DEPARTMENT OF

PLANT SCIENCES

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES

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OVERVIEW OF 2024

The Department of Plant Sciences is a propulsive and unique department with a comprehensive approach, covering various aspects of plant science through its three divisions: Botany, Plant Breeding, and Plant Pathology. This interdisciplinary approach provides a well-rounded education and research environment. Plant Sciences fosters collaboration with both local and international researchers that demonstrates the staff's commitment to the growth and development of the Department which can significantly enhance its impact towards the Sustainable Development Goals. Teaching and learning are an integral part of the Department where staff members align the theory with application through diverse excursions at different teaching levels, enhancing job-related skills. During 2024, a total of 59 scientific papers were published in accredited journals, along with a book and four book chapters, while 76 presentations at national and international symposia, research days, and student symposia were delivered – confirming the active and productive research output of the Department. Many of these publications were co-authored with national and international collaborators which highlights the Department's strong global network and its role in contributing to the wider scientific community, enabling the Department to remain at the forefront of current developments in plant sciences. This was a year of growth and proof of Plant Sciences' dedication to both academic excellence and professional development, in which the Department hosted five Postdoctoral Fellows and more than a hundred postgraduate students, of whom 13 obtained BSc Honours degrees, 10 completed MSc degrees, and 6 MSc in Agriculture. Three Doctoral degrees were conferred.

ACHIEVEMENTS

Staff Achievements

Prof Botma Visser improved his NRF-rating in 2024 from a previous C2 to a current C1 rating. Prof Visser presented the keynote lecture at the 2024 edition of the Department of Botany and Plant Biotechnology Postgraduate Student Symposium at the University of Johannesburg titled 'Wheat rust surveillance in South Africa: past, present and future'.

Prof Maryke Labuschagne won the second prize in the 'Exceptional Supervisors Award' for 2024 at the UFS Exceptional Academic Achievers Awards.

Prof Sandy-Lynn Steenhuisen was invited to submit a full proposal to the Oppenheimer Memorial Trust New Frontiers Research Award after her concept note, aiming to refine the phylogeny of the *Protea* genus, was successfully accepted in January 2024. She was also a finalist for a National Science and Technology Forum (NSTF) Green Economy Award in July 2024. Prof Steenhuisen was invited to apply for a South African Research Chair position at UFS Qwaqwa in 2025, as part of the NRF's Decadal Plan Aligned Research Chairs initiative.

Dr Mpho Mafa was a semi-finalist in the NSTF Emerging Researcher Awards. He was also one of the UFS delegates that hosted an esteemed team from Botswana University of Agriculture and Natural Resources (BUAN), at which his research in the Carbohydrates and Enzymology Laboratory (CHEM-LAB) and its role in plant health and by extension its impact to food security and repurposing of the agro-waste were discussed. He was invited to participate as a panellist to the Early Career Researchers and Scholars (AECRS) at the South African Science Forum week, held at the CSIR Internation Convention Centre in December 2024.

Dr Mpho Mafa

Prof Rodney Moffet (UFS Qwaqwa Research Fellow) was awarded a Gold Medal by the Heritage Association of South Africa for his contribution to the preservation of indigenous knowledge and Basotho heritage.

Dr Dimitri Veldkornet was selected to advance from the Emerging Scholar Accelerator Programme to the Future Professoriate Mentoring Programme from 1 January 2025 to December 2026.

Prof Liezel Herselman was appointed as Vice-Dean of Teaching and Learning for the Faculty of Natural and Agricultural Sciences (NAS), after serving the Department of Plant Sciences as academic departmental head for more than 11 years.

Dr Angeline Jacoby was appointed as Programme Director for the Department. She was elected as treasurer to serve on the Southern African Plants Breeders' Association (SAPBA) executive committee during the 15th Southern African Plant Breeding bi-annual symposium that was held at the Monte Bella Estate in Bloemfontein, from 11to13 March 2024.

Student Achievements

Thabiso Masisi was selected to present a poster and Jesumayowa Ajidahun delivered a paper ('Exogenous abscisic and salicylic acids improve wheat tolerance to Russian wheat aphid Infestation') at the NRF Next Generation and Emerging Researchers Symposium held in Johannesburg in October 2024.

During the annual Faculty Prize-Giving various under- and postgraduate students received prizes.

In Plant Pathology, Sthandiwe Hlongwane received the best second-year incentive prize, Arinao Magwaba received the award for the best third-year student, and Amy Coetzer for the best Honours student. Lineo Maphobole was recognised for an exceptional MSc in Plant Pathology.

In Botany, Mercy Tsubella was awarded the Botanical Society of South Africa (Free State Branch) prize for best second-year student, Jaki du Plooy received the Van Schaik prize, the Botany prize, as well as the Botanical Society of South Africa (Free State Branch) prize for the best third-year student, Gaopalelwe Motshegwa was awarded the Botanical Society of South Africa (Free State Branch) prize for best Honours student, and

Christiaan Johannes Botha received the Botany prize for the best MSc student.

In Plant Breeding, the following students were awarded prizes in the different categories: Wian Botma (best second-year student), Janetta Strydom (best third-year student), Karabo Pule (best Honours student), Faith Kobedi (best MSc student), and Grant Richardson (best Doctoral student).

Amy Coetzer was awarded Best Presentation (in Afrikaans) at the Annual Conference of the South African Academy for Science and Arts hosted by the UFS on 30 and 31 October 2024.

Six students from the Department attended the 2024 edition of the Department of Botany and Plant Biotechnology Postgraduate Student Symposium at the University of Johannesburg (UJ) on 21 October. Doctoral candidate Selloane Lehasa (Qwaqwa Campus), supervised by Dr Pheello Mojau, won first prize for her PhD presentation, with Jeremiah Hlahla (Bloemfontein Campus) claiming the third prize. The Department is proud of our students' outstanding achievements, the professional way in which all presented their research, as well as the fun they had networking with peers from UJ.

Jeremiah Hlahla (left – from the Bloemfontein Campus) and Selloane Lehasa (right – from the Qwaqwa Campus) at the University of Johannesburg Postgraduate Symposium

Ntjabane Alfred Ntjabane received the certificate and Silver Medal in the Honours research projects' category at the Library & Information Services Honours and Undergraduate Research Seminar (LISHURS) in 2024.

Mamosela Mohotloane received a bursary from the Council for Scientific and Industrial Research (CSIR) Department of Science and Innovation (DSI) Inter Programme Bursary Scheme (IBS) to continue with her PhD studies in 2025.

On the Qwaqwa Campus, Master's student Thembelihle Mbele was awarded the Best Student Presentation Award at the National Symposium on Biological Invasions in Kimberley (9 to 12 September 2024) and at the 19th Kimberley Biodiversity Research Symposium (18 September 2024). Doctoral student Lehlohonolo Donald Adams was awarded first prize for his speed presentation at the South African Wildlife Management Association Conference (6 to 11 October 2024), in Windhoek, Namibia, and second prize for his student presentation at the 16th Annual NRF-SAEON Graduate Student Network Indibano (16 to 20 September 2024) in Gqeberha. Masters' student Siyanda Shabalala was awarded a CSRC Leadership award at the UFS 2024 Executive Director of Student Affairs Prestige Awards in Bloemfontein (12 October 2024).

Karabo Moloi, a Doctoral candidate, was selected to be a part of a documentary, commissioned by Prof Vasu Reddy, UFS Deputy Vice-Chancellor for Research and Internationalisation, which will premiere at the 2nd Southern African Mountain Conference in 2025.

Karabo Moloi being interviewed for the documentary

Qwaqwa Master's student Zinhle Sithole received two bursaries – one from the South African Association of Botanists and a second from the Centre for Biological Control, Rhodes University. Arni le Roux, another Qwaqwa Master's student, received a bursary from the Centre for Global Change and a tuition bursary from the Ernst and Ethel Ericksen Trust.

Lesego Malekana, a Masters' student, was awarded a Swiss Government Excellence Scholarship to pursue his PhD under Dr Jake Alexander at the prestigious ETH Zürich, a leading science and technology institute in Switzerland.

Diana Mngomezulu won second prize in the Master's category at the annual Flash Fact competition in the NAS Faculty.

Diana Mngomezulu

TEACHING AND LEARNING

Dr Andri van Aardt and Dr Lize Joubert accompanied the third-year Botany students on an excursion to Moolmanshoek in the eastern Free State. The students had the opportunity to learn about field sampling and data collection techniques, the biodiversity of the Free State grasslands, and the impact of rehabilitation on degraded vegetation.

The Botany excursion module, BTNY2621, has increased in enrolment from 14 in 2022 to 25 in 2024. At the end of August, the students were exposed to new plant ecophysiological techniques used in the field and taught to capture and process data at the Amanzi Game Reserve, 40 km from Bloemfontein. Dr Dimitri Veldkornet and Dr Mokoena (Boke) Moloi facilitated the excursion and were delighted by the enthusiasm and effort made by the students when they presented their findings to the lecturers and demonstrators. The overall feedback from the students was encouraging and lectures are hopeful for a larger number of students participating in the excursion in 2025.

Students on the Botany excursion 2024

During the first semester of 2024, Prof Steenhuisen led a number of off-site fieldtrips to Witsieshoek Mountain Lodge and the Royal Natal National Park for the third-year Vegetation Ecology module, where students were trained in vegetation sampling techniques and plant identification, and were able to experience the natural beauty of the areas surrounding the UFS Qwaqwa Campus. Additionally, from 8 to 10 March the Vegetation Ecology students went on a weekend fieldtrip to Golden Gate Highlands National Park, in conjunction

Students on field trip to Golden Gate Highlands National Park

with the Behavioural Ecology module taught by Prof Aliza le Roux of the Department of Zoology and Entomology. During this fieldtrip students from both courses collaborated to collect data and teach each other new techniques for the collection of field data for both plants and animals.

Dr Dalene Meintjes, from the UFS Centre for Teaching and Learning invited, Dr Rudo Ngara and Prof Steenhuisen to present a poster at the 2024 Annual UFS Learning and Teaching Conference held in September. The presentation summarised the work-integrated learning activities that the two academics incorporate in their day-to-day teaching engagements at both undergraduate and postgraduate levels.

Prof Sandy Steenhuisen and Dr Rudo Ngara at the UFS Learning and Teaching Conference

As part of the online seminars to MSc students who register for the Plant Breeding and Protection for Sustainable Production course in the Department of Plant Protection Biology at the Swedish University of Agricultural Sciences, Alnarp, Sweden, Dr Jacoby and Prof Boshoff presented lectures titled 'Nutritional improvement through biofortification' and 'Stem rust in wheat – the Southern African perspective', respectively.

In May 2024, Dr Moloi visited the University of Debrecen in Hungary through the Erasmus Teaching Mobility Program, and she also hosted Prof Brigitta Tóth to strengthen the academic collaboration.

RESEARCH, INNOVATION RESEARCH COLLABORATION

SARChI Chair on Disease resistance and quality in field crops

2024 was the ninth year of the SARChI Chair on Disease Resistance and Quality in Field Crops (held by Prof Maryke Labuschagne). The pathology part of the chair, led by Prof Willem Boshoff and Prof Botma Visser, concentrated on monitoring the rust disease causing fungal populations of important crops in South Africa; survey and genotypic characterisation of rust species of South African grasses; genetic reconstruction of three South African cereal rust populations using herbarium specimens; sequence analysis of the *avrSr35* and *avrSr50* genes in the South African *Pgt* (wheat stem rust) population; genetic and functional analysis of resistance/tolerance against strobilurin and azole fungicide application in the South African *Pgt*, *Pst* (wheat stripe rust) and *Pt* (wheat leaf rust) populations, and inhibition of their urediniospore germination and growth with smoke; molecular survey of *Berberis* species in South Africa; molecular and biochemical characterisation of the adult plant disease resistance response of wheat varieties against *Pgt* infection; and the molecular basis of all stage resistance of selected South African wheat cultivars and potential new germplasm sources.

On the quality side, led by Prof Labuschagne and Dr Angeline Jacoby, the project on the influence of heat and drought stress and a combination of the two on gluten protein and quality in durum and bread wheat, was completed, as was the project of the effect of the *wheat bread-making* (*wbm*) gene on protein quality. The project on resistant starch in South African wheat cultivars as a source of dietary fibre is still underway. The project on crop biofortification (maize, legumes and sorghum) and nutritional value has generated very good outcomes both in terms of research outputs and the release of commercial genotypes for production. Several students have completed their MSc and PhD degrees on the chair projects and the research led to several conference presentations, and publications in accredited journals. Prof Labuschagne collaborated with the University of Córdoba in Spain, with the International Institute for Tropical Agriculture in Nigeria and Zambia, with the International Crops Research Institute for the Semi-Arid Tropics in Kenya and Zimbabwe, the International Maize and Wheat Improvement Centre (CIMMYT) in Zimbabwe and the University of Namibia. Nationally she collaborated with the Agricultural Research Council.

Botany: Plant physiology/ biochemistry and molecular biology

Dr Arun Gokul continued with research regarding candidate microbial biocontrol agents (identified previously). These biocontrol agents were tested both *in vitro* and *in vivo* and showed no adverse effects on the growth and health of commodity crops treated; however, a marked reduction in disease incidents was observed. The potential control mechanism was different for each putative biocontrol isolate, with some affecting the nutrient solubilisation within the plants and others producing volatile organic compounds to deter colonisation and growth of the phytopathogen. He and his team also moved on to assessing how the introduction of this technology would impact existing agricultural practices. Dr Gokul is involved in a collaboration between the UFS and the University of the Western Cape (running for the fourth year). The team also continued a collaboration with the University of Zululand. The projects focus on the utilisation of endophytes and other endosymbiotic microorganisms as biological agents to enhance plant resistance to pathogens, improve tolerance to abiotic stresses, and promote growth through biostimulator mechanisms. This collaboration has resulted in seven peer-reviewed articles in high impact factor journals.

Dr Boke Moloi specialises in plant ecophysiology, focusing on how abiotic stressors, like drought and elevated temperatures, and their combination affect the physiological, biochemical, and morphological responses of crops. She also leads a project exploring the use of natural biostimulants, biodegradable compounds, and micronutrients to mitigate these stresses in agricultural crops. Her work is vital for developing solutions to boost crop production in the face of climate change. Dr Moloi collaborated with Prof Ned Bowden from University of Iowa, USA, on a project involving the use of Cysteine derivatives for the improvement of drought tolerance in edamame. Dr Moloi and Dr Mafa worked on the edamame project investigating the role of the carbohydrates and amino acid osmolytes during drought or combined heat and drought stress, as well as the contribution of cell wall adjustment and modification during the abiotic stress. Dr Moloi also has an ongoing collaboration with Prof Brigitta Tóth, from the University of Debrecen, Hungary, on a project involving a PhD student who they jointly supervise. She visited the University of Nyíregyháza in Hungary, where she gave a lecture on 'Selenium's impact on enhancing drought tolerance in edamame'. During this visit she established a collaboration with Dr Csilla Tóth, a specialist in stress physiology, on heat and drought stress physiology at ultrastructural level.

Dr Rudo Ngara continued with her research investigating the molecular responses of selected cereal crops to drought stress, using multi-omics approaches. A notable highlight from her research group was the observed enrichment of photosynthesis-related proteins that were highly suppressed in the drought-tolerant maize variety, possibly to reduce photosynthesis-related oxidative stress damage under conditions of limited water supply. These results form part of Sellwane Moloi's Doctoral thesis, under examination and published in 2024, in collaboration with Dr Gokul and Dr Boke Moloi. Data analyses for the drought-responsive sorghum root transcriptome are underway, while preliminary RNA-SEQ data for the root drought-responsive microRNA have been generated. These data are pivotal in shaping Dr Ngara's future research focus. Dr Ngara collaborates with Dr Nemera Shargie from the Agricultural Research Council-Grain Crops on all her sorghum projects, and with Dr Dirk Swanevelder from the Agricultural Research Council-Biotechnology Platform & Core Facility on a sorghum transcriptome project. She continues to work with Stephen Chivasa from Durham University, UK, mainly on the metabolome and proteome analyses of plants in response to water deprivation.

Prof Botma Visser continued his research on wheat rust surveillance in South Africa through the PhD study of Isabella du Toit. The aim of her study is the implementation of MARPLE technology to rapidly identify variants of *Puccinia graminis* f. sp. *tritici* and *Puccinia striiformins* f. sp. *tritici*, that cause stem and stripe rust of wheat, respectively. This is done in collaboration with Prof Diane Saunders of the John Innes Centre (JIC) in Norwich, UK. As part of her study, Isabella spent two months at the JIC during which she received training on the MARPLE system. The collaboration with Prof Saunders resulted in a paper titled 'Comparative genomics identifies genetic markers linked to structural variations that differentiate *Puccinia graminis tritici* and *secalis formae speciales'*. A second project, by Jaki du Plooy, focused on the identification of possible effector genes involved in the wheat-*Puccinia graminis* f. sp. *tritici* pathosystem. Two possible effector genes were identified that will form the focus of her MSc study starting in 2025. Prof Visser's collaboration with Prof Melania Figueroa from the CSIRO in Australia resulted in a paper titled 'Genome-enabled analysis of population dynamics and virulence associated loci in the oat crown rust fungus *Puccinia coronata* f. sp. *Avenae'*.

The Carbohydrates and Enzymology Laboratory (CHEM-LAB) led by Dr Mpho Mafa includes research on plant carbohydrate metabolism, Carbohydrates-Active enzymes' (CAZymes) physiological functions during plant-pathogen/pest interaction, and the application of CAZymes in the synthesis of value-added products (VAPs) for the circular economy. All the work done by postgraduate students (Honours, MSc, and PhD) was overseen by Dr Mafa and published in four research articles in 2024. Dr Mafa worked with Dr Mohase and Dr Vicki Tolmay (Agricultural Research Council), on the wheat-aphids interactions projects, in which he studies the role of CAZymes and adjustments of carbohydrate metabolism during wheat infestation by aphids and he elucidates the protective function of the cell wall reinforcement processes during wheat infestations. He also investigated the CAZymes that have potential to be classified as effectors that make wheat susceptible to aphid infestation.

Dr Mafa also applied the carbohydrates or CAZymes in the biorefinery sector for the production of VAPs. He studied the chemical composition of the lignocellulose of the agricultural waste/biomass with high holocellulolytic content, develop enzyme cocktails that can extract and saccharify the holocellulolytic content to produce simple sugars that can be fermented to produce value added chemicals, e.g. ethanol, butanol, short fatty acids, and aromatic compounds. On this project he collaborates with Dr S Malgas (University of Pretoria), Prof BI Pletschke (Rhodes University), and Prof Aniko Varnai (Norwegian University of Life Sciences).

The current projects under Dr Lintle Mohase's supervision focus on the interaction of wheat (*Triticum aestivum* L.) and the Russian wheat aphid (*Diuraphis noxia*, Kurdjumov). The team strives to dissect and describe various resistance components in host plants, including the biosynthetic pathways of defence-related metabolites, especially phytohormones, reactive oxygen species, and antioxidants. Additionally, components are profiled for aphid saliva in search of potential elicitors or effectors in wheat-aphid interactions. In striving for integrated pest management in the changing climatic conditions, they study the effect of drought on host resilience to the Russian wheat aphid and the mode of resistance therein. They also investigate the potential of various compounds, including salicylic acid, silicon, selenium, and fungal pathogens, as priming agents that confer host resistance to aphids. Lastly, the team assess the potential loss of aphid sensitivity to commercial insecticides. Dr Mohase and her team are supported in their research through their collaboration with Dr Astrid Jankielsohn, an entomologist from the ARC specialising in cereal aphids and their impact on wheat production, who facilitates access to verified aphid biotypes, assessment of aphid responses to insecticides and co-supervision of students.

Botany: Phytomedicine and ethnobotany

Dr Pheello Mojau 's research involves bioprospecting for affordable and readily accessible herbal remedies for both diabetes mellitus and cancer. The aim is to reduce the dependence of sufferers of those diseases on Western/orthodox medicines that come with deleterious side effects. This research includes determining antimicrobial, antimycobacterial, anticancer and antidiabetic properties of medicinal plants. Dr Mojau continued to collaborate with Prof Rialet Pieters from North-West University on the study of anti-cancer properties of *Dioscorea sylvatica*.

Botany: Plant taxonomy and molecular systematics

Dr Lize Joubert (the curator of the Geo Potts Herbarium on the Bloemfontein Campus), and representatives from the Qwaqwa Herbarium collaborated with the National Science Collections Facility (NSCF) at the South African National Biodiversity Institute (SANBI) to image all the specimens in their main collections. During the next phase of this project the specimen data and images will be made available online to support research on the flora of central South Africa. This is a step towards developing the herbarium into a world-class herbarium with an online database.

Dr Mariëtte Jackson's research focuses on plant molecular systematics. In 2024, the systematics of

genus *Garuleum* (Asteraceae) were published, and more work is planned for the phylogeny of genus *Curio*, in the same family. Dr Joubert and Dr Jackson collaborated with Pieter Bester from SANBI on the systematics of *Nemesia*, a genus of indigenous snapdragons. The team was awarded a Botanical Education Trust Grant to continue the research in 2025. Dr Jackson also collaborates with Dr Lisa Rothmann on the soybean project, identifying seedborne diseases with molecular techniques and one student submitted his Masters' dissertation for examination end of 2024.

Botany: Palaeo-botany and ecology

Dr Andri van Aardt continued her research on pollen cores from Colbyn and the Rietvlei Dam from the Gauteng region, supplied by Dr Piet-Louis Grundling and co-workers and dated by Stephan Woodborne at iThemba LABS. Together with Prof Louis Scott, she collaborated with Palooma de la Perha Universidad de Granada, Spain, on a project on Marshill Rock Shelter (Eastern Cape) and with Piet-Louis Grundling and Althea Grundling on the reconstruction of past environments at Colbyn wetland. Dr Van Aardt also collaborated with Dr Michael Toffolo from CENIEH in Spain on the PEOPLE project, exploring the role of changing environments in the adaptation strategies of *H. sapiens* in the Middle and Late Pleistocene in the central interior of the country. This project also includes other researchers from Germany and the USA.

In terms of modern ecology, Dr Van Aardt is working on mapping of various vegetation types in the Free State in collaboration with Anisha Dayaram at SANBI. She is also investigating various soil-plant relationships in National Parks across South Africa, with Prof Johan van Tol from the UFS Department of Soil Sciences at UFS.

Prof Louis Scott continued his research studies on several South African palaeoenvironmental sites. He worked with Dr Abraham Dabengwa, a postdoctoral researcher at the University of Witwatersrand, on the late Quaternary fire history of the savanna biome, and with researchers from North-West University on projects on modern pollen analysis. Both Prof Scott and Dr van Aardt collaborated with researchers from Spain on Marshill in the Eastern Cape.

Nomcebo Mngomezulu, under the supervision of Dr Dimitri Veldkornet, completed her MSc study on 'Salt marsh habitat loss due to erosion of the Berg Estuary, South Africa', which has contributed to the understanding of the vegetation and invertebrate species dynamics at the Berg River estuary in the face of ongoing erosion.

The RangeX project, funded by the Department of Science and Innovation (DSI) through a BiodiverSA call (Horizon 2020), is a collaborative reciprocal climate-change and transplant experiment consortium of international ecologists led by South African principal investigator Prof Ralph Clark (UFS Afromontane Research Unit [ARU]) and Swiss principal investigator Dr Jake Alexander (ETH Zürich), and includes collaborators from Switzerland, Norway, Denmark, Sweden, Germany, Chile, China and Australia. The project continued with several helicopter-aided research fieldtrips to their Alpine Research Station on the plateau of the Amphitheatre at 3100 masl in the Maloti-Drakensberg. South African co-PI Prof Steenhuisen, Postdoctoral Research Fellow Dr Stephanie Payne, UFS Plant Sciences affiliate Dr Onalenna Gwate, Master's student Lesego Malekana, and several team members from the ARU and Centre for Biological Control (CBC) at Rhodes University, conducted their third and final full cycle of plant trait measurements and camera trap observations to assess the effects of elevation and warming on range expanding plant species. Alongside other insect and pollinator data, Prof Steenhuisen and Dr Payne collected camera trap images of insect visitors to transplanted *Scabiosa* flowers. The images will be annotated and analysed with the aim of using the images to train machine learning models to identify insect visitors to flowers, in partnership with Dr Jamie Alison at Aarhus University, Denmark. Lesego Malekana completed his Master's project on impacts of bush encroachment by woody Rosaceae species up an elevational gradient, as a component of the RangeX project.

As part of the outcomes for the RangeX project, Lesego Malekana and Dr Payne participated in a Policy and Practice Workshop, hosted by the ARU at the 59th Annual Congress of the Grassland Society of Southern Africa on 26 August, during which the results from the RangeX project were presented to various stakeholders. The South African RangeX team also travelled to Todtnauberg, Germany, to participate in the annual RangeX writing retreat. Here, progress of each of the regional projects was shared, data management was standardised, publications were planned and drafted, and future plans for continuing projects were discussed. Although the RangeX project reached completion in April 2024, when cameras were decommissioned, the RangeX site and the Alpine Research Station remain active for other projects to be conducted through the ARU.

UFS Qwaqwa Campus participants at the RangeX writing retreat (back row: first on the left, Prof Ralph Clark (ARU); middle row: second from the left, Lesego Malekana, and third from the right, Prof Sandy-Lynn Steenhuisen; kneeling: first from the right, Dr Onalenna Gwate, and third from the right: Dr Stephanie Payne

The Northern Temperate Weeds project, led by Prof Grant Martin and Dr Kim Canavan, members of CBC at Rhodes University (both UFS Plant Sciences affiliates), continued with existing projects and launched new projects in 2024. Lehlonolo Adams completed his PhD assessing fleshy-fruited alien plant invasions in eastern South African grasslands, using community perceptions, seed germination and dispersal, and repeat photography. Karabo Moloi (PhD candidate) continued with her project assessing the potential role that invasive Rosaceae species may be playing as ecosystem engineers, and Zinhle Sithole (MSc) started her project untangling the possible cryptic invasion of a second *Rosa* species in the eastern Free State grassland. Siyanda Shabalala (registered in Department of Geography, under Prof Clark) is conducting research for his Master's on the importance of invasive woody species for the environment and surrounding Qwaqwa community. Sphindile Dlamini (registered in the Department of Zoology and Entomology, under Prof Le Roux) is conducting research on how the Qwaqwa community use invasive Australian Acacias and assessing the interactions of the *Acacia* species with seed dispersers. Tapiwanashe Mashamba submitted his MSc research on the invasive status of two Willow species in the eastern Free State and found that while the charismatic Weeping Willow seems to be in the decline, populations of the other, lesser-known Crack Willow are stable to increasing. Thembelihle Mbele completed her MSc research on the genetic diversity and distribution of pampas grass and was awarded two separate prizes for her research at two biological invasion conferences this year. Sanele Mfusi conducted a study on the distribution of two invasive Toadflax species in South Africa as part of his honours project for 2024. Both Thembelihle Mbele and Sanele Mfusi are developing risk analyses for these invasive species that could inform future policy regarding these species.

Lumko Mboyi (Director of Sustainability and Ecology for Conservation Exposure Education and Training [CEET] in KawZulu-Natal) continued with his MSc research on the invasion pattern and impacts of *Nassella tenuissima* in the Eastern Cape regions of the Drakensberg, in partnership with Prof Clark (ARU), Dr Anthony Mapaura (ARU), and Dr Canavan (CBC, Rhodes University).

[Photo credit: Anthony Mapaura]

Arni le Roux started his Master's project on macroinvertebrate assemblages and vegetation dynamics of high-elevation wetlands of the Eastern Escarpment of South Africa (with Dr Kyle Lloyd [Birdlife South Africa], Prof Michelle Greve [University of Pretoria], and Prof Mark Robertson [University of Pretoria], as co-supervisors). Thulile Buthelezi continued her Master's project evaluating the reproductive ecology of the endemic cushion plant *Euphorbia clavarioides*, which appears to be pollinated by flying insects.

Prof Sandy Steenhuisen continued her main collaboration with Prof Martin and Dr Canavan from the Centre for Biological Control (Rhodes University), with whom she co-supervises seven postgraduate students. This collaboration resulted in a new collaboration with another esteemed CBC researcher, Prof Martin Hill, as they form part of a supervisory team for a new Master's student, Mukololo Khaku, along with Dr Michelle Tedder (University of KwaZulu-Natal) and Prof Doug Harebottle (Sol Plaatje University). This resulted in a new international collaboration with Dr Andrew McConnachie of the Australia NSW Department of Primary Industries. Another new collaboration between Dr Tedder, Prof Harebottle, Prof Martin, and Dr Gokul was implemented late in 2024, with new setups of the Drought-Net project (Drought-Net) in Clarens and Kimberley being planned for 2025.

Prof Steenhuisen has also continued collaboration with Prof Colleen Downs (UKZN), co-supervising a PhD candidate funded by the South African National Biodiversity Institute (SANBI), and the CBC. She also externally supervises one Doctoral candidate and one Master's student with Prof Glynis Goodman-Cron (University of the Witwatersrand) and one Masters' student with Dr Michelle Tedder (UKZN).

As part of the research on untangling the *Protea* phylogeny, Prof Steenhuisen collaborated with Prof Nora Mitchell (University of Wisconsin Eau-Claire, USA), Prof Robert Raguso (Cornell University, USA), and Prof Elizabeth Arnold (University of Arizona, USA). Prof Mitchell and three postgraduate students travelled to South Africa in January 2024 to conduct fieldwork on proteas and to attend the 49th annual South African Association of Botanists Conference in Richards Bay, KwaZulu-Natal.

Participants of the 49th Annual South African Association of Botanists Conference, hosted by the University of Zululand in Richards Bay, KwaZulu-Natal. From the left, Chase Fillion (University of Wisconsin-Eau Claire), Prof Nora Mitchell (University of Wisconsin-Eau Claire), Prof Sandy-Lynn Steenhuisen (UFS Plant Sciences), Anna Fregien and Carolyn Hansen (University of Wisconsin-Eau Claire)

Prof Steenhuisen is furthering her collaboration with the Mountain Invasion Research Network (MiREN), as she, along with members of the MiREN network, work together to implement new MiREN monitoring transects as part of her application for a SARChI chair at UFS Qwaqwa.

Plant Breeding: Molecular plant breeding

Breeding disease-resistant crop varieties is a common goal for plant breeders across the globe to ensure the sustainability and growth of production of economically important crops. Prof Adré Minnaar-Ontong's research focuses on resistance breeding against Sclerotinia stem rot (SSR) in soybean, soybean sudden death syndrome (SDS), and associated phytotoxins as well as resistance to mycotoxins produced by Fusarium head blight (FHB) causal pathogens with the application of marker-assisted selection to integrate and combine major and minor effect genes or QTLs. She collaborates with breeding companies from industry, and researchers from the Agricultural Research Council and the University of Pretoria.

The Sclerotinia resistance research identified five South African soybean cultivars with partial resistance to Sclerotinia stem rot. These cultivars have now been included in a pre-breeding programme to further enhance resistance to SSR in local cultivars with the aim to improve soybean production in South Africa. One MSc student (Faith Kobedi), who worked on this project, obtained her MSc Agric degree at the April 2024 graduations. With collaborators, the *Sclerotinia sclerotiorum* culture collection was established with more than 1000 isolates from eight of the nine South African provinces across multiple crops. The collection is maintained at UFS Plant Breeding.

Detached leaf assay used to evaluate susceptibility of South African soybean cultivars to Sclerotinia stem rot

A pre-breeding programme for Soybean sudden death (SDS) resistance was initiated using marker-assisted breeding approaches after the evaluation of the South African commercial soybean as well as edamame germplasm for potential resistance to this destructive disease. Furthermore, a diversity study was initiated to determine the causal pathogen of SDS as well as the distribution of the fungal species involved, in collaboration with the University of Pretoria. The culture collection for the collected *Fusarium* species is also maintained at UFS Plant Breeding.

Breeding for resistance against the mycotoxins associated with FHB causal species is important and contributes to food safety, impacting food security and sustainability. This research is funded by the SARChI Chair in Disease Resistance and Quality of Field Crops. Several *Fusarium* species associated with FHB were identified, but *F. graminearum* was identified as the predominant causal species in South Africa. The mycotoxins involved, pose a threat to both human and animals. Knowledge gained from analyses will assist with the development of effective management and control strategies, i.e. resistance breeding against FHB and the mycotoxins associated. This will assist with improving wheat production in South Africa.

Dr Chrisna Steyn's research focuses on breeding for resistance against fungal diseases across a diversity of legume crops, particularly on diseases initiated by *Sclerotinia sclerotiorum* and *Fusarium* spp. on economically important legumes such as soybeans, cowpeas, pigeon pea, and Bambara groundnut. Research includes identification and profiling (morphology and DNA) of fungal isolates collected from legumes (cultivars and landraces) across South Africa. She uses different screening methods to optimise disease evaluation and resistance of the different legumes to the fungal pathogens involved. The information gained, will assist to promote improvement of disease management and

control strategies. This research is undertaken in collaboration with Prof Minnaar-Ontong and Prof Rouxlene van der Merwe as part of the ARC-DALLRD-UFS research chair, breeding vegetables and grains research focusing on breeding climate-resilient, nutrient-rich and disease-resistant legumes for human and industrial uses.

Cowpea greenhouse trial

Prof Van der Merwe's research focuses on breeding for resistance to pod shattering in vegetable-type soybean (in collaboration Prof Qiuying Zhang from the Northeast Institute of Geography and Agroecology at the Chinese Academy of Sciences). This research continued to make progress towards the development of an improved South African vegetable type soybean cultivar that shows resistance to pod shattering. Prof Adré Minnaar-Ontong assisted with marker-assisted selection of progenies grown in field trials. One MSc student (Kelvin Hlatshwayo) obtained his MSc Agric degree during the April 2024 graduations.

Plant Breeding: Conventional breeding

Prof Rouxlene van der Merwe's research on breeding for tolerance to drought and heat stress in vegetable-type soybean continued to make progress. This project, funded by the NRF-Competitive Support for Unrated Researchers, is done together with Dr Angeline Jacoby and Dr Boke Moloi, who assisted with the physiological and biochemical response analyses. Robert Coertzen obtained his MSc Agric and Estiaan Coetzee his BSc Hons degree during the April 2024 graduations.

Research on the impact of water-limited-stress on the morphology, physiology and nutritional quality of dry bean was completed in 2024. This project aimed to characterise dry bean cultivars in terms of drought stress tolerance and nutritional quality. This project was done in collaboration with Dr Jacoby, who assisted with nutritional quality analysis, Dr Moloi, who assisted with physiological response analyses, and Dr Deidré Fourie (Dry Bean Producers' Organisation), who co-supervised Lesole Sefume, who obtained his MSc Agric degree with distinction during the December 2024 graduations.

Prof Van der Merwe continued her research collaboration with TransfOrmus to evaluate the effect of enOrmus and Soil Life Combo on plant biomass and yield of vegetable-type soybean and maize cultivars under field and glasshouse conditions. The aim of this collaboration is to evaluate the effectiveness of using the different plant biostimulants on crop biomass and yield and to determine possible phytotoxic effects on plants. The report developed by Prof Van der Merwe will assist with the registration of the newly developed biostimulants as group 3 fertilizers with the Department of Agriculture, Forestry and Fisheries. This project is also done in collaboration with Dr Elmarie van der Watt at Agronomy (UFS). One student (Brandon da Paixao) obtained his BSc Agric Hons degree during the April 2024 graduations. Brandon also enrolled for the MSc Agric using the same project and submitted his MSc dissertation in November 2024.

Soybean greenhouse trial

Prof Van der Merwe initiated research collaboration with Dr Armand Smit, the KwaZulu-Natal Agricultural Technical Manager at Green Farms Nut Company, on a project to establish a correlation between thrip insect levels on macadamias to nitrogen and calcium in the macadamia leaf. This project is being funded by Macadamias South Africa.

Dr Kwame Shamuyarira is involved in the Sorghum pre-breeding project, 'Evaluation of exotic germplasm as a precursor to sorghum pre-breeding', with Sorgho Pvt Ltd and the University of KwaZulu-Natal. Since when varieties were last released in South Africa, no new varieties have been developed. The team is currently importing germplasm from different sources globally to evaluate them locally and start a pre-breeding programme. Superior lines will be selected for further breeding to develop new varieties that are locally adapted to South Africa. The new varieties will help stimulate the growth of the sorghum industry in South Africa.

Plant Breeding: Wheat-quality and crop-nutritional value research

Dr Angeline Jacoby continued with research on the influence of abiotic stress on the nutritional profile and quality of crops such as wheat, maize, vegetable-type soybeans, dry beans, sorghum, and cassava. Nutritional screening includes the study of storage protein through size exclusion and reverse-phase high-performance liquid chromatography, including the determination of total starch, amylose, tryptophan, tannins, mineral content (especially iron and zinc) and the bioavailability of these minerals.

Dr Jacoby collaborated with Prof Maryna de Witt from the UFS Department of Sustainable Food Systems and Development on the study of proteins in *Opuntia* genotype mucilage. She also collaborated with Dr Amelework Assefa from the ARC-Vegetable, Industrial and Medicinal Plants on a casava project focusing on the nutritional value of the crop, and Prof Erik Alexandersson and D. Sajeevan Radha Sivarajan from the Swedish University of Agricultural Sciences in Alnarp, Sweden.

Plant Pathology: Cereal rust diseases

Prof Willem Boshoff continued with wheat cultivar and breeding line assessment for resistance to

Prof Willem Boshoff

rust pathogens. This research involves annual greenhouse and field screening with selected races of the three rust pathogens of wheat. During 2024, field trials were carried out near Greytown, KwaZulu-Natal. Results from this industry-funded project are annually shared with wheat breeders and published in the National Wheat Production Guidelines of Agricultural Research Council-Small Grains (ARC-SG). This collaboration resulted in a paper on surveillance of *Puccinia graminis* f. sp. *tritici*.

A study to characterise isolates of the maize rust pathogen, *Puccinia sorghi*, was completed with the financial support of the Maize Trust. Field phenotyping of wheat and barley research populations to map rust resistance sources was successfully carried out in collaboration with Dr Renée Prins at Central Genetics (CenGen) and Prof Brian Steffenson at Minnesota University. A paper titled 'Mapping of resistance loci in wheat line Milan/S87230//Babax to South African races of *Puccinia striiformis* f. sp. *Tritici*' was published.

Prof Boshoff also collaborated with Prof Brande Wulf and researchers at the King Abdullah University of Science and Technology (KAUST), Kingdom of Saudi Arabia, from which a paper titled 'Origin and evolution of the bread wheat D genome', resulted.

Plant Pathology: Soil microbial ecology and Soilborne Diseases

Dr Norman Muzhinji leads the Microbial Ecology and Soilborne Diseases research group, which focuses on soil health, soil-borne diseases of solanaceous crops, and sustainable agriculture. The group investigates host-pathogen interactions using advanced bioinformatics, including genomics and transcriptomics, to develop holistic disease management strategies. In collaboration with Dr Tika Adhikari and Prof Frank Louws from North

Carolina State University, whole genome sequencing resources for *Botrytis cinerea*, the causative agent of grey mould on small fruits was provided. They also conducted comparative genomics of *Colletotrichum* species associated with anthracnose in strawberries, as well as Alternaria isolates from tomatoes. In another study, they emphasise the role of soil microbiomes in soil and plant health, using metagenomics to assess soil health under various agricultural practices. Additionally, the potential of biocontrol agents is explored, particularly from plant microbiomes, to enhance crop productivity and manage diseases sustainably. This research aims to bridge ecological and socio-economic sustainability in agriculture.

Plant Pathology: Mycology

The Pecan Health Research Group at the UFS, led by Dr Gert Marais, in collaboration with the pecan industry, has been studying pecan diseases and their management since 2017. Ongoing projects that at the UFS include the diversity and distribution of the pecan scab fungus, *Cladosporium cladosporioides*, the benefit of mycorrhizal fungi in pecan orchards, and the cause of overall decline of pecans. For future research, the pecan orchard on the Paradys Experimental Farm outside Bloemfontein is under expansion.

[Photo credit: Dev Fourie]

At the beginning of 2024, Prof Clive Bock at the USDA in the USA visited the UFS, attended the Plant Pathology conference held in Clarens (22 to 24 January 2024), and travelled the pecan scab-stricken areas in South Africa together with representatives of the pecan industry (SAPPA) and the UFS. During the growing season of 2024, all pecan production areas were visited, including the Orange River from Luckhoff to Upington, Vaalharts, Jacobsdal, as well as various other areas in Limpopo, Mpumalanga, Gauteng, Eastern Cape, Western Cape, and KwaZulu-Natal. Famers days were organised during these trips where the newest findings on student projects were shared with pecan producers and interested parties. A book guide (*Fungal diseases of pecans in South Africa*) was published in November 2024, including information on the most prominent diseases, their causative agents, management, and potential use of fungicides.

Plant Pathology: Epidemiology

Dr Lisa Rothmann leads the McLab Field Pathology and Epidemiology Research Group, which focuses on diseases affecting summer grain crops, including dry bean, sorghum, soybean, and sunflower. The group's mission is to inspire and lead impactful research, extension, and outreach initiatives that encourages sustainable disease management in a changing climate, promoting food security and safety, while empowering agricultural communities through our active participation.

Thabiso Masisi's Doctoral study, 'Incidence, management, and producer perceptions of fungal diseases in sorghum cropping systems' (funded by NRF-Thuthuka and the Sorghum Trust), is being conducted in partnership with Dr Lindy Rose (Stellenbosch University). An interdisciplinary component involves the UFS Department of Sociology, examining socio-economic factors influencing sorghum disease management decisions. Nomvula Moloi started her MSc Agric Plant Pathology research project, titled 'Fungal pathogens of grain sorghum and host-pathogen interactions', utilising samples collected during the 2023/2024 survey seasons. These surveys, funded by the Sorghum Trust, will continue in the growing season, covering producers' fields across the Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga, and North West. The team is also undertaking a project on "Seeds of knowledge: exploring fungi associated with uChokwane (tepary bean), a climate-smart landrace', supported by the Central Research Funds and NRF-Thuthuka. Results were presented at the Southern African Society for Plant Pathology in January 2024.

Thabiso Masisi and Nomvula Moloi conducting sorghum pathology tests

Soybean and sunflower cultivar evaluations were conducted in collaboration with the Agricultural Research Council-Grain Crops (ARC-GC). These trials, led by Annelie de Beer and Dr Safiah Ma'ali, were funded by the DSI, Technology Innovation Agency (TIA), the Oil and Protein Seeds Development Trust (OPDT), the Oilseeds Advisory Committee (OAC), and Grain SA. The evaluations focused on assessing cultivar tolerance to *Sclerotinia sclerotiorum*, and will continue during the 2024/2025 season, with contributions from Dr Derick van Staden and Koos Strydom. Research focusing on sclerotinia head rot management was led by Kwanele Sabela (MSc Agric student). This research is supported by the OPDT/OAC. Kwanele Sabela developed and validated a standard area diagram for evaluating sclerotinia head rot, to ensure accurate disease assessments are conducted by various individuals working on sclerotinia, e.g. breeders, agronomists, and agricultural extensionists. Marais Cloete initiated his MSc Agric Plant Pathology research on soybean stem rot during the 2023/2024 growing season, focusing on early disease detection through remote sensing and alternative approaches to disease management.

The project titled 'Identifying and assessing soybean seedborne diseases, towards improving seed health through reducing prevalent fungal pathogens. was completed in 2024, under the leadership of MSc Agric student Neo Hlongwane. This work is supported by Central Research Funds. Research by Michelle Rossi (MSc Agric Plant Pathology), supported by Plantovita and the Dry Bean Organisation, investigates the race identification of *Colletotrichum lindemuthianum* isolated from South African production areas.

Dr Rothmann collaborated with AgriSeed/DMS Genetics in Delmas on soybean and sunflower field trials on the experimental farm, aimed at cultivar and fungicide evaluations.

In collaboration with the University of Stellenbosch, Dr Rothmann is co-supervising Mariana van Deventer's MSc Agric (Plant Pathology) research titled 'Modelling the effect of environmental conditions and inoculum load on the development of sclerotinia stem rot of canola in the Western Cape, led by Dr Diane Mostert (Stellenbosch University), Dr Gert Van Coller and Lizette Nowers (Western Cape Department of Agriculture), and co-funded by OPDT/OAC. The McLab Plant Pathology team spent a week assisting in canola stem rot disease evaluations in the southern Cape during the growing season.

The official Memorandum of Understanding between Grain SA and the UFS Plant Sciences was re-signed for the seventh term. Spearheaded by Dr Rothman, this entails the administration of the South African Sclerotinia Research Network, composed of a community of practice and a research consortium. The Network, which provides a platform for South African researchers, industry, and producers to work together towards a management solution for Sclerotinia diseases in South Africa, has continued their website and social media activities since the launch in September 2019.

ACADEMIC CITIZENSHIP AND COMMUNITY ENGAGEMENT

Dr Lisa Rothmann served on the Organising Committee for the 53rd Congress of the Southern African Society of Plant Pathology (SASPP) hosted by the UFS, held in Clarens in January 2024. As part of this role, she hosted keynote speaker Prof Emerson Del Ponte (Universidade Federal de Viçosa, Brazil), who was sponsored by ZZ2

In February, Dr Rothmann delivered a lecture at the Agricol | Don Mario Intacta RR2 Pro Soybean Launch to an audience of approximately 100 farmers in Reitz, Free State. The McLab research group also participated in the Agronomy Info Services farmer information day held in Delmas, Mpumalanga, in March. At this event, the group presented their ongoing Sclerotinia disease management research conducted at the experimental farm in Delmas to an audience of over 200 farmers. In August, Dr Rothmann co-hosted a #SclerotiniaZA farmer's day in Ganyesa, North West, at which Marais Cloete facilitated discussions on sunflower head rot disease management. Additionally, in September Dr Rothmann was invited by Strauss Seed & Co to deliver an address at a canola farmers' day in Lydenburg, Mpumalanga.

Dr Rothmann completed her tenure as President of the American Phytopathology Society: African Division, which hosted a successful online meeting in September. The theme of the meeting was 'Plant Health Management for Sustainable Food Security and Safety'. She also served as the Master of Ceremonies at the National Grain Research Programme hosted at the UFS in April 2024.

Dr Rothmann has been selected to co-chair the Epidemiology Committee of the International Society for Plant Pathology. She is a member of the Scientific Committee for the Botrytis, Monilinia, and Sclerotinia symposium (International Symposium on Plant Pathogenic Sclerotiniaceae 2025), to be hosted by Aristotle University of Thessaloniki, Greece.

Scientific communication and popular articles produced by the McLab research group are regularly distributed through *SA Grain Magazine*, *Oilseed Focus*

Magazine, and *Pula Imvula Magazine*. Contributors include Dr Rothmann, Kwanele Sabela, Thabiso Masisi, Mariana van der Venter, and Marais Cloete. Topics covered include *Sclerotinia sclerotiorum* spore dispersal mechanisms, detection methods, and plant disease surveillance.

Dr Boke Moloi reviewed manuscripts for Horticulture and Agronomy (Q1) journals and served as an external examiner for the University of Zululand. She is also a co-Guest editor for a special issue in *Plants*, titled 'Navigating the Future of Agriculture: Balancing the Benefits and Challenges of Alternative Plant Nutrition Methods'.

Through the second-year Education module, Dr Moloi participated in a collaborative project between the Department of Zoology, Entomology, and Plant Sciences, sponsored by Leadership for Conservation in Africa. The initiative aimed to introduce conservation principles to non-conservation students. As part of the project, students designed posters, with the top three being donated to schools in Bloemfontein. Additionally, five trees were donated and planted at two schools in the city, further promoting environmental awareness.

Dr Andri van Aardt presented talks on the Pretoria FM programme 'Ek wil weet' in answer to questions from listeners. She was invited to present a talk on 'Goud in Grasvelde' at the Bloemspruit Garden Club. Her research on the firebreaks appeared as an article about the Golden Gate Highlands National Park, which contributed towards a research question of Park Management.

Dr Lize Joubert was elected to the South African National Plant Checklist Committee. The Geo Potts Herbarium (of which Dr Joubert is the curator), provided plant identification services to UFS researchers, students, external companies and members of the public.

Dr Dimitri Veldkornet was part of the NRF Geo & Marine, Marine & Research Review Panel and Thuthuka Research Review Panel (2024-2026).

Prof Sandy Steenhuisen

The Department of Plant Sciences was invited to be part of a community engagement project to establish a library at Kagisano Combined School in the Ikgomotseng community (Soutpan, Free State province) in collaboration with the Library and Information Services (LIS) and the Faculty of the Humanities. Dr Veldkornet and Botany postgraduate students Nomcebo Mngomezulu, Masego Sekhurwane, Mamosela Mohotloane, and Siphelelo Zondo were responsible for creating a garden in front of the library.

Dr Mpho Mafa is a reviewer of nine Quartile 1 and 2 journals with impact factors that range from 9.7 to 3.0. These are *Journal of Chemical Ecology*, *Biomass Conversion and Biorefinery*, *European Food Research and Technology*, *Plant Physiology and Biochemistry*, *Basic and Applied Ecology*, *Agronomy*, *World Journal of Microbiology and Biotechnology*, *Biofuels, Bioproducts & Biorefining*, and *Bioresource Technology*.

Prof Sandy Steenhuisen continued as an Executive Council member and Honorary Treasurer for the Council of the South African Association of Botanists, a Review Board Editor for the *South Journal of Botany*, Associate Editor for the *American Journal of Botany*, and a scientific member of the Free State Wetlands Forum, and the Alien Grass Working Group run by SANBI. She also continued as an external moderator for various South African universities. In addition, Prof Steenhuisen was part of the UFS Qwaqwa organising committee for the Social Innovation Exchange (SIX) Conference.

In conjunction with the Department of Sociology Bloemfontein Campus, Prof Steenhuisen facilitated UFS Qwaqwa Campus' involvement in National e-Waste Day on 14 October 2024. She was interviewed, as a small-mammal pollination biology expert, by a Science and Health reporter from National Public Radio (USA) on her opinion of the recently discovered wolf pollination of red-hot pokers in Ethiopia.

Dr Norman Muzhinji is an active reviewer of articles

submitted to *Plant Disease*, *Phytopathology*, *European Journal of Plant Pathology*, *Plant Pathology*, *Crop Protection*, *GMO Crops and Food*, *Phytopathology Research*, *Journal of Plant Pathology*, and *Journal of Phytopathology*. He continued as a review Editor for *Frontiers in Plant Science* – Plant Pathogen interaction.

Dr Rudo Ngara is guest editor for a Special Issue in *Plants* titled 'Omics' and 'multi-omics' insights into plant responses to abiotic stresses', which runs from 01 July 2024 to 31 May 2025. Dr Ngara is also a Guest Editor for two Research Topics in the journal *Frontiers in Plant Science* – titled 'The plant extracellular matrix; dynamics in composition and function in response to biotic and abiotic stresses' (08 May 2024 to 24 February 2025) and 'The Omics Applications for Pathogen Control and Disease Resistance' (18 November 2024 to 3 June 2025).

Dr Linhle Mohase was a panel member in the African Origins Platform (NRF) applications evaluation meeting on 12 September 2024, and for the United Kingdom Research and Innovation (UKRI) Future Leadership fellowship Round 8 Panel Sift and Interview Meetings.

Prof Maryke Labuschagne is serving as chief editor for *Frontiers in Sustainable Food Systems* and serves on the editorial boards of the *Journal of Cereal Science* and *Cereal Chemistry*.

Prof Adré Minnaar-Ontong is an active reviewer of articles submitted to the *Journal of Fungi*, *Scientific Reports*, *Genetic Resources and Crop Evolution*, *BMC GWAS*, *Agronomy*, and *Discovery Sustainability*. She is a board member of the National Grain Research Programme. Prof Minnaar-Ontong was also an Agriculture ambassador where a Roadshows with Food for Mzanzi to engage with schools on careers in agriculture were held.

Prof Minnaar-Ontong and Dr Chrisna Steyn served on the Organizing Committee of the Crop Research Platform (CRP) focusing on the innovative topic 'Regenerative agriculture', held from 3 to 5 April on the Bloemfontein Campus.

OTHER ACTIVITIES

The Plant Sciences Department at Qwaqwa Campus was granted funding to obtain a new Gas Chromatography-Mass Spectrometer (GCMS) and High-Performance Liquid Chromatography machine (HPLC) in 2024. Following renovations of a glassware storeroom into an analytical laboratory, the new equipment was installed, and training will commence in 2025. The acquisition of this machinery will allow for in-house analysis of volatile and liquid samples and create a potential third-stream income for the department through the analysis of samples for other researchers external to UFS. In addition to these renovations, the NAS faculty renovated a room into a new laboratory for Dr Gokul for his lab group's biotechnological research on plant endophytes.

Delegates at the 2024 National Grain Research Programme Research Day

In April 2024, Prof Steenhuisen, Dr Payne (Postdoctoral Fellow), and Lesogo Malekana (Master's student) took part in the filming of a German documentary, facilitated by the ARU and Laurenz Media, which focused on the Drakensberg Mountains. Their research in the Maloti-Drakensberg was showcased as part of the documentary.

Prof Steenhuisen's Qwaqwa Plant-Animal Interactions Research (QPAIR) Lab group undertook two on-campus writing retreats in 2024. These retreats created a space for students to work on their data, writing and publications, as well as giving them unrestricted access to their supervisors, while creating comradery within the lab group.

POSTGRADUATE STUDENTS

Honours graduates

At the 2024 graduations, nine students graduated with BSc Hons majoring in Botany (four on the Bloemfontein Campus and five on the Qwaqwa Campus), one student graduated with BSc Hons majoring in Plant Pathology, two students graduated with BSc Hons majoring in Plant Breeding and one student graduated with BSc Hons in Agriculture majoring in Plant Breeding.

Master's graduates

Ten students graduated with an MSc:

- Macdonald, SE (Botany, Bloemfontein Campus)
- Mngomezulu, NT (Botany, Bloemfontein Campus)
- Mohotloane, MM (Botany, Bloemfontein Campus)
- Sedimo, G (Botany, Bloemfontein Campus)
- Zondo, SNN (Botany, Bloemfontein Campus)
- Masole, P (Botany, Qwaqwa Campus)
- Henema, NP (Botany, Qwaqwa Campus) – with distinction
- Malekana, LM (Botany, Qwaqwa Campus)
- Kobedi, FK (Plant Breeding) – with distinction
- Clayton, JJ (Plant Pathology)

Six students graduated with an MSc in Agriculture:

- Botha, FJ (Plant Breeding) – with distinction
- Coertzen, RD (Plant Breeding)
- Combrinck, M (Plant Breeding) – with distinction
- Hlatshwayo, KK (Plant Breeding)
- Sefume, LD (Plant Breeding) – with distinction
- Maphobole, LA (Plant Pathology) – with distinction

Doctoral graduates

Three candidates from the Department of Plant Sciences graduated with a PhD in 2024:

Chalachew Endalamaw Engida (Plant Breeding)

Thesis: Genetic diversity in yield traits and kernel composition of selected Ethiopian sorghum landraces

Supervisor: Prof MT Labuschagne

Mandla Victor Hlongwane (Botany, Qwaqwa Campus)

Thesis: Antimicrobial and antimycobacterial properties of *Lotononis lanceolata* and *Senecio harveianus*

Supervisor: Dr P Mojau

Grant Anthony Richardson (Plant Breeding)

Thesis: Understanding genotype by environment by management interactions in the western maize growing region of South Africa

Supervisor: Prof MT Labuschagne

POSTDOCTORAL RESEARCH FELLOWS

The Department of Plant Sciences hosted five Postdoctoral Research Fellows in 2024.

Dr Lee-Ann Niekerk (South Africa), hosted by Dr Gokul, participated in the Next Generation of Emerging Researchers Symposium which was hosted at the Birchwood Hotel from 23 to 25 October 2024. Dr Niekerk was selected to participate in the Global Young Scientists Summit (GYSS) in Singapore in January 2025, at which she will be presenting her research.

Dr Stephanie Payne was hosted by Prof Steenhuisen. In June 2024, Dr Payne, as an expert in southern African mountain flora along with Prof Peter Taylor (Department of Zoology and Entomology, Qwaqwa Campus), was invited to attend the first Global Mountain Biodiversity Assessment (GMBA) Workshop, hosted by the University of Lausanne and University of Bern in Davos, Switzerland, from 11 to 14 June 2024. Dr Payne was able to establish connections with high-calibre mountain researchers from across the globe and, arising from the workshop, is one of the leading authors (along with Dr Clara Pissolito [CIEFAP, Argentina] and Dr Davnah Urbach [GMBA, University of Bern, Switzerland]) on a high-impact publication on collecting and prioritising questions in mountain biodiversity research. Dr Payne's contribution to the global assessment is ongoing as the assessment progresses, and she is involved in the special session to be hosted by the GMBA at SAMC2025.

Dr Stephanie Payne and Prof Peter Taylor in Davos, Switzerland

Dr Payne co-taught BIOL6834: Advanced Biostatistics in 2024 and co-supervised four MSc students (one graduated in April 2024) and one Doctoral candidate in the Department of Plant Sciences. She leads the South African component of the pollination and camera trap aspect of the internationally collaborative RangeX project in affiliation with the ARU. She took part in a Policy and Practice Workshop, hosted by the ARU at the 59th Annual Congress of the Grassland Society of Southern Africa on the 26th of August 2024, where the results from the RangeX project were presented to various stakeholders. Dr Payne is part of the local organising committee for the 2nd Southern African Mountain Conference (SAMC2025) to be held in March 2025.

Three Postdoctoral Research Fellows, Isaac Amegbor (Ghana), Tesfaye Mekonnen (Ethiopia), and Neila Abdi (Tunisia) worked in collaboration with Prof Labuschagne in Plant Breeding during 2024.

STAFF MATTERS

Prof Botma Visser

Willem Boshoff and Botma Visser were both promoted from associate professor to full professors. Rudo Ngara, at the Qwaqwa Campus, was promoted to associate professor.

Two new appointments were made in the Department during 2024. Dr Chrisna Steyn was appointed as Lecturer and Diana Mngomezulu as professional officer in Plant Breeding.

RESEARCH OUTPUTS

Research Articles

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Gwanya, H., Mohase, L. & Mafa, M. 2024. *Bioprospecting glycoside hydrolase influencing RWASA2 and RWASA5 virulence during wheat-aphid interaction.* Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Gwate, O., Payne, S., Steenhuisen, S.L, Martin, G.D., & Clark, V.R. 2024. *Exploring mechanisms underlying the success of range expanding plants in Maloti-Drakensberg Mountains.* Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Hlahla, J.M., Mafa, M.S., Van der Merwe, R. & Moloi, M.J. 2024. *Synergistic effects of drought and heat stress on the photosynthetic efficiency and osmolytes accumulation in edamame.* Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Hlahla, J.M., Mafa, M.S., Van der Merwe, R. & Moloi, M.J. 2024. *The enzymatic and non-enzymatic antioxidant systems and cell wall modification enhanced edamame tolerance during combined drought and heat stress.* Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Hlahla, J.M., Mafa, M.S., Van der Merwe, R. & Moloi M.J. 2024. *The enzymatic and non-enzymatic antioxidant systems and cell wall modification enhanced edamame tolerance during combined drought and heat stress.* Paper delivered at the 11th International Plant Protection Symposium at University of Debrecen, Hungary (online session). 15 October 2024.

Hlakotsa, N.M.M.S. & Ngara, R. 2024. *Identification of drought-responsive small RNAs in sorghum roots.* Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Hlakotsa, N.M.M.S. & Ngara, R. 2024. *Physiological and small RNA responses of sorghum seedlings under mild drought stress.* Paper delivered at the Qwaqwa Campus Research Conference. Science, Social Innovation and the Future of Local Societies: Keeping Pace in a Changing Knowledge and Political Landscape, Clarens, South Africa. 9-10 October 2024.

Labuschagne, M.T. 2024. *Crop biofortification for iron content in African food security crops: current status, progress and prospects.* Keynote address delivered at the 21st International Symposium on Iron Nutrition and Interactions in Plants (ISINIP), Düsseldorf, Germany. 8-11 July 2024.

Labuschagne, M.T., Reveglia, P., Cobos, M.J. & Rubiales, D. 2024. *Metabolomics as a tool in plant breeding: Pisum sativum as a case study.* Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Lichakane, M., Labuschagne, M., Van Der Merwe, R. & Zhou, M. 2024. *The effect of photoperiod treatments on time to genotype flowering and implications for sugarcane breeding in South Africa.* Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Lichakane, M., Zhou, M., Labuschagne, M.T. & Van der Merwe, R. 2024. *The effect of photoperiod treatments on time to genotype flowering and implications for sugarcane breeding in South Africa.* Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA), Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Mafa, M.S. & Mohotloane, M.M. 2024. *Elucidating holocellulolytic enzymes of commercial secretome sourced from Aspergillus Niger and its saccharification of alkaline-pretreated mango seed husk.* Paper delivered at the 20th International Conference on Polysaccharides-Glycoscience, Novotného lávka 5, Prague, Czech Republic. 13-15 November 2024.

Malekana, L., Clark, V.R., Steenhuisen, S. Martin, G.D. & Alexander, J. 2024. *Impact of invasive Rosaceae on plant diversity along elevation gradients in the Maloti-Drakensberg.* Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Marais, G.J. 2024. *Types of fungal diseases in pecans.* Paper delivered at the Annual General Meeting of the South African Pecan Nut Producer's Association NPC, Douglas, South Africa. 1 November 2024.

Martin, G.D., Canavan, K., Chikowore, G. & Hill, M. 2024. *Biological Control for* Pinus pinaster *seeds in the Cape Floristic Region.* Paper delivered at the Forestry Science Symposium, Hilton, KwaZulu Natal, South Africa. 26-27 November 2024.

Martin, G.D. & Clark, V.R. 2024. *Legal aspects around listing of and management of indigenous bush encroaching species in southern Africa.* Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Martin, G.D., Mashamba, T., Steenhuisen, S. & Payne, S. 2024. *Beauty and the Beast: A story of* Salix *species in South Africa's grassland biome.* Paper delivered at the National Symposium on Biological Invasions, Sol Plaatje University, Kimberley, South Africa. 9-12 September 2024.

Martin, G.D., Philip, I. & Chikowore, G. 2024. *Resolving conflict situations when using biological control against economically-useful invasive tree species.* Paper delivered at the 3rd International Congress of Biological Control (ICBC3), San José, Costa Rica. 24-27 June 2024.

Martin, G.D., Steenhuisen, S.L., Moloi, K.T., Adams, L.D., Payne, S., Gwate, O., Masole, P., Malekana, L., Downs, C. & Clark V.R. 2024. *Invasive temperate Rosaceae in southern African mountains and highlands.* Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Masisi. T.V, Jackson. M., Rose, L.J., Sabela, K.S. & Rothmann, L.A. 2024. *National grain sorghum disease surveillance: Detecting fungi threatening production and livelihoods.* Paper delivered

at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Masisi, T.V., Sabela, K.S. & Rothmann, L.A. 2024. *Sorghum disease surveillance to understand South African producer perceptions and inform disease management and industry needs*. Paper delivered at the 13th International Epidemiology Workshop, Foz do Iguaçu, Brazil. 9-12 April 2024.

Matjeke, B.M., Gerrano, A.S., Labuschagne, M., Minnaar-Ontong, A., Truter, M. & Mbuma, N.W. 2024. *Combining ability and heritability of cowpea (*Vigna unguiculata L. Walp*) for yield and yield components*. Paper delivered at the Combined Congress, George, South Africa. 22-25 January 2024.

Mbele, T., Steenhuisen, S. & Canavan, K. 2024. *Invasive status of pampas grass in South Africa*. Paper delivered at the Centre for Biological Control Research Day, Rhodes University, Makhanda, South Africa. 28 November 2024.

Mbele, T., Steenhuisen, S. & Canavan, K. 2024. *Invasive status of pampas grass in South Africa*. Paper delivered at the National Symposium on Biological Invasions, Sol Plaatje University, Kimberley, South Africa, 9-12 September 2024. (Best Student Presentation Award for Miss Mbele).

Mbele, T., Steenhuisen, S. & Canavan, K. 2024. *Seed germination of naturalized and floristically traded* Cortaderia *species in South Africa*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Mekonnen, T.W., Matongera, N., Van Biljon, A. & Labuschagne, M.T. 2024. *Breeding of high iron and zinc and grain yield under abiotic stress conditions, supporting enhanced maize biofortification*. Paper delivered at the Applied Genetics Conference, Washington DC, USA. 6-10 March 2024.

Minnaar, J.J., Steenhuisen, S. & Cron, G.V. 2024. *Pollinators drive floral diversification and speciation in* Galtonia *(Hyacinthaceae): a Drakensberg near-endemic genus*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Mohotloane, M.M., Alexander, O., Adoons, V.N., Pletschke, B.I. & Mafa, M.S. 2024. *Peroxidase application reduces microcrystalline cellulose recalcitrance towards cellulase hydrolysis in model cellulose substrates and rooibos biomass*. Paper delivered at the 20th International Conference on Polysaccharides-Glycoscience, Novotného lávka 5, Prague, Czech Republic. 13-15 November 2024.

Moloi, M.J. & Hafeez, A. 2024. *Effects of increasing temperature on the photosynthesis efficiency, biochemical and yield responses of edamame cultivars*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Muzhinji, N. & Ntuli, V. 2024.*Soil microbial Profile as a bioindicator of soil health, biodiversity, functionality, and disease risk*. Paper delivered at the 32nd Soilborne Plant Diseases Interest Group of South Africa (SBPDG-SA), ARC-PHP Vredenburg, Stellenbosch, South Africa. 22-24 October 2024.

Nekundi, J. & Mafa, M.S. 2024. *Osmotic stress induced with sorbitol: a tool for selecting drought tolerant wheat cultivars at seed germination and seedling stages*. Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Ntswane, M., Labuschagne, M., Shandu S.F., Rantso, P. & Mbuma, N.W., 2024. *Phenotypic diversity among cowpea mutants and accessions for grain yield and yield components*. Paper delivered at the Combined Congress, George, South Africa. 22-25 January 2024.

Payne, S., Alison, J., Høye, T. & Steenhuisen, S. 2024 *Pollination interactions and wildlife camera by-catch across elevations in the northern Maloti-Drakensberg*. Paper delivered at the Policy and Practice Workshop: Woody range-expanding species in southern African mountains: Trends, predictions and Mitigations at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Ramovha, D., Bender, C.M., Boshoff, W.H.P. & Visser, B. 2024. *A study of* Puccinia coronata *isolates from oat and* Phalaris aquatica *in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Rothmann, L.A. 2024. *Syllabus redesign: A quest to conquer a 'wee beastie' in plant health education*. Paper delivered at the American Phytopathological Society Plant Health Conference, Memphis, Tennessee, USA. 27-30 July 2024.

Shamuyarira, K.W., Labuschagne, M., Shimelis H., Botha, E. & Fourie, P. 2024. *Pre-breeding and breeding capacity of sorghum within South Africa*. Paper delivered at the European Association for Research on Plant Breeding (EUCARPIA) Conference, Leipzig, Germany. 18-23 August 2024.

Shamuyarira, K.W., Labuschagne, M., Shimelis, H., Botha, E. & Fourie, P. 2024. *Pre-breeding and breeding capacity of sorghum within South Africa*. Paper delivered at the South African Plant Breeders Association (SAPBA) Conference, Bloemfontein, South Africa. 11-13 March 2024.

Sithole, J.V., Dayaram, A. & Van Aardt, A.C. 2024. *Influence of Aspect on the Drakensberg Amathole-Afromontane Fynbos (Gd6) vegetation composition, Golden Gate Highlands National Park*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Sithole, Z., Moloi, K.T., Steenhuisen, S. & Martin, G.D. 2024. *Role of mammals in the seed dispersal of the invasive plant species,* Rosa rubiginosa*, in the Free State rangelands*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Sondela, L.C., Gokul, A. & Moloi, M.J. 2024. *Influence of Pseudomonas spp endophytes on the physiological and biochemical responses of drought-stressed edamame* (Glycine max (L.). Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Spanner, R.E., Henningsen, E.C., Li, F., Matny, O., Hodson, D., Virzì, N., Nguyen, K.-P., Moscou, M., Pretorius, Z.A., Boshoff, W.H.P., Sperschneider, J., Dodds, P., Steffenson, B. & Figueroa, M. 2024. *Understanding the role of somatic hybridisation in global wheat stem rust epidemics through the development of haplotype-phased reference genome assemblies*. Paper delivered at the Fungal Genetics Conference, Pacific Grove, California, USA. 12-17 March 2024.

Steenhuisen, S.L., Martin, G.D., Moloi, K.T., Adams, L.D., Payne, S., Gwate, O., Masole, P., Malekana, L., Downs, C. & Clark V.R. 2024. *When roses go rogue: Expanding ranges of invasive Rosaceae in South Africa*. Paper delivered at the 20th International Botanical Congress (IBC), Madrid, Spain. 21-27 July 2024.

Terefe, T.G., Boshoff, W.H.P., Park, R.F., Pretorius, Z.A. & Visser, B. 2024. *Virulence diversity of Puccinia graminis f. sp. tritici on wheat and triticale in South Africa*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Terefe, T.G., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Virulence diversity of* Puccinia triticina *in South Africa and the response of wheat cultivars and breeding lines to new races*. Paper delivered at the 20th International Plant Protection Congress, Athens, Greece. 1-5 July 2024.

Terefe, T.G., Visser, B., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Variation in* Puccinia graminis f. sp. tritici *and* P. triticina *on wheat in South Africa and reaction of commercial cultivars and breeding lines to recently identified races*. Paper delivered at the ARC-DALRRD Conference, ARC-VIMP, Roodeplaat, Pretoria, South-Africa. 12-14 February 2024.

Tsotetsi, M.E., Boshoff, W.H.P. & Visser, B. 2024. *Sequence analysis of the AvrSr35 and AvrSr50 avirulence genes in South African* Puccinia graminis f. sp. tritici *isolates*. Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Van Aardt, A.C., De Jager, J.C.L. & Van Tol, J.J. 2024. *Effect of annual burning on diversity and vegetation composition of Golden Gate Highlands National Park*. Paper delivered at the 59th Annual Congress of the Grassland Society of Southern Africa, Gariep Forever Resort, Gariep Dam, South Africa. 22-26 July 2024.

Van Aardt, A.C., Scott, L., Grundling, P.-L, Grundling, A. & Woodborne, S. 2024. *Late-Holocene paleoenvironmental reconstruction of the Savanna-Grassland ecotone, Gauteng, South Africa*. Paper delivered at the XXIV SASQUA Conference, Cango Valley, South Africa. 19-24 May 2024.

Van der Merwe, R., Coetzee, E. & Moloi, M.J. 2024. *Combining ability of drought tolerance-related traits in vegetable-type soybean*. Paper delivered 15th Southern African Plant Breeding Symposium (SAPBA). Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Visser, B., Terefe, T.G., Bender, C.M., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Wheat rust surveillance in South Africa: past, present and future*. Paper delivered at the Annual post-graduate symposium of the Department of Botany and Plant Biotechnology at University of Johannesburg, South Africa. 21 October 2024.

Weaver, K., Hill, M.P., Martin, G.D., English, K., Ngxande-Koza, S., Ivey, P., Paterson, I. & Coetzee J. 2024. *Promoting biological control leads to improved implementation and long-term sustainability*. Paper delivered at the 3rd International Congress of Biological Control (ICBC3) in San José, Costa Rica. 24-27 June 2024.

Zondo, S.N.N., Mohase, L., Tolmay, V., & Mafa, M.S. 2024. *Functional characterisation of β-1,3-glucanase regulating callose accumulation upon wheat infestation by Diuraphis noxia*. Paper delivered at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Conference Posters

Adams L, Martin G.D. Downs C, & Steenhuisen S. 2024. *The role of mammals in seed dispersal of fleshy-fruited invasive alien plants in the Grassland Biome of South Africa*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Delport, B., Marais, G.J., Castillo-Hernandez, J., McCarlie, S. & Bragg, R. 2024. *Metagenomic evaluation of the bacterial diversity in overall decline pecan trees*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Edwards, G., Swart, V. & Marais, G.J. 2024. *Ecological aspects of soil-dwelling arthropods in pecan orchards*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Engida, C., Van Biljon, A., Herselman, L., Nida, H. & Labuschagne, M.T. 2024. *Ethiopian sorghum landraces as a possible genetic diversity resource for breeding*. Poster presented at the 15th Southern African Plant Breeding Symposium, Bloemfontein, South Africa. 11-13 March 2024.

Gqola, B.N., Mebalo, J., Boshoff, W.H.P. & Terefe, T.G. 2024. *Virulence diversity of* Puccinia triticina *collected from wheat and triticale in South Africa from 2021 to 2022*. Poster presented at the Combined Crops, Soils, Horticulture and Weeds Congress, Wilderness Hotel, George, South Africa. 22-25 January 2024.

Hlatshwayo, K., Maré, A., Minnaar-Ontong, A., Zhang, Q. & Van der Merwe, R. 2024. *Family selection for pod-shattering resistance and seed yield of vegetable-type soybean*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Kruger, W., Achilonu, C.C. & Marais, G.J. 2024. *Post-harvest pathogens associated with pecan nuts in South Africa*. Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Lichakane, M., Zhou, M., Labuschagne, M.T. & Van der Merwe, R. 2024. *The effect of photoperiod treatments on time to genotype flowering and implications for sugarcane breeding in South Africa*. Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Malekana, L., Clark, V.R., Steenhuisen, S., Martin, G.D. & Alexander, J. 2024. *Impact and Management of Range Expanding Rosaceae Species Along Elevational Gradients in the Maloti Drakensberg*. Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of

Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Maphobole, L.A., Visser, B., Meyer, W.B., Pretorius, Z.A. & Boshoff, W.H.P. 2024. *Pathogenicity and microsatellite analysis of* Puccinia sorghi *isolates in South Africa.* Paper delivered at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Masisi, T.V., Sabela, K.S., Rose, L., Jackson, M., Matebesi, S., Pelser, A., & Rothmann, L.A. 2024. *A first look at farmer perceptions of sorghum production, disease constraints and future outlooks.* Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Matjeke, B.M., Gerrano, A.S., Labuschagne, M., Minnaar-Ontong, A. & Mbuma, N.W. 2024. *Diallel analysis and heritability of cowpea for nutritional characteristics.* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Matjeke, B.M., Gerrano, A.S., Labuschagne, M., Minnaar-Ontong, A., Truter M. & Mbuma, N.W. 2024. *Combining ability and heritability of cowpea (*Vigna unguiculata *L. Walp) for yield and yield components*. Poster presented at the Combined Congress, George, South Africa. 22-25 January 2024.

Mbuma, N.W., Steyn, P.J., Laurie, S.M., Labuschagne, M.T. & Bairu, M.W. 2024. *Phenotypic diversity of the South African-bred potato varieties for tuber yield and processing quality*. Poster presented at the Combined Congress, George, South Africa. 22-25 January 2024.

Mekonnen, T.W., Gerrano, A.S., Van Biljon, A. & Labuschagne, M.T. 2024. *Application of artificial intelligence (AI) in crop breeding, with a focus on teff, grass pea and cowpea.* Poster presented at the 15th Southern African Plant Breeding, (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024

Mishasha, T., Zhou, M., Van der Merwe, R. & Labuschagne, M. 2024. *Genetic correlations among cane quality traits and implications on sugarcane breeding.* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Moloi, KT., Martin, G.D., & Steenhuisen, S. 2024. *Seed dispersal and germination* of Cotoneaster pannosus *on Afromontane grasslands of eastern Free State, South Africa.* Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Moloi, N., Masisi, T.V., Achilonu, C.C., Sabela, K.S. & Rothmann, L.A. 2024. *Occurrence and identification of fungi associated with sorghum grain from contrasting production systems.* Poster presented at the 53rd Congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Motshegwa, G. & Moloi, M.J. 2024. *Frequency matters: The impact of multiple selenium foliar applications on the physio-biochemical responses of drought-stressed edamame.* Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Muzhinji, N. & Nghalipo, N. 2024. *Decoding the soil microbiome to enhance Pearl Millet growth and drought resilience under varying soil amendments***.** Poster presented at the International Society of Microbial Ecology (ISME), Cape Town Convention Centre, Port Elizabeth, South Africa. 18-23 August 2014

Ngara, R. & Steenhuisen, S-L. 2024. *Work Integrated Learning.* Poster presented at the Annual UFS Learning and teaching Conference: Enhancing the Quality of Blended Learning and Teaching within the UFS Context, University of the Free State, Bloemfontein, South Africa. 16-10 September 2024.

Niekerk, L-A., Gokul, A., Keyster, M. & Klein, A. 2024. *An Omics view of the alleviation of iron deficiency in common beans through the application of indole-3carboxyaldehyde.* Poster presented at the Next Generation of Emerging Researchers Symposium hosted by the National Research Foundation (NRF), Birchwood Hotel, Johannesburg, South Africa. 23-25 October 2024.

Ntjabane, N.A., Boshoff, W., Visser, B. & Mafa, M.S. 2024. *Unravelling functions of the modified cell wall in Thatcher and ThatcherLr9 wheat infected by* Puccinia triticina. Poster presented at 49th South African Association of Botany (SAAB) Annual Conference, University of Zululand, Richards Bay campus, South Africa. 7-11 January 2024.

Ntswane, M., Labuschagne, M.T., Shandu, S.F., Rantso, P. & Mbuma, N.W. 2024. *Variation in seed protein, selected minerals, phytic acid and potential mineral bioavailability of cowpea [*Vigna unguiculata (L.) Walp*] mutants and accessions.* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein. 11-13 March 2024.

Nxumalo, P.D., Labuschagne, M., Van Der Merwe, R. & Zhou, M. 2024. *Quantifying the contribution of fibre content to indirect breeding for* Eldana saccharina *(Lepidoptera: Pyralidae) stalk borer resistance in sugarcane.* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein. 11-13 March 2024.

Payne, S., Steenhuisen, S., Moloi, K., Masole, P., Carvalho, G., Sithole, Z., Chikowore, G., Westwood, T., Rahlao, M., Chatanga, P., Seleteng-Kose, L. & Martin, G.D. 2024. *Review of the invasive, yet economically beneficial,* Rosa rubiginosa *L. (Rosaceae) within southern Africa.* Poster presented at the 49th Annual Conference of the South African Association of Botanists (SAAB), University of Zululand, Richard's Bay, South Africa. 7-11 January 2024.

Rothmann, L.A., Del Ponte, E.M., Boshoff, W.H.P. & Pretorius, Z.A. 2024. *Plant rust research in South Africa: "A picture is worth a thousand words."* Poster presented at the American Phytopathological Society - Plant Health Conference, Memphis, Tennessee, USA. 27-30 July 2024.

Sabela, K.S., Masisi, T.V., Van der Walt, P.J. & Rothmann, L.A. 2024. *Seeds of knowledge: exploring fungi associated with uChokwane (tepary bean), a climate-smart landrace.* Poster presented at the 53rd congress of the Southern African Society for Plant Pathologists (SASSP), Golden Gate Highlands Hotel, Golden Gate, South Africa. 22-25 January 2024.

Sivhada, R.A., Van Biljon, A. & Labuschagne, M.T. 2024. *Going back to the wild for better bread.* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Tenesi, T., Jumbo, M., Jaba, J. & Labuschagne, M.T. 2024. *Genetic resistance to fall armyworm in sorghum.* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Valombola, J.S., Labuschagne, M.T., Van Biljon, A. & Horn, L. 2024. *Radio sensitivity test of gamma-irradiated Bambara groundnut for lethal dose (LD_{50}) and growth reduction (GR_{50}).* Poster presented at the 15th Southern African Plant Breeders' Association (SAPBA) Symposium, Monte Bello Estate, Bloemfontein, South Africa. 11-13 March 2024.

Research Reports

Boshoff, W.H.P. 2024. *Evaluation of wheat cultivars and lines for genetic resistance to rust diseases.* Report delivered to the South African Winter Cereal Industry Trust, Pretoria, South Africa.

Boshoff, W.H.P. 2024. *Explore new rust resistance sources in wheat.* Report delivered to the South African Winter Cereal Industry Trust, Pretoria, South Africa.

Figlan, S., Chaplot, V., Shimelis, H., Shamuyarira, K.W., Ngidi, A. & Mutanda, M. 2024. *Water use efficiency and soil carbon sequestration of selected indigenous and modern crop cultivars for sustainable agriculture intensification and climate change mitigation.* Report delivered to Water Research Council (WRC). ISBN 978-0-6392-0603-5.

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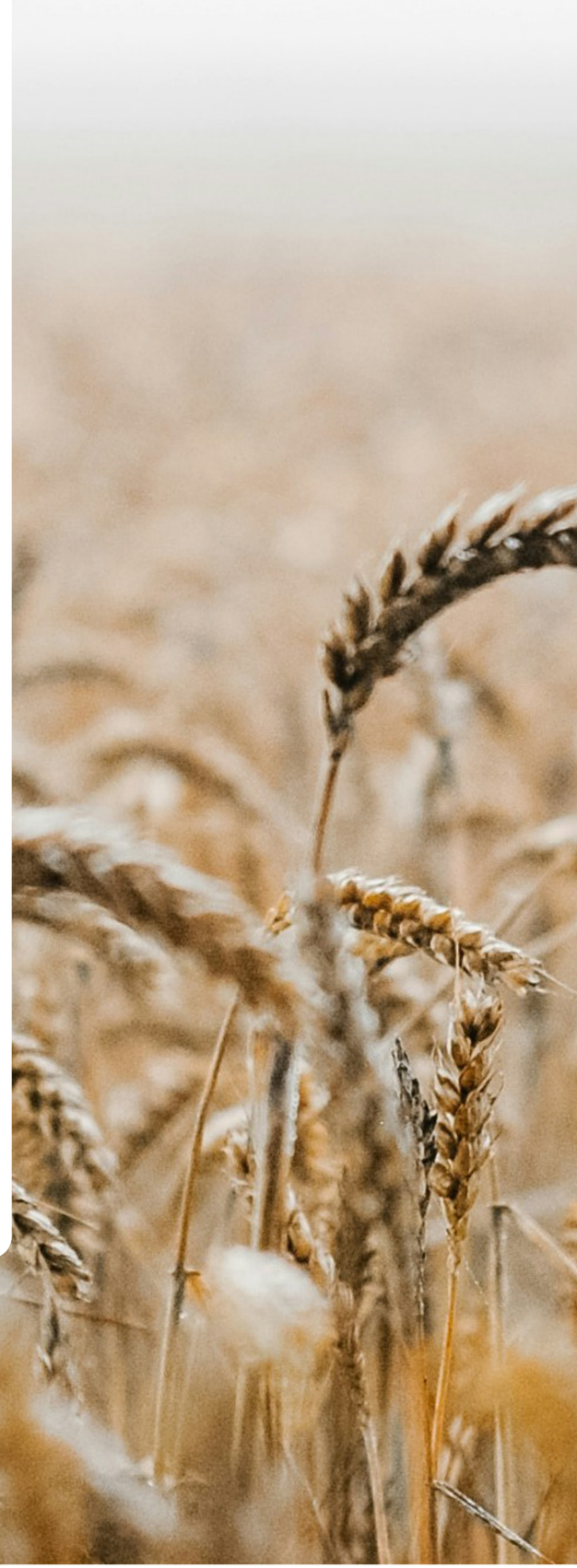

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