Hortgro science peer review group, and serves as a member of the steering committee of several Water Research Commission assessment panels. Ailsa Hardie is a council member of the Soil Science Society of South Africa. Cathy Clarke serves as a member of the Soil Classification Working Group that currently is revising the Soil Classification System of South Africa. Vink Lategan is a board member and vice-president of the South African Society for Viticulture and Enology. A number of postgraduate students and academic staff of the De-

partment presented their research at the annual Combined Congress of the Soil Science Society of South Africa (SSSSA).





Photo 1: Ms Eunice Avenant at the OIV congress technical tour in Brazil with the agriculture representative of the South African embassy



Photo 2: Ms Marianne McKay receiving an SU teaching fellowship



Photo 3: "Wine as a system" workshop



Photo 3: "Wine as a system" workshop

VITICULTURE & OENOLOGY

FOCUS AREAS

- **Grape sciences (viz. viticulture, grapevine molecular biology and biotechnology)**
- **Wine sciences (viz. oenology, wine chemistry, wine microbiology and molecular biology, sensory)**



OVERVIEW

The mission of the Department of Viticulture and Oenology (DVO) and the Institute for Wine Biotechnology (IWBT) is to be a centre of excellence in grape and wine sciences that focuses on training and innovative research. As the only wine science environment at a South African university, a major focus is on producing well-trained, professional graduates and postgraduates who make major contributions, not only to the wine industry, but also to several other sectors. The Institute for Grape and Wine Sciences (IGWS) is a joint venture between the wine and table grape industries and Stellenbosch University and currently situated in the DVO. The focus is to build capacity and infrastructure in support of research and training, and on technology transfer. Specific projects investigate the influence

of viticultural and oenological practices on berry and wine composition (wine quality), biopreservation, wine ageing and aroma, wood and phenolics, oxidation, and chemical and other taints in wine. Research in viticulture includes approaches using remote sensing, grapevine ecophysiology, as well as molecular biology and biotechnology to study grapevine-environment interactions, the influence of abiotic factors on vine physiology and berry composition, optimising table grape cultivation and monitoring/evaluating berry quality impact factors.

RESEARCH

The research carried out at the DVO and the IWBT is in essence multidisciplinary and, whenever possible, integrated between the different disciplines of grape and wine science.

Achievements

In 2016, the DVO and IWBT published 22 peer-reviewed articles and 1 book chapter. 3 PhD, 11 MSc and 6 HonsBSc students graduated. A number of academics and post-graduate students also attended local and international conferences (Photo 1). Some major contributions included the following awards: best presentation at the 2016 Centre for Teaching & Learning symposium by Ms Marianne McKay, best poster at the 2016 South African Society for Enology & Viticulture Conference by Ms Jeanne Brand, best student poster at the 2016 Macrowine Conference with Prof Wessel du Toit as co-author.

STAFF NEWS IN 2016

Hard work paid off: Drs Erna Blancquaert was promoted to Lecturer and John Moore to Senior Researcher, and Prof Florian Bauer to Distinguished Professor. Dr Benoit Divol obtained a C2 rating from the National Research Foundation.

Ms Marianne McKay was awarded one of two prestigious 2016 Stellenbosch University Teaching Fellowships (Photo 2). The DVO welcomed Dr Carlos Poblete-Echeverría, who is appointed as Senior Lecturer in Viticulture.

Collaborations

The DVO-IWBT is a partner of several bilateral agreements, as well as staff and student exchange programmes, such as the international Oenodoc PhD programme, the international staff exchange scheme of the 7th Framework Programme of the European Union. As part of the latter, Drs Luca Roscini and Laura Corte from the University of Perugia in Italy visited our environment and worked closely with Prof Hugh Patterson to gain skills in genome analyses using bioinformatics tools. In exchange Ms Bahareh Bagheri, a PhD student from the IWBT, visited the University of Perugia in Italy for 3 months, taking advantage of the grape harvest season in the Northern Hemisphere. Her visit was unfortunately interrupted by earthquakes: so she now holds the record of being the first student in the IWBT to experience 3 earthquakes in 3 months!

Dr Marina Bely from Bordeaux University, France spent a 5-month sabbatical at the IWBT, working on a collaborative project in the field of wine microbiology.





Photo 4: “The Dassie”, a prototype vineyard robot under development in partnership with the CSIR, Pretoria



Photo 5: Dr José Luis Alexandre Tudo investigating the semi-automated tanks in the experimental cellar



Photo 6: The Pinotage Youth Development Academy



Photo 7: The Sensory team presenting an event for the Sanlam group, one of the IGWS funders

FOCUS ON A FEW SPECIFIC RESEARCH OUTPUTS

Coetzee et al. (2016) *Chemical and sensory study on the evolution of aromatic and non-aromatic compounds during the progressive oxidative storage of a Sauvignon blanc wine. Journal of Agriculture and Food Chemistry* 64, 7979–7993. This article, published in a journal with a good impact factor, was a collaborative effort between different researchers and institutions, and has an applicable outcome for industry.

Young et al. (2016) *Grapevine plasticity in response to an altered microclimate: Sauvignon blanc modulates specific metabolites in response to light. Plant Physiology* 170, 1235–1254. The grapevine biology team published this paper in one of the top plant journals on their studies to understand the influence of increased light exposure on Sauvignon blanc grapes. The berries activated protection mechanisms that lead to the formation of specific secondary metabolites, indicating the metabolic plasticity of grapes. It is clear that many (wine) quality impact compounds are actually stress compounds with biological functions produced in berries.

Smoke Taint research: Mr Heinrich du Plessis (Agricultural Research Council) and Ms Marianne McKay, in collaboration with oth-

er DVO and IGWS colleagues, collaborated on analysis and removal of smoke taint for veld-fire affected vineyards of the Western Cape (Winetech funded project).

Organisation of conferences

As part of an NRF-Sweden bilateral project titled, “Wine as a System”, that was awarded for 2016 to 2018 to Profs Melané Vivier (IWBT, DVO) and Johan Trygg from the University of Umeå, Sweden, a project launching workshop was held at STIAS in July 2016 (Photo 3). The project promotes an integrated approach to wine studies, implementing workflows to conduct large scale field studies in vineyards using highly characterised model vineyards. The project “follows” wine production from the vineyard through all steps of wine making and ultimately wine perception (sensory evaluation).

Short courses

The garagiste winemaking short course was, as always, a great success with 80 attendees in 2016.

HOW THE IGWS IS CONTRIBUTING TO RESEARCH AND DEVELOPMENT SUCCESS IN WINE SCIENCE

Viticultural Flagship Project

A project on “Automation, sensors, robotics and intelligent systems for Viticulture in South Africa” has been awarded to the Viticulture Platform and involves several academics from the DVO/IWBT as well as partners in Engineering. In collaboration with a team at the Council for Scientific and Industrial Research (CSIR), Pretoria, a prototype vineyard robot (commonly known as “Dassie”) has been developed, and is currently being evaluated and optimised (Photo 4).

Semi-automated tanks in the experimental cellar

These tanks were installed with IGWS funding and will allow for automatic monitoring of certain wine parameters and controlled additions during fermentation in the DVO’s experimental cellar (Photo 5).

SOCIAL IMPACT

Pinotage Youth Development Academy

Mss Marisa Nell and Marianne McKay (amongst other DVO and IGWS col-

leagues) continue the very successful short course interaction with the Pinotage Youth Development Academy. The short course presented to them includes basic chemistry and analysis for winemaking, wine trade and marketing, wine legislation and sensory evaluation of wine (Photo 6).

The **Sensory Facility** of the DVO presented 2 wine events for Sanlam representatives in 2016. The aim was to explore the opportunity to promote the South African wine industry, not only in South Africa, but also in the neighbouring African countries and strengthen our partnership with Sanlam, one of our IGWS funders (Photo 7).

Technology transfer to the wine industry

Academic staff gave presentations at annual technical workshops such as those organised by the SA Chenin blanc, Sauvignon blanc and Shiraz Associations, Vinpro workshops, as well as at the international ML School in France and Australia. The Vinpro technical consultants visited the viticultural team, postgraduate students and the research facilities in September 2016.





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