AGRI PROBE

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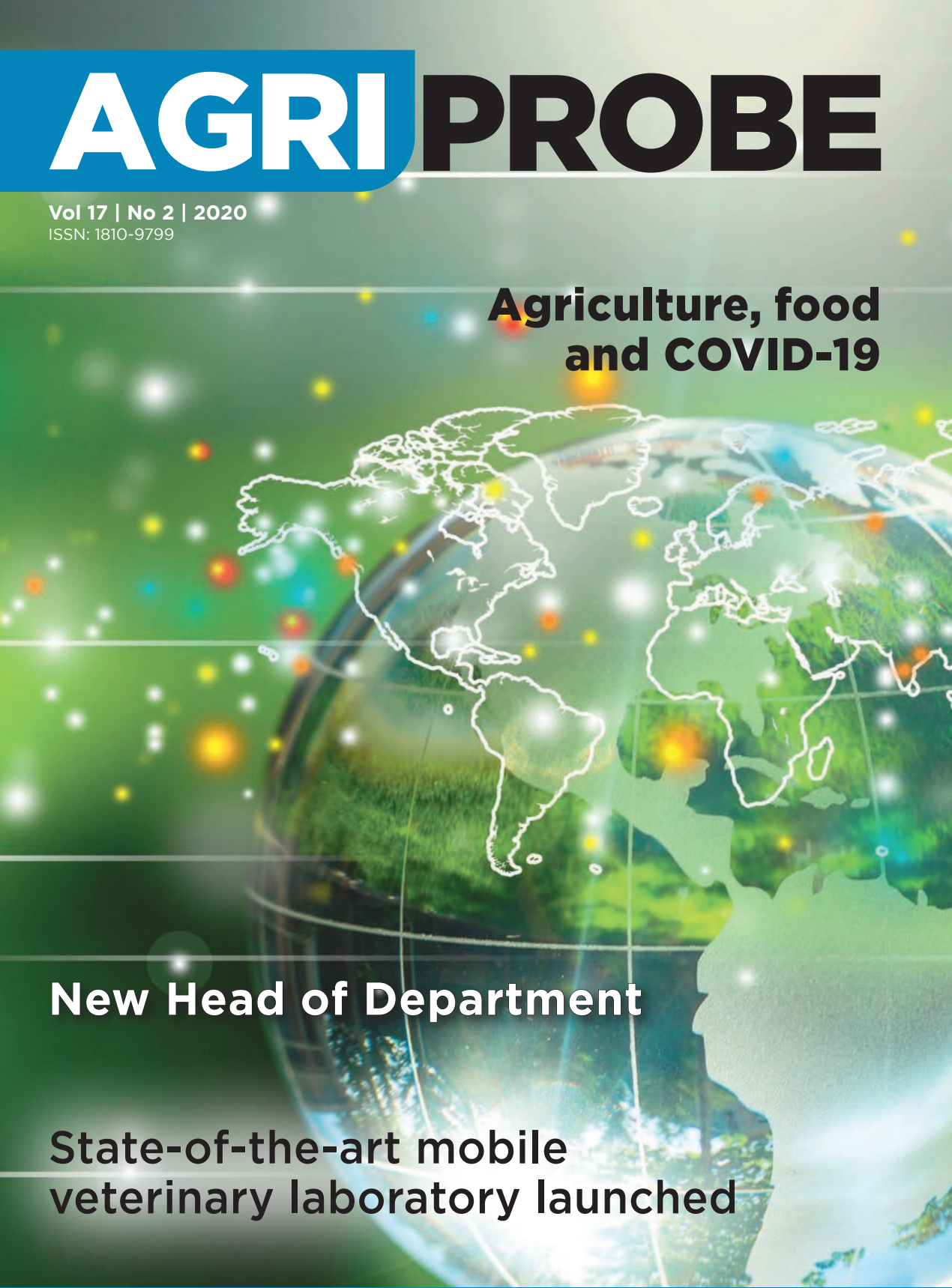
Agriculture, food and COVID-19



New Head of Department

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Research and news magazine of the Western Cape Department of Agriculture

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AGRI'S GOT TALENT IS COMING TO YOU!

Setting the SCENE

by Dr Mogale Sebopetsa

"The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands in times of challenge and controversy." – Martin Luther King Jnr

Greetings to all our *AgriProbe* readers!
What an interesting couple of months it has been since the start of my term in office as head of department. One thing is for sure, there has never been a dull moment in agriculture.

COVID-19 has caused a lot of disturbance in our way of life and we had to adapt and adopt a new "normal" in an effort to flatten the curve and curb the spread of this pandemic. We are compelled to follow certain precautionary measures, such as keeping social distance and having very little to no physical contact – practices that are foreign to us as humans.

Just a couple of weeks ago, we were comfortable living in silos as individuals, organisations, provinces, and countries. Suddenly we are all faced with the same problem, a common enemy that does not care who you are or where you come from. Therefore, the greatest lesson would be that we are all connected integrally as one, no matter how we would want to separate ourselves from one another. Each one of our decisions impacts humankind as a whole and that is what makes these times truly ironic and extraordinary: being physically apart but socially together.

It might be a good time to stop, reset, and reflect on how we approach our day-to-day living. We must ask ourselves if we can really afford to be worlds apart when it comes to global debates on climate- and environment-related challenges. How much are we doing to ensure the sustainable management of our natural resources?

We need to think differently and creatively on how to solve some of our current problems. The radio series *Die Kwik Styg* was one such an example. As the first ever radio series in South Africa focusing specifically on climate change, it is certainly a feather in our cap. Now that we are bidding farewell to this grand vehicle, let's strive to find new and exciting ways to make a difference and have an impact.

That said, it makes it even more important to invest in our youth. They are the custodians of our work going forward, the driving force in making sure we live on a food-secure and prosperous planet. The department has been engaging with the youth on many platforms and it is gratifying to see them claiming their space in research and technology in agriculture.

Making agriculture sexy and accessible has always been our goal as a department. It is very exciting to see the new courses and booklets that allow for this much-needed targeted intervention, as the youth remains essential for us to continue to change the landscape of agriculture.

These are tough times but there is certainly much to look forward to! Let us strive on!

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ON OUR COVER

"Oh, crystal ball, what does the future of agriculture have in store?"

One could easily mistake the globe on the cover for a crystal ball and wouldn't it be great to be able to see what the future holds, especially during these uncertain times? That said, the planet has been giving us "subtle" nudges that we need to live differently. Be it climate change or even the current pandemic, Covid-19, now might be the perfect time for a change in narrative and to reflect on how we can live differently for a more sustainable future.

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AgriConnect
Your communications partner in the agricultural industry

PUBLISHING TEAM

Project leader: Henk Odendaal
Manager: Leza Putter
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Copy editor: Michele van Loggerenberg

A LEADER IS A DEALER IN HOPE

by Minister Ivan Meyer

Keep washing hands, keep sanitising, keep social distancing, keep staying at home, and keep wearing a mask when you venture outdoors.

These golden rules have become my mantra since the implementation of the COVID-19 national lockdown. This new norm impacts me daily. I have developed a new appreciation for fundamental human rights, such as the freedom of movement, which one can easily take for granted.

It has also meant working from home and quickly adapting to the world of technology. Video calls, teleconferencing and virtual meetings have become part and parcel of my daily life. I have also developed a greater appreciation for social media platforms such as Facebook, Instagram and Twitter as effective channels to share information regarding the pandemic. Producing and editing of media clips and content for media platforms such as radio, Twitter and WhatsApp between the many virtual meetings have not only become par for the course, but also an opportunity to develop a new set of skills.

Napoleon Bonaparte once said, "A leader is a dealer in hope". I attempt to do so daily. Media statements, interviews, and virtual interactions with our key stakeholders deal with the issues at hand and build resilience. These interactions provide encouragement, motivation and the vision of a world without the invisible enemy we have come to know as COVID-19.

Others have also inspired me. Media statements I have issued over the past six weeks have left me with a deep sense of pride to be associated with the agricultural sector. The range of issues and opportunities included among others the establishment of the Tissue Culture Facility of the deciduous fruit industry, sustainable resource management, the export of agricultural products like wine, the contribution of producers and agri-workers in securing food and nutritional security, virtual learning and teaching at Elsenburg Agricultural Training Institute, the provision of cloth masks and hand sanitiser to agri-workers, and the adherence to health and safety regulations in the sector. Each of these offered a glimpse into the critical work the Western Cape Department of Agriculture is doing.

I am encouraged by the generosity of corporates such as Distell that has repurposed one of its plants to produce 100 000 litres of hand sanitiser for distribution to vulnerable communities. This example of good corporate citizenship was also recently reflected in the actions of emerging deciduous producers who donated 10 000 fruit parcels to the Gift of the Givers for further distribution. Contributions from the likes of Agri Western Cape and AFASA reassure me that there is much goodwill in the sector and that we will beat the humanitarian crisis brought

about by the COVID-19 pandemic.

Lockdown, however, has not only been all work and no play. I have also seized the opportunity to play in the kitchen and the garden. My cooking and baking skills are coming along very nicely. I am also becoming quite skilful at cleaning the swimming pool and being the family gardener and chief maintenance man.

I have also used the opportunity to explore my creative side. I urge you to read the prayer I wrote for farmers and agri-workers during one of my creative moments. Farmers and agri-workers continue to work our fields and produce food to feed our nation. They deserve our gratitude and continued support.

MY GEBED VIR BOERE, LANDBOUERS EN AGRI-WERKERS

Dr Ivan Meyer, Wes-Kaapse Minister van Landbou, April 2020

Liewe Heer,
ons is in afsondering,
maar nogtans weet ons, U het opgestaan om ons vry te maak.
Vry van ons bekommernisse, siektes en ons pyn.

Dankie Here vir ons boere en landbou-werkers wat
ons elke dag van kos voorsien om te eet.
Dankie Here dat u hulle elke dag die nodige krag en wysheid
skenk om die grond te bewerk.

Dankie Here dat u ons elke dag in geloof vervul.
Deur u genade en krag, voorsien ons boere ons daagliks
van die nodige voedsel.
Here beskerm asseblief ons boere, landbou-werkers en
almal wat deel uitmaak van die voedselwaardeketting.

Dankie Heer, vir U deernis met en beskerming van, ons boere en landbou-werkers.
Boere en landbou-werkers is mans en vrouens, wat leef in geloof.
Dankie Heer, dat u ons geloof in U versterk het,
deur die opstanding van Jesus Christus.

Ons loof en dank U Heer, vir al Suid-Afrika se boere
en landbou-werkers, nou en tot in alle ewigheid. Amen.

Keep washing hands, keep sanitising, keep social distancing, keep staying at home and keep wearing a mask when you venture outdoors.

#ForTheLoveOfAgriculture AP

One-on-one with the new Head of Department

Dr Mogale Sebopetsa

THE HORIZON LOOKS GREEN!

by Mary James, maryj@elsenburg.com

Q&A

• Tell us about your academic background and why education is important to you.

"We cannot solve today's problems with the same level of thinking that created them." – Albert Einstein

I am a firm believer in this quote and many may have heard me using it before, and I live by it. I hold a PhD in public administration and education remains an essential element in my life. It is important that everybody embrace the notion of continuous learning and development, not just for themselves but as a selfless act to society. If we are able to broaden our scope through education, we are able to adopt various angles in how we approach and solve ever-changing problems.

• Tell us about your work background and your path to becoming head of the department.

I started my career at the University of Limpopo, where I lectured for a year (1999).

I had a stint at the Gauteng Department of Agriculture from December 1999, where I served farmers as an agricultural development officer (extension officer) for the West Rand region.

In 2003, I was promoted to the position of agricultural development control technician, where my job entailed ensuring the delivery of quality extension services across the province. I was also responsible for the implementation of the farmer-to-extension approach, which is still relevant today. In 2005, I joined the then National Department of Agriculture (NDA) as a deputy director responsible for project implementation and support, and I had the opportunity to serve in the Secretariat Office for the Comprehensive Agricultural Support Programme (CASP).

I took on a new challenge in 2006 as I relocated to the Western Cape for my new role as Director: Food Security at the Western Cape Department of Agriculture. This was something very special to me as I was able to implement much of what I had learnt back in 1999 as a young extension officer to improve the lives of many people. My reach for making an impact just expanded and this drove me to deliver. In 2012, my hard work paid off when I was appointed as Acting Chief Director: Farmer Support and Development. My permanent position as chief director was subsequently confirmed.

During my 20 years of service I lectured, worked with researchers, and was even involved in land reform and transformation in the agricultural sector. I have cut my teeth at the coalface of agriculture, under the

leadership of one of the giants in the sector, Mr Mortimer Mannya, who is my mentor to this day.

In the words of Martin Luther King, "Not everybody can be famous, but everybody can be great, because greatness is determined by service". I have used every role given to me as an opportunity to serve and this is what I will continue to do in my capacity as HOD.

• By taking up the position in the midst of the COVID-19 pandemic you were thrown in at the deep end. How did you deal with it?

There couldn't have been a better time to take the reins of the department than now. As they say, there is always a silver lining to every dark cloud, and COVID-19 presented an opportunity to take up the job with speed. Urgent decisions needed to be made and of course without precedence. In a short space of time we were able to establish structures to support a sector, which have remained operational from Day 1 of the national lockdown.

In my first week at work we had to develop business continuity plans to allow for some of our staff to work from home, given the lockdown regulations. A core team supporting the food value chain had to be maintained, and this was completely unprecedented in the history of our country.

We also established weekly contact with the industry to ensure that they were supported during the lockdown period. We all had to learn to conduct virtual meetings for this purpose and after 13 weeks we have all mastered the art, which is great. These weekly meetings were important for me to be able to say to the sector, "I am here and ready to serve".

As the regulations regarding lockdown levels 5 to 3 were coming through from CoGTA, we as a team had to quickly interpret it with a view to ensure that the sector be allowed space to function unhindered.

For example, farmers were initially not allowed to complete harvesting and there were issues regarding the wine sector. I remember receiving a call from Mr Rico Basson of VinPro on these issues in my first week. We immediately made a submission to the national Minister arguing for some changes. At the time we were issuing one or two submissions per week. We have had some success in this regard and I am grateful to my team and the sector for their involvement.

It was also a time to establish new relationships. In the past 13 weeks I have had interactions with the Eastern Cape Department of Agriculture and we are reviving the cooperation between our two departments. This was triggered by the fact that we have had to develop protocols for the transport of essential agri-workers who needed to travel to their families during the lockdown period.

Another great outcome is the fact that we were able to put measures in place to enable e-learning for students during the lockdown period. We will reopen the college from 17 June 2020 with a third of the students, as per the prescribed health and safety measures.

I have to emphasise that this would have been impossible without the collective leadership of the department.

• What is your vision for the department? What would you like to achieve and how do you plan to set about doing it?

A great deal of good work has already been done by my predecessor and I think that makes for a good foundation.

In terms of my vision, I want to see growth in the sunrise sector and its contribution to the economy of the Western Cape. This is the sector that has the potential to absorb people in terms of employment and it would be great to see the sector create more jobs, particularly for our youth in the rural areas of the province.

• Is there anything else that you would like to add?

I would like to thank the agricultural sector as a whole. As essential service, we were working around the clock to ensure food security. Your work during this time made a significant difference.

There is much to look forward to in the agricultural landscape and the horizon certainly looks green! AP

VOTING FOR THE BEST – THE MEDIA TRIBE HAS SPOKEN!

The editorial committee of *AgriProbe* annually invites the "media tribe" – the Western Cape Agricultural Writers' Association – to vote on the best articles in four editions (Vol. 15 no. 2, 3, 4 and Vol. 16 no. 1) of *AgriProbe*.

The experts listed the following articles as exceptional as they were written in a palatable format with graphics and photos to keep the reader interested:

- "Using food gardens to help a troubled community" – Heather D'Alton
- "Increasing biodiversity in dryland cropping systems" – Dr Johann Strauss
- "Are chickpeas the 'nuts and berries' of the Swartland?" – Dr Dirk Troskie
- "Flyover: Tracking agricultural land-use changes in the Western Cape, 2013–2017" – Louw Pienaar
- "Creating a buzz – save the honeybee population" – Bianca Capazorio
- "Colour variants: Have they lost their impetus?" – Riaan Nowers

The tribe has spoken and the winner is:

"Are chickpeas the 'nuts and berries' of the Swartland?" — Dr Dirk Troskie
The comments on this outstanding article were that it informed the reader of chickpeas as a very exciting new crop for the Swartland, and Dr Troskie's "easy-reading" style of exploring the export opportunities for this crop made this one the winner by far. Second prize went to Bianca Capazorio for an excellent article on honeybees.

Well done to the winners and our sincere appreciation for the "media tribe" for voting every year! And to our contributors to *AgriProbe* – keep up the good stories in agriculture. AP

Dr Dirk Troskie

Bianca Capazorio

WORLDS APART

by Dr Dirk Troskie, dirkt@elsenburg.com

We, in South Africa, are often so deeply involved in our own realities of transformation, jobs, and disasters, that public debates in other countries go unnoticed. Thanks to a visit sponsored by the German Federal Government, the author had the opportunity to be part of a twenty-member multi-country group invited to attend the 85th Grüne Woche (Green Week) in Berlin, Germany during January 2020. As the programme was organised by the German Federal Government, it included engagements with senior members of the German Foreign Office, Ministry of Food and Agriculture, some heads of state and ministers. The result was a unique opportunity to receive a perspective on policy debates in Europe and the rest of the world.

Its "Green Deal" is the European Union's (EU) response to tackling climate- and environment-related challenges. The target is to have no net emissions of greenhouse gases by 2050 while maintaining a competitive economy, with economic growth decoupled from resource use. The first European "climate law" was introduced in March 2020 and the EU will use its influence, expertise, and financial resources to mobilise its partners. Germany, who will take over the presidency of the EU during the second part of 2020, intends to place the Green Deal and climate issues at the core of its agenda.

The political will to implement its environmental agenda exists at EU level. Following court action and formal warnings, the EU Commission has informed Germany that it faces a fine of €850 000 per day if it fails to comply with the nitrate groundwater-pollution legislation by June 2020, and that will be at the moment when Germany takes over the EU presidency!

»

Animal welfare and rights are prominent in the EU's public spaces, to the level of looking at alternatives for castrating boar piglets. As the castration of ruminants is not common practice in the EU, consumer resistance to beef, mutton and lamb exports from other parts of the world can be expected. This is in addition to other growing animal rights issues.

The conflict between farmers and consumers is real and is on the increase. Consumers and special-interest groups consider farmers (particularly large-scale commercial farmers) to be conservative and not responsive enough to environmental and animal rights agendas. Farmers, in turn, convinced of their own worth and value to society, feel that society does not sufficiently appreciate them and expect consumers to compensate them (higher prices/more subsidies) for the demands they place on farmers. Expect more "enough is enough" demonstrations in public spaces.

Photos: © Messe Berlin GmbH

The current revision of the Common Agricultural Policy (CAP) of the EU will increasingly make it an instrument with environmental and animal welfare goals. However, no increase in value, absolute or relative, is expected.

2019 was the 30th celebration of the fall of the Berlin Wall. With it came introspection and the realisation that the "unification" was actually one system absorbed by another. East German workers found it more difficult than expected to compete in the labour market with 75% being unemployed at one stage and 50% unemployed at least twice. Great nostalgia about the social norms and cohesion of the past exists; probably causing the drive to make a contribution to the local village (society) and people (jobs) of farmers in the former East Germany.

Can the EU be trusted to keep its word? Apparently not. Although it negotiated a free trade agreement with Mercosur (Argentina, Brazil, Paraguay, and Uruguay), it is unlikely that the EU parliament will ratify it.

Other group members highlighted policy issues from their own countries. The nomadic farmers of Mongolia are facing the "tragedy of the commons" and Koreans are despondent about the future of their agricultural sector. In Argentina, the newly elected Peronist party populistically reintroduced a 30% export tax on important food products (beef, maize, and soya). The subsequent low food prices are good for the poor but devastating to the economy. Brazil is innovating. The UK only focuses on Brexit and experiments with its own policy that, ironically, may be more environmentally responsible than the CAP. USA farmers continue to support President Trump despite his policies devastating their export markets. African governments are full of good intentions and former Eastern bloc countries dream of collective action.

Each country has its own issues and areas of concern. Our debates are important, but we need to be aware of debates abroad; almost 66% of the value of agricultural production in the Western Cape is exported. Be prepared, therefore, to comply with the strictures of the EU's Green Deal and animal rights prescripts. AP

Three awards go to Directorate Plant Sciences at Combined Congress

by Annelene Swanepoel, annelenes@elsenburg.com

The Combined Congress was hosted at the University of the Free State during January 2020. The Soil Science Society of South Africa, the South African Society of Horticultural Science, and the South African Society of Crop Production established a platform where renowned and aspiring scientists can share their knowledge and findings and contribute to agricultural research in South Africa. Researchers of the Directorate Plant Sciences, Programme Research and Technology Development, in collaboration with students from Stellenbosch University (SU) and North-West University (NWU), attended the conference and presented five papers and 13 posters. The Plant Sciences team and their postgraduate students received three awards. Dr Johann Strauss, Lisa Smorenburg, Rens Smit, and Charné Augustyn were also selected as members of the council of the Crop Science Society of South Africa. Dr Johan Labuschagne was awarded honorary membership of the South African Society of Crop Production.

The award for best presentation by a crop science student went to Karen Truter. Her presentation was entitled "Seed-drills and their influence on the uniformity of crop emergence". Karen is an MSc student who aims to determine the influence of seed-drill choice on the physical properties of soil and crop performance, within one of the existing long-term cropping trials at Napky in the Eastern Rûens. In current conservation agriculture systems, farmers can make use of both tine and disc seed-drills. It is, however, not yet fully known which of the two is better suited for specific crops produced in the Western Cape. The Western Cape Agricultural Research Trust funds the project, with Karen working under the supervision of Dr Pieter Swanepoel (SU) and Dr Johann Strauss (Directorate Plant Sciences).

The Rovic Leers award for the best paper presented in the field of conservation agriculture went to Izane Crous for her presentation entitled "The influence of foliar and application rate of nitrogen fertiliser on seed and oil yield of canola". Izane is a PhD student who aims to establish new fertiliser norms for canola produced in conservation agriculture systems. Current fertiliser applications are based on outdated data from conventional agricultural systems,

and adaptations are necessary to optimise production and sustainability. Izane works under the supervision of Dr Johan Labuschagne (Directorate Plant Sciences) and Dr Pieter Swanepoel (SU), on five research sites managed by Dr Labuschagne in the grain-producing areas of the Western Cape.

The Rovic Leers award for the best poster presented in the field of conservation agriculture went to Johan Habig for his poster entitled "The long-term effect of crop rotation and tillage practices on biological soil health indicators" co-authored by J Labuschagne, M Marais, A Swart and S Claassens. Johan is a PhD student at the Unit for Environmental Sciences and Management, North-West University. He aims to develop a better understanding of the effect of soil disturbance and cropping sequence on biological soil health indicators such as nematode populations and microbial diversity and activity. Data used in this study were generated from long-term trials at Tygerhoek and Langgewens research farms of the department, managed by Dr Labuschagne. Johan works under the supervision of Prof. Claassens and is co-supervised by Dr Johan Labuschagne.

These accolades serve as an indication that both researchers and industry acknowledge the importance of these research endeavours. AP

1. WCDoA and SU student delegates.

2. Award to Dr Johan Labuschagne – honorary membership.

3. Award to Karen Truter with one of her supervisors, Dr Johann Strauss.

Career booklet explores **agri-career opportunities for the youth**

by Giselle Terblanche, gisellet@elsenburg.com

The sustainability of the agricultural sector, vitally important for South Africa and its people, is dependent on young people to take the sector forward in years to come. As part of its efforts to promote careers in agriculture, the Western Cape Department of Agriculture recently launched an agricultural career booklet titled: "Living Agriculture: 50 Career Opportunities".

Unfortunately, there is still a misconception among many young people that in order to start a career in agriculture, one has to own a farm or perform manual labour outside in harsh conditions. Nothing could be further from the truth! For instance, few young people know of the existence of careers such as agricultural engineers, advisors, and economists, to name but a few.

There are many wonderful career prospects available in the agricultural sector. The booklet captures 50 of them, but that only scratches the surface. The careers listed are diverse in terms of day-to-day activities. They are also diverse in terms of the skill set required. Agriculture is a sector that can be anything you want it to be, with no limits. The book is written for school leavers investigating career opportunities that are available in agriculture, or young professionals considering a career change.

> "It is crucial for the youth to follow careers in agriculture, in order to ensure the sustainability of this vitally important sector."

Ms Joyene Isaacs, former head of the department at the time the book was written, says "The agricultural sector (and value chain) is amazing and remains unexplored by most young people. This publication presents exciting agricultural career opportunities to inform and to demystify this sector."

She says the opportunities to study in agriculture are endless, because we must eat (food) and wear clothes (fibre). The agricultural sector presents opportunities for office or field work, travel, social interactions, development, research, training, and education, among many others.

The booklet is only the first in a series of similar publications in the pipeline. The department aims to release the second booklet in the series within the next year. It is currently only available in English but will soon be made available in Afrikaans and isiXhosa. Watch this space!

To request your free hard copy, send an email to info@elsenburg.com. Get yours now and see how you can become part of the agricultural family! AP

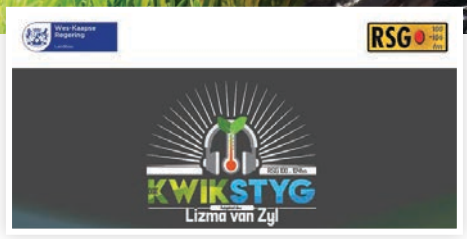
Western Cape Government
Agriculture

Living Agriculture

50 Career Opportunities

It is time to say farewell, but stay tuned to Station Climate Change!

by Dr Ilse Trautmann, ilset@elsenburg.com



We truly hope that you tuned in to our second series of "Die Kwik Styg", which was broadcast on RSG at 12:45 on Friday afternoons. Our presenter Lizma van Zyl informed, educated, and empowered South Africans on climate change and relevant subject matters with world-renowned experts as her studio guests. We informed our *AgriProbe* readers on this most popular series in previous editions of *AgriProbe* (Vol 15, No 2, p 12–13; Vol 15, No 3, p 44–49).

The programme was funded by the Western Cape Department of Agriculture with Dr Ilse Trautmann, chief director of Research and Technology Development as project leader. This project was run as part of the SmartAgri plan (**greenagri.org.za** or **elsenburg.com**) with the objective of creating awareness on climate change for the agricultural sector and the general public. After the success of the first series, RSG invited the department to do a second series. Experts on climate change in South Africa (and one from the UK) took part in the two series.

The sad news is that the team, Lizma, Ilse and Lindsay, broadcast their last programme on Friday 3 April 2020 after 104 programmes. Please take time to listen to this programme – the grand finale of "Die Kwik Styg"!

Our sincere appreciation to our team of

Lizma, Ilse and Lindsay

> Please take time to listen to this programme – the grand finale of "Die Kwik Styg"!

experts for informing us week after week on this very important challenge to South Africa and our agricultural sector. They brought the realities and opportunities of climate change to our farms and into our homes.

To Lizma, a warm word of thanks for compiling and presenting the programmes in such a professional and listener-friendly way, and a round of applause to Lindsay Johnson of Crossfade Studios who did the immaculate editing of each programme. A special word of thanks to RSG for allowing us to produce the first ever radio series on climate change in South Africa.

Missed some programmes? Download the podcasts on **elsenburg.com** or **rsg.co.za**.

For more information on the series, contact Dr Ilse Trautmann at ilset@elsenburg.com or 021 808 5012 AP

JOIN US IN COOKING!

During the 2019 South African Cheese Festival, it was "cooking" in the Cape Made Kitchen. The Cape Made Recipe Book 2019 was launched with mouth-watering recipes, meticulously developed by the young chefs of The Private Hotel School. The purpose? To showcase the use of alternative crops in the kitchen.

moroccan meatballs in tomato sauce, served with couscous

6-8 SERVINGS

INGREDIENTS

MEATBALLS

500 g	beef mince
1	small onion, diced
1	clove garlic, diced
1	egg
30 mℓ	flat-leaf parsley, chopped
5 mℓ	cumin, toasted and crushed
5 mℓ	coriander, toasted and crushed

COUSCOUS

300 g	couscous
300 g	water, hot not boiling
5 mℓ	Ras-el-hanout (Moroccan spice mixture of paprika, ginger, and coriander)
5 mℓ	salt

Pomegranate rubies for garnish

TOMATO SAUCE

2	red peppers
2	green peppers
30 mℓ	olive oil, extra for peppers
3	garlic cloves, chopped
250 mℓ	olives, pitted and sliced
100 g	prunes, chopped
125 mℓ	capers, chopped
450 g	tomatoes, chopped
100 mℓ	red wine vinegar
50 mℓ	sugar
2	anchovies, chopped
10 mℓ	smoked paprika
30 mℓ	flat-leaf parsley, finely chopped

RECIPE BOOK 43

MORE DELICIOUS **RECIPES**

will follow in future editions of *AgriProbe*.

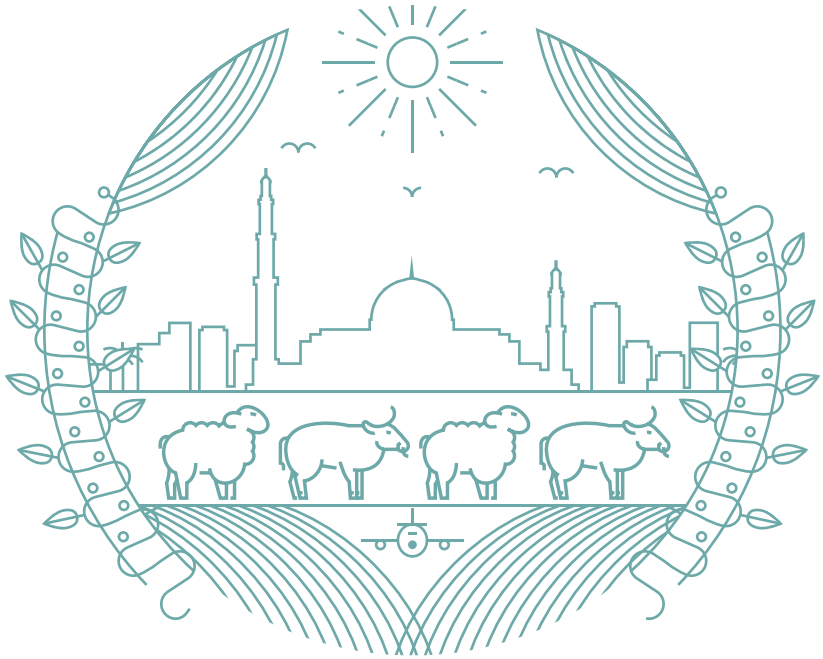
www.elsenburg.com/resource-library/cape-made-taste-alternatives

METHOD

- Preheat the oven to 180 °C.
- Start by making the tomato sauce.
- Place the peppers on a baking tray and drizzle with some olive oil.
- Roast for 25-30 minutes until the skins are blistered and charred.
- Place the peppers in a bowl and cover with cling wrap to steam some more.
- When the peppers have cooled down, skin and deseed them, reserving the excess cooking liquid.
- Slice the peppers into strips.
- Heat a medium sauté pan over a low heat.
- Add the olive oil and garlic, and sauté for about 2-3 minutes until soft.
- Add the peppers, olives, capers, chopped tomatoes, prunes, vinegar, sugar, and excess cooking liquid.
- Cook until the liquid has reduced, and the relish is thick and glossy.
- Add the anchovies, smoked paprika, and parsley and mix through.
- Adjust seasoning if needed.
- Combine all the meatball ingredients in a bowl.
- Refrigerate for approximately one hour to allow for flavour development.
- Once refrigerated roll the mince into 16 equal balls.
- Place on a baking tray.
- Drizzle with olive oil and bake for 15-20 minutes until browned, and almost cooked through.
- Once the sauce is done, place the meatballs in the tomato sauce and cook for an additional 10 minutes.
- Place the couscous in a bowl and mix in the Ras-el-hanout and salt.
- Pour hot water over, cover with cling film, and let it steam for 5-10 minutes.
- Remove the cling film and fluff the couscous with your hands to get rid of any lumps.
- Garnish the dish with pomegranate rubies.

MEAT IN THE MIDDLE EAST

by Dr Azeemah Parker, azeemahp@elsenburg.com



In October 2019, veterinary services teamed up with Wesgro (Cape Town and the Western Cape's trade, tourism and investment agency), on a fact-finding mission to determine the import requirements for meat in parts of the Middle East. The aim of the trip was to enable the export control veterinarians in the Western Cape to gain insight into the standards of the Middle Eastern meat market as well as other animal-based products. This was done to boost halal exports from the Western Cape. Three countries were visited, namely Oman, the Kingdom of Saudi Arabia, and the United Arab Emirates.

The first country the team visited was Oman. All visits and meetings took place in the capital city Muscat. Meetings were held at the South African embassy and the Oman Ministry of Agriculture, and there were site visits to traditional markets and abattoirs. There was a keen interest in small stock exports, especially sheep and goat meat. The Kingdom of Saudi Arabia was

Meat market in Muscat Oman.

next. Official meetings took place in Jeddah and Riyadh, and the team also visited farms and abattoirs in both cities. The Saudi Agricultural Expo in Riyadh helped the team to gain a better understanding of the market. As with Oman, sheep and goat meat is the main interest but there is also a demand for South African artisanal cheese products. The United Arab Emirates was the final destination. Meetings and visits similar to the other cities took place in Dubai. Exports to the United Arab Emirates from the Western Cape are already taking place but an increase in volume is being considered. The most interesting thing to note was that "Karoo lamb" has become rather popular in the Emirates and it is seen as a uniquely South African type of lamb. Consumers, many of whom are South African expatriates, specifically request "Karoo lamb". Currently most of the meat imported into these countries comes from Romania, Sudan, New Zealand, Australia, and other Asian countries. The possibility of South African game and ostrich meat exports was also discussed in all three countries and was received favourably.

This official visit can be deemed a success since all three countries were excited to either start a relationship or build on an existing one for meat exports. Without Wesgro and our South African embassies arranging all the meetings and contacting livestock and meat trading companies on the department's behalf, this would not have been possible. AP

1. Feedlot sheep in Jeddah, Saudi Arabia.
2. The Mutrah market in Muscat, Oman.

RSG 100-104 fm
DIS DIE EEN

Kom gesels en luister saam na *RSG Landbou!*

RSG Landbou (RSG 100–104 FM) word Vrydae om 04:45 en Saterdae om 11:45 uitgesaai en word vervaardig deur die Wes-Kaapse Departement van Landbou. Op die Vrydagprogram help ons graag landbouers met tegniese raad en kennis komende van ’n wye verskeidenheid van kenners. Belangrike nuusgebeure word ook op hierdie inligtingsryke program bespreek. Tydens die Saterdagprogram deel ons stories van hoop en inspirasie oor die mense in die landbousektor. Kontak my, Eloise Pretorius, indien jy self ’n bydrae wil lewer, of indien jy weet van iemand wat kan, by **eloisep@elsenburg.com**.

Listen to *RSG Landbou!*

RSG Landbou is broadcasted on Fridays at 04:45 and Saturdays at 11:45 on RSG 100–104 FM, nationwide. This programme is produced by the Western Cape Department of Agriculture. On Fridays, the programme is filled with useful information from an array of experts with the aim to support and inform the agricultural community. Technical advice is given and newsworthy items are discussed. During the Saturday programme we share stories of hope and inspiration about the people in agriculture. Feel free to contact me, Eloise Pretorius, should you wish to make a contribution on *RSG Landbou*, at **eloisep@elsenburg.com**.

Partnership agreement brings Upper Austrian group to the Western Cape

Students enjoying the beach.

by Gareth Williams, garethw@elsenburg.com

The Western Cape Department of Agriculture hosted a group from the Upper Austrian Student Exchange Programme during the latter part of 2019, as part of the partnership agreement between the Western Cape and Upper Austria. Both are members of the Regional Leaders Forum, which comprises seven provinces including Upper Austria, Western Cape, Georgia, Shandong, Bavaria, Quebec, and São Paulo.

One of the key areas for bilateral interaction between our province and Upper Austria is human capacity development. Minister Hiegelsberger, Minister of Agriculture, and his delegation visited the Western Cape during 2016 where he and the former Minister of Economic Opportunities, Minister Winde, co-signed a memorandum of understanding (MOU) between the two regions. The aim was to develop and implement concrete

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possibilities for agricultural student exchange, which was expected to commence in 2018. The programme would help to transfer knowledge and best practices in agriculture and the food industry (primary and agri-processing) at an educational level.

Dr Ilse Trautmann (Chief Director: Research and Technology Development), Rashidah Wentzel (Chief Director: Operational Support Services) and Gareth Williams (agro-processing expert from the Farmer Support and Development Programme) are coordinating the Western Cape Student Exchange Programme between the two regions. The first group of Western Cape students visited Upper Austria in 2018.

For the first study tour from Upper Austria in October 2019, four students and one teacher from HLBLA Elmberg and four students and one teacher from HLBLA St Florian attended the programme. The Elsenburg College and Oakdale Agricultural School in Riversdale were selected as study venues for the eight students. The two-week programme covered agricultural theory and hands-on training in specific areas, like on-farm agri-processing. In addition, farm visits and excursions were arranged as a means of experiencing agriculture in a foreign country and the opportunity to see on-farm agri-processing by visiting selected farmers and agribusinesses in the Western Cape.

↘

Front row: Christa Magdalena Möslinger-Gehmayr, Fabian Pointstingl, Kathrin Weißensteiner, Lena Heibl, Martina Seyr, Johanna Huber, Anna Breinesberger, Felix Maximilian Lumetsberger, Robert Pargfrieder, Taahir Harris, and Juanita Isaacs.
Back row: John Bantham, Gareth Williams, Martina Schobersberger, and Schoeman du Preez.

> The lessons learnt during the exchange programme and the experience of agriculture within the Western Cape was regarded as invaluable to the students from Upper Austria and will inspire future generations of farmers.

One of the key highlights of the exchange programme was the visit to the Mosstrich Group and the Garden Route Game Lodge, hosted by the Oakdale Agricultural School. The Upper Austrian students had the opportunity to view the ostrich meat industry and interact with elephants at the game lodge. The outcome of the programme was to display and share the vast agricultural diversity of the agricultural sector within the Western Cape with future farmers and exposing the students to the culture of South Africa and its people. This will evidently lead to the empowering of young professionals within the agricultural and agribusiness professions. In turn, this would facilitate better policy and decision-making and contribute towards solving the challenges facing South Africa's agricultural sector and economic development. In addition, the continuation of such a student exchange programme would be highly beneficial for the future development of the next generation of farmers within the Upper Austrian region and the Western Cape.

"The lessons learnt during the exchange programme and the experience of agriculture within the Western Cape was regarded as invaluable to the students from Upper Austria and will inspire future generations of farmers.

The second group of students from South Africa will not be able to travel to Upper Austria in 2020 due to the COVID-19 pandemic and plans are made for travelling in 2021. The content of the arrangement and programme will be essentially reciprocal. AP

AGRICULTURE, FOOD AND COVID-19

Dr Dirk Troskie, dirkt@elsenburg.com

During March 2020 South Africans experienced empty food shelves for the first time in generations and concerns were raised whether household food security would weather the COVID-19 storm. It must be recognised that South Africa is a surplus producer of food (with good crops harvested this summer) and global food supplies benefited from a decade-long growth spurt. However, South-Africa's food value chains are complex (with a strong international interface) and we should remember that about 35% of food is distributed via informal trade. The poorest part of our society spends 40% of household income on food, making it vulnerable to any shock in the food system. Finally, the "envelope of the possible" of food production is created by rainfall, climate, and the geographic features of our natural resources.

Soon after COVID-19 was declared a pandemic, the WCDoA conducted an assessment of the potential disruptors that will have an impact on the agricultural sector and food supply in the province (see Table 1). Variables in the international interface, local supply chains, demand, production systems, as well as the regulatory environment, were identified (see Troskie, 2020 for more detail).

Table 1: Impact of disruptions caused by COVID-19 on the Western Cape agricultural sector.

DISRUPTION	IMPACT						
	Shortage on domestic markets		Vulnerable communities	Fresh produce wasting	Loss of market share abroad	Shortage of inputs	Failing farms
	Short term	Long term					
Bottlenecks at, and closure of, ports	X	X		X	X	X	
Disruption of air traffic	X	X		X	X	X	
Importing countries prioritising goods				X	X		
Farm inefficiencies abroad		X					
Disruption of domestic value chains	X	X	X	X			
Social unrest			X				X
On-farm outbreak of COVID-19							X
Inability to import key inputs		X				X	X
Lockdown/diversion of production		X				X	
Inefficiencies in input supply chains		X				X	X

Table 1 continues

DISRUPTION	IMPACT						
	Shortage on domestic markets		Vulnerable communities	Fresh produce wasting	Loss of market share abroad	Shortage of inputs	Failing farms
	Short term	Long term					
Lockdown leading to job losses			X				
Weakening exchange rate		X				X	
Slowdown in South Africa's economy			X	X			X
Slowdown in the global economy				X	X		
Changing consumer patterns					X		X
Government failure	X	X	X		X		
South African lockdown		X	X		X		
Emerging from the lockdown		X	X		X		
Inconsistent application of regulations		X					X
Lockdown abroad		X			X	X	X

Source: Troskie (2020)

[1] **From various definitions of household food security, the National Policy on Food and Nutrition Security identifies the main elements: (a) adequate availability, (b) accessibility (physical, social and economic), (c) utilisation, quality and safety of food, and (d) stability of food supply.**

Table 2: Status of COVID-19 impact on the Western Cape agricultural sector.

IMPACT	STATUS	ACTION REQUIRED
Short-term shortage of goods on domestic markets		Monitor availability of food in rural areas and especially in remote communities.
Long-term shortage of goods on domestic markets		Monitor imports of farming inputs as well as food price inflation of imported products.
Food insecurity in vulnerable communities		Provide direct and indirect assistance to the most vulnerable households. Develop direct transfer/food voucher/coupon system.
Wasting of fresh produce		Monitor the status of fresh produce and put mechanisms in place to acquire "surplus" food.
Loss of market share abroad		Monitor the export status of the wine industry and support relevant initiatives.
Shortage of farming inputs		Monitor the availability of imported farming inputs as well as domestic input supply chains. Industries and importers/ suppliers coordinate bulk purchase of essentials.
Failing farms		Monitor the financial and technical health of farms.

Source: Troskie (2020)

During this analysis it was found that these disruptors could manifest in seven different types of impact and the status of each needs to be monitored (see Table 2).

There are two main areas showing an "amber light", of which the first is food security in vulnerable communities. In this case the challenge is access to food (i.e. households do not have the means to pay for food) rather than the availability of it. The second area of concern is the availability of imported farming inputs (e.g. specialised machinery parts and chemicals such as growth regulators) which may have an impact on the next season's harvest.

The status of the various disruptors and impacts are regularly monitored on the domestic market (Pienaar, 2020) and weekly at national and international level (BFAP, 2020).

COVID-19 has highlighted the importance of food production and for the first time consumers realised that food value chains do not start in supermarkets. The result is not only new opportunities in competing for consumer and public resources, but also an increased responsibility for farmers regarding the management of natural, social, and human resources.

Agriculture, food and COVID-19

Frequently asked questions

COVID-19 information on provincial website

COVID-19 information of national website

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Top-performing opportunity for agri processing

by Andrew Partridge, andrewp@elsenburg

Agri processing was identified in 2014 as a priority sector for the Western Cape, given its potential to contribute towards economic growth and job creation. In order for policies and plans to be developed in a way that enables the province to extract this potential, the Western Cape Department of Agriculture developed an agri processing index (API) to help identify and prioritise the optimal agri processing products.

The API is a multivariate index that scores 169 different agri processing products on several sub-indicators relating to production potential, employment potential, domestic market growth, global market growth, and the association with trade barriers. The details of the construction of the index, as well as an overview of recent trends in agri processing developments, locally and globally, were provided in the 2015 *Agri processing Report*.

It became apparent, five years after the completion of the initial study, that an update is necessary. This has led to the compilation of an updated report for 2020 and an updated API to provide a more current measurement of opportunities.

Recent evidence shows the continued importance of agri processing for economic development and job creation in South Africa. This is both from the perspective of the sector itself where growth has been strong for a number of industries, and also for the strongly connected upstream industries (e.g. agriculture, forestry and fisheries) and downstream industries

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(e.g. retail trade, hospitality and tourism). It is particularly relevant for South Africa, given the high level of unemployment among low-skilled workers and the location of agri processing industries within agricultural value chains, which tend to be the greatest absorber of low-skilled workers.

In 2018 agri processing accounted for 4,9% of economic activity in South Africa and 3,2% of the labour force. However, if agri processing is taken to include the primary agricultural sector from which it is supplied, then these shares rise to 7,3% and 10,2% respectively. This share is higher for the Western Cape where the two sectors together account for 10,7% of economic activity and 13,3% of employment. The sectors are particularly important for Western Cape exports, with

agriculture accounting for 28,6% of total provincial exports and agri processing 25,7%. This means that together the two sectors account for more than half of the province's exports.

Rapid growth in the imports of several agri processing products means that strong export growth has not resulted in a solid, positive trade balance. This highlights more opportunity in that there are several products being imported, which could be produced domestically.

The updated API reaffirmed the enormous potential for berry production in South Africa, which had already been highlighted in the 2015 API. Cherries and macadamia nuts were also top performers, as was the more industrial processing of fruit jams and honey. Overall primary processing activities tended to perform better, largely driven by greater employment potential. However, performances varied across the different areas on which products were scored, making generalised statements difficult.

Based on the analysis, the following are recommended:

- Continued prioritisation of agri processing development in the Western Cape
- Efforts to accelerate production for products with high APIs (e.g. cherries, berries, macadamia nuts, fruit jams, and honey)
- Adoption of a whole-value-chain approach for agri processing developments
- A study to be conducted on the water requirements of the production of different agri processing products
- All agri processing developments to be conducted in an engaged and inclusive manner

It is believed that with informed planning and targeted interventions, the agri processing sector could be a driver of economic growth and employment in the Western Cape. If done correctly, this has the potential to provide a channel to help revive agriculture in the region. Also, there are additional spillover benefits for not just economic growth but food security, poverty alleviation and providing livelihoods for all the people living under the Western Cape Government's care.

Any requests to obtain the report or to receive more information on any of the contents, please email Andrew Partridge (andrewp@elsenburg.com) or Louw Pienaar (louwpp@elsenburg.com) or scan this QR code.

AP

Pork market analysis

Western Cape's potential market in Ghana

by Masego Moobi* and Babalo Mbuqe

Western Cape pork exports to world:
R45 million in 2018
(Total SA pork export: R328 million)

Western Cape exports to world
Namibia (R35 million); Mozambique (R3,8 million); Ghana (R2,9 million); Nigeria (R0,7 million); Botswana (R0,4 million)

Frozen: meat of swine (R16,2 million); carcasses (R8,0 million), hams, shoulders and cuts (R0,8 million)

Fresh: meat of swine (R11,4 million); carcasses (R7,8 million), hams, shoulders and cuts (R0,7 million)

Western Cape

World

Western Cape exports to Ghana

R2,9 million (total SA R3,4 million)

Frozen: meat of swine (R0,7 million); carcasses (R0), hams, shoulders and cuts (R40 000)

Fresh: meat of swine (R2,2 million); carcasses (R0), hams, shoulders and cuts (R0)

World exports to Ghana

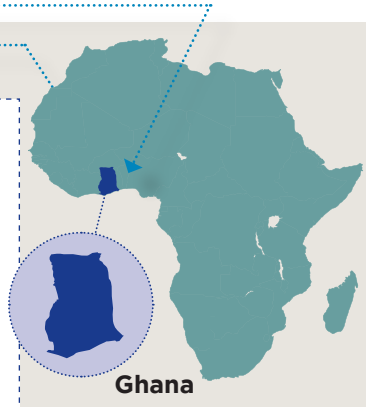
Belgium (R11,3 million); Poland (R1,2 million); Argentina (R0,7 million); Denmark (R0,6 million)

Frozen: meat of swine (R20,8 million); carcasses (R13 000), hams, shoulders and cuts (R0,9 million)

Fresh: meat of swine (R2,6 million); carcasses (R0), hams, shoulders and cuts (R92 000)

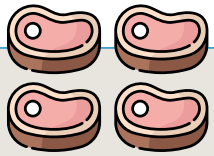
Why Ghana?

- **Overall increase in the demand for meat** (meat imports: R5,3 billion in 2018 as compared to R1,6 billion in 2007)
- **Growing economy** (2019 GDP growth rate estimated at 6,5% compared with 5,4% in 2018)
- **Higher population** relative to SA traditional pork markets (29,8 million in 2018)



- World exports to Ghana: ffiR24,3 million in 2018
- Up from ffiR11,4 million in 2017

The Western Cape has the potential to increase exports of **frozen and fresh meat of swine** to Ghana.



Ghana imposes a 35% tariff rate on all pork imports

Documents required to clear goods for import

Bill of landing, certificate of origin, commercial invoice, customs packing list, insurance bond, import declaration and technical standard/health certificate

Import documentary compliance: Time (hours): 36; Cost: USD474/R6 279

Import inspection: done by the Ghana Standards Authority (GSA)

Food products are declared high-risk goods

Importers shall:

- Register with GSA
- Purchase applicable Ghana Standard(s)
- Send declaration to the GSA through the Ghana Community Network Services (GCNet)
- Imports should be accompanied with a certificate of analysis/conformance

Import border compliance: Time (hours): 80; Cost: USD553/R7 325

Port of entry: Tema Port

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Rekordpryse vir jong volstruiswyfies

deur dr. Anel Engelbrecht, AnelE@elsenburg.com

Uitstekende pryse is behaal by die jaarlikse veiling van teeltmateriaal wat die Wes-Kaapse Departement van Landbou onlangs by sy navorsingsplaas in Oudtshoorn aangebied het. Hierdie volstruise is afkomstig van die hulpbronkudde op die navorsingsplaas, wat reeds sedert 1996 geselekteer word vir reproduksie en gewig. Daar word dan jaarliks van die nageslag van die kudde op 'n produksieveiling aan die bedryf beskikbaar gestel.

Klein Karoo Veilings & Veebemarking het die volstruise volgens die katalogus wat voorberei is deur die departement se navorsers, opgeveil. Jong broeivolstruise is individueel te koop aangebied met inligting oor hulle ouderdom, massa en teeltwaardes vir reproduksie, massa en haarfollikels.

Rekordpryse van R15 500 is behaal vir twee-jaar-oue wyfies met goeie teeltwaardes. Die aanvraag na mannetjies was aansienlik minder, met R10 500 wat die hoogste prys was wat behaal is. Daar was slegs ses kopers en altesaam 66 volstruise is teen 'n gemiddelde prys van R7 750 verkoop.

Mnr. Jurie Klue van Klaarstroom het vir die tweede agtereenvolgende jaar die meeste volstruise gekoop. Mnre. Ebon le Roux en Sarel du Plessis, albei van Oudtshoorn, het die hoogste pryse vir wyfies betaal, terwyl Mnr. Maartin Gildenhuys van Heidelberg die hoogste prys vir 'n mannetjie betaal het.

Die seleksie van volstruise vir reproduksie het oor tyd tot gevolg gehad dat die volstruise al vroeër geslagsryp raak en begin eiers produseer. Op die navorsingsplaas word die volstruise reeds voordat hulle 'n volle twee jaar oud is in broeikampe gesit vir enkelparing. Daar is gevind dat meer as 90% van hierdie jong pare reeds tydens hulle eerste produksieseisoen eiers en kuikens produseer, met 'n gemiddelde eierproduksie van 40 en 'n kuikenproduksie van 16 tydens hulle eerste broeiseisoen.

Die Wes-Kaapse Departement van Landbou spog met die enigste volstruisnavorsingseenheid in die wêreld en het daarom ook medewerkers in verskeie lande. Die telingsnavorsing is krities vir die verbetering van die effektiwiteit en produkkwaliteit van die plaaslik ontwikkelde volstruisras. AP

The official opening of the **state-of-the-art mobile BSL-3 veterinary laboratory**

by Solomon Bhandi, solomonb@elsenburg.com

Dr Ivan Meyer, the Western Cape Minister of Agriculture, officially opened the biological safety level 3 (BSL-3) veterinary laboratory at the Western Cape Provincial Veterinary Laboratory in Stellenbosch in January 2020. The minister explained that this world-class facility is setting a high benchmark for curbing zoonotic diseases in the province and South Africa at large. Dr Meyer stressed this by giving an example – the novel coronavirus (COVID-19) pandemic that started in China – to demonstrate the impact of communicable and zoonotic diseases and the need for this cutting-edge facility to ensure that animal health promotes human health. He also explained the economic importance of animal disease control by saying "45% of all South Africa's agricultural exports leave our shores via the Western Cape and veterinary certification of animal products for the export market is a key component of growing our export market and the Western Cape economy".

The mobile laboratory is a state-of-the-art facility that enables diagnostic or research work involving diseases of public health relevance, for instance tuberculosis (TB) and other infectious diseases, or pathogens

Uwe Schoen, Director Biomedhelix, explaining how the mobile lab will operate to Minister Ivan Meyer and Marietjie van Jaarsveld, Ministry of Agriculture.

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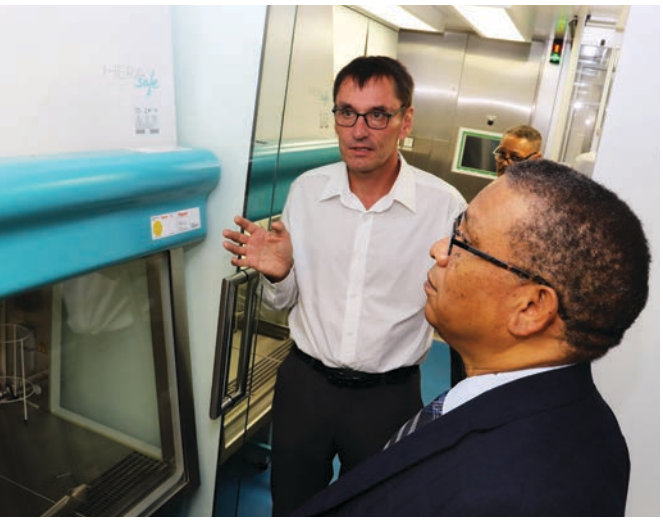


of unknown risk. Laboratory facilities that work on infectious agents are categorised by the biological safety level (BSL) that corresponds to the level of risk posed by the pathogens being managed. The Biosafety in Microbiological and Biomedical Laboratories (BMBL) designates BSL-3 for indigenous or exotic agents that may cause serious or potentially life-threatening diseases through the inhalation route of exposure. Uses for the BSL-3 laboratory range from microbiological research, scientific education, biomedical, diagnostic, and clinical, biosecurity, and vaccine research. It is a controlled access laboratory required for all experiments involving Hazard Group 3 pathogens (P3) of high-potential risk to laboratory personnel and the environment.

The BSL-3 laboratory is a valuable addition to the Department of Agriculture, veterinary services, and the Western Cape Government as a whole. The mobile BSL-3 was designed in Germany where it was initially used as a laboratory facility in rural/remote regions. The laboratory is accessed via two self-closing and self-locking doors to restrict and control entry. It does not need external electricity, nor does it need any water or sewage connections. Its self-sufficient 65 kW power supply with its 1 000 ℓ diesel fuel tank supplies the required power. The laboratory has an internet connection and a satellite phone to ensure that the data is available online, therefore it can be monitored and controlled remotely. It has a high-security sealed cubicle at the entrance and negative pressure is guaranteed in all spaces. The laboratory has two biological safety cabinets and an autoclave for sterilisation and safe disposal of wastes. Freezing and storage of cryosamples inside the laboratory are facilitated by a 300 ℓ liquid nitrogen tank.

Uwe Schoen, the Biomedhelix director who was involved in the original engineering of the mobile laboratory said, "In my view, this BSL-3 laboratory can play a significant role in the diagnosis of animal diseases and in this way obtain optimal health for people, animals and the environment, universally known as the One Health concept". The opening of the BSL-3 was attended by various dignitaries from veterinary services and other professions. The BSL-3 is stationed at the Western Cape Provincial Veterinary Laboratory which is itself a BSL-2. The addition and promulgation of the BSL-3 will now make it possible to test for diseases that require such a facility, including tuberculosis and highly pathogenic avian influenza.

The BSL-3 is an important facility for the Western Cape Government and the people of South Africa. The unveiling of this mobile laboratory will now make it possible for South Africa to be able to perform tests for dangerous pathogens. It will facilitate the cooperation of all disciplines in promoting the One Health concept to make South Africa's health system "stronger together". AP

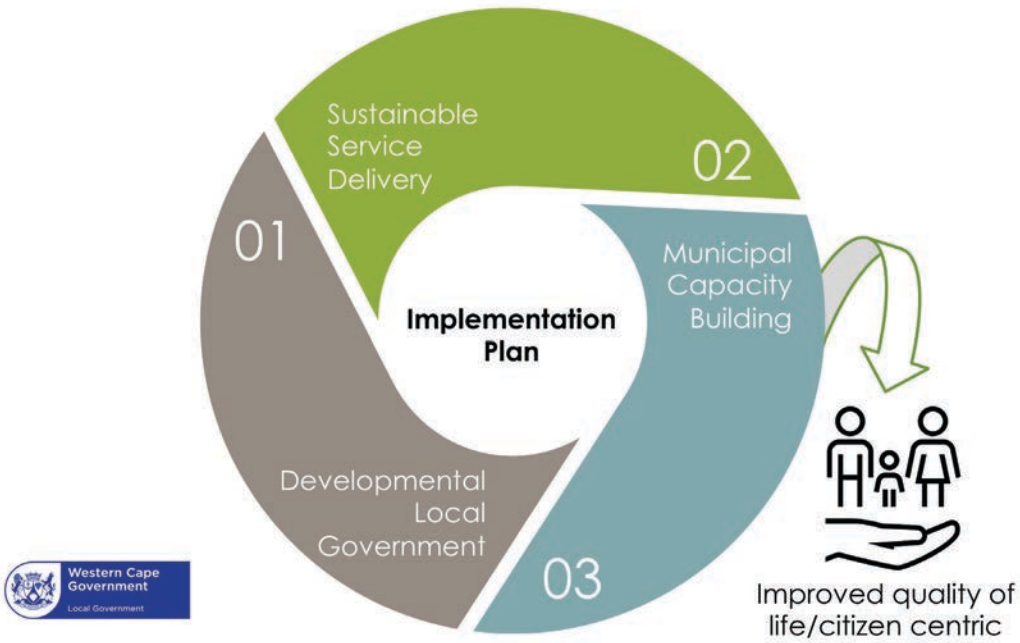
JOINT DISTRICT APPROACH (JDA): A NEW INTERGOVERNMENTAL COOPERATIONAL MODEL

by Japie Kritzinger, japiek@elsenburg.com

During the past 10 years the Department of Local Government (DLG) has introduced a number of initiatives to improve the cooperation and alignment of planning between the provincial and local government spheres in the Western Cape. In August 2010, it started with biannual integrated development plan (IDP) indabas, which led to joint planning initiatives (JPIs) later in October 2014. These JPIs were priorities identified in the various municipal areas and which were agreed upon between the two spheres of government during these engagements.

Both these initiatives arguably varied in terms of its success, taking into account that the main purpose thereof was to align planning priorities between the provincial and local government spheres. This will eventually result in faster service delivery on ground level.

The core objectives forming the rationale behind the JDA concept.



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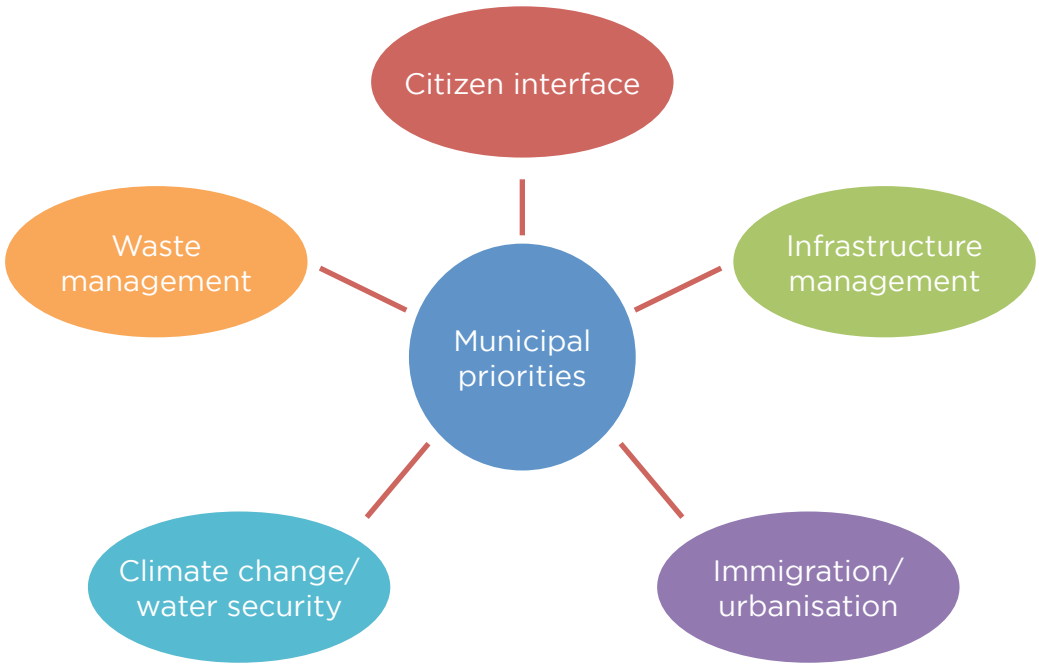
During 2019 the National Department of Cooperative Governance and Traditional Affairs (CoGTA) launched the joint district approach (JDA) as the new model for arranging intergovernmental relations and cooperation among the three spheres of government. The launch of the Western Cape Joint District Approach took place at Goudini Spa on 5 November 2019 and all municipalities and provincial sector departments were present. At this event the Head of Department of Local Government, Graham Paulse, shared the JDA context and rationale behind this initiative with the audience.

At its core, the mechanics of this model rest upon a strong institutional structure with dedicated officials serving on the various platforms. The whole ideology of the JDA model rests upon the assumption that effective coordination and monitoring of planning priorities should be done on district level. For this, the DLG has established district interface teams that will meet on a regular basis to discuss/coordinate and monitor the priority projects of mutual interest among the different local authorities in the specific district and the implicated or responsible provincial sector departments. District interface teams will be led by a team leader (a senior manager allocated by DLG), while each department will have a departmental representative in support of the team leader.

In addition to the above, the respective district coordinating forums (DCF) (each chaired by the mayor of the district municipality) will play a crucial role in monitoring the work and progress of the district interface teams. DCF meetings should ideally be scheduled once a quarter in accordance with the requirements set out in terms of the Intergovernmental Relations Framework Act of 2005, thereby also

Five common priorities in the Western Cape municipalities.



Some elements that the district implementation plans will include.

- Previous provincial–municipal planning engagements: matters remaining
- All to agree on principles to be applied for the inclusion of projects, e.g. Catalytic projects to ensure citizens' growth and prosperity only which means... and strategic vs operational
- Identify the risks
- Rural vs urban

An example:

Municipal priority	Sub themes	Context/ background	Municipality	Project/s	Activities	Department/s	Time-frame	Progress to date, including on capital spending
Provincial priority – jobs and economy								
Waste management								

> The whole ideology of the JDA model rests upon the assumption that effective coordination and monitoring of planning priorities should be done on district level.

providing a constant monitoring mechanism on the highest possible level at the local sphere.

As a first step in this process, the DLG will draft and finalise a district implementation plan for each of the five districts in the Western Cape. The role of the interface teams will therefore be to guide the co-planning, co-budgeting and co-implementation within the district. In addition, it will also promote the coordination and collaboration across all departments and within the district to minimise duplication.

The Department of Agriculture immediately showed its commitment towards this process and has appointed at least three dedicated officials for each district, which includes a senior manager for each of the districts.

It is now nearly 20 years since December 2000, when the current 30 municipal boundaries were demarcated and the new municipal dispensation was established in the Western Cape. During these first few years a range of new legislation was passed in parliament, putting local authorities on the forefront of not only basic service delivery, but also giving municipalities an extended mandate to cater for the socio-economic needs of communities. It is sincerely hoped that the latest joint district approach will promote faster and more effective service delivery to mostly the needy communities of the Western Cape. Only time will tell.

Thank you to all the officials from the Western Cape Department of Agriculture allocated to the respective district interface teams for embracing this initiative. AP

An introduction to **vegetation indices for agriculture**

by Dr Mike Wallace, mikew@elsenburg.com

The use of vegetation indices such as the well-known NDVI (normalised difference vegetation index) is not new in agriculture. Some of our farmers have been using NDVI analyses based on satellite imagery for decades. However, the availability of free satellite imagery from organisations such as NASA and the European Space Agency, plus the proliferation of drone service providers offering vegetation analysis, have led to renewed interest in applications of this technology. The principles remain similar, whether the platform is a satellite, aircraft, drone, or even an in-situ sensor.

The sensors on board the various platforms can quantify what fraction of photosynthetically active radiation is absorbed by vegetation. The more the plant is absorbing in the visible sunlight, the more it is photosynthesising and therefore being productive. Also, healthy vegetation reflects strongly in the near infrared (NIR) wavelengths. The NDVI uses this phenomenon to provide a measurement of this photosynthetic productivity. In Figure 1, healthy vegetation absorbs most of the visible red light and strongly reflects in the near-infrared band (high NDVI value). Conversely, the unhealthy brown plant reflects much of the visible light and absorbs more of the NIR band (low NDVI value).

The reflectance in the various wavebands is measured by sensors on the various platforms. The downloaded data are then processed by remote sensing specialists. The spectral response (or reflectivity) of vegetated areas is confounded by a complex mix of vegetation and plant density, soil colour and brightness, environmental effects, soil moisture, aspect, shadows, and atmospheric influences. With the advent of cloud computing and web portals, the processing complexities can be hidden from the end user who can now very simply access the final vegetation index product. Behind the scenes, processes are carried out to correct for atmospheric effects, position the image geographically (georectification), correct for any other aberrations, and, in the case of satellite data, mask cloud cover. To reduce the impact of cloud cover, many satellite NDVI products are accumulated over a 10- or 16-day period, within which time the maximum value is chosen for each pixel in the image. These composite images are therefore mostly free from the impact of clouds. Although drone imagery should be free of cloud cover there may be reflectivity influences from cloud shadows that should be corrected for.

Figure 1: Healthy plant (A) is absorbing strongly in the visible spectrum and reflecting 50% of near infrared light, in contrast to the unhealthy plant (B) that is reflecting 30% of visible light and reflecting less than plant A in the near infrared band. This phenomenon results in a considerably higher NDVI calculated for plant A (0,72), compared to plant B (0,14). This is the basis of NDVI mapping (drawing by A van Ravenswaay).

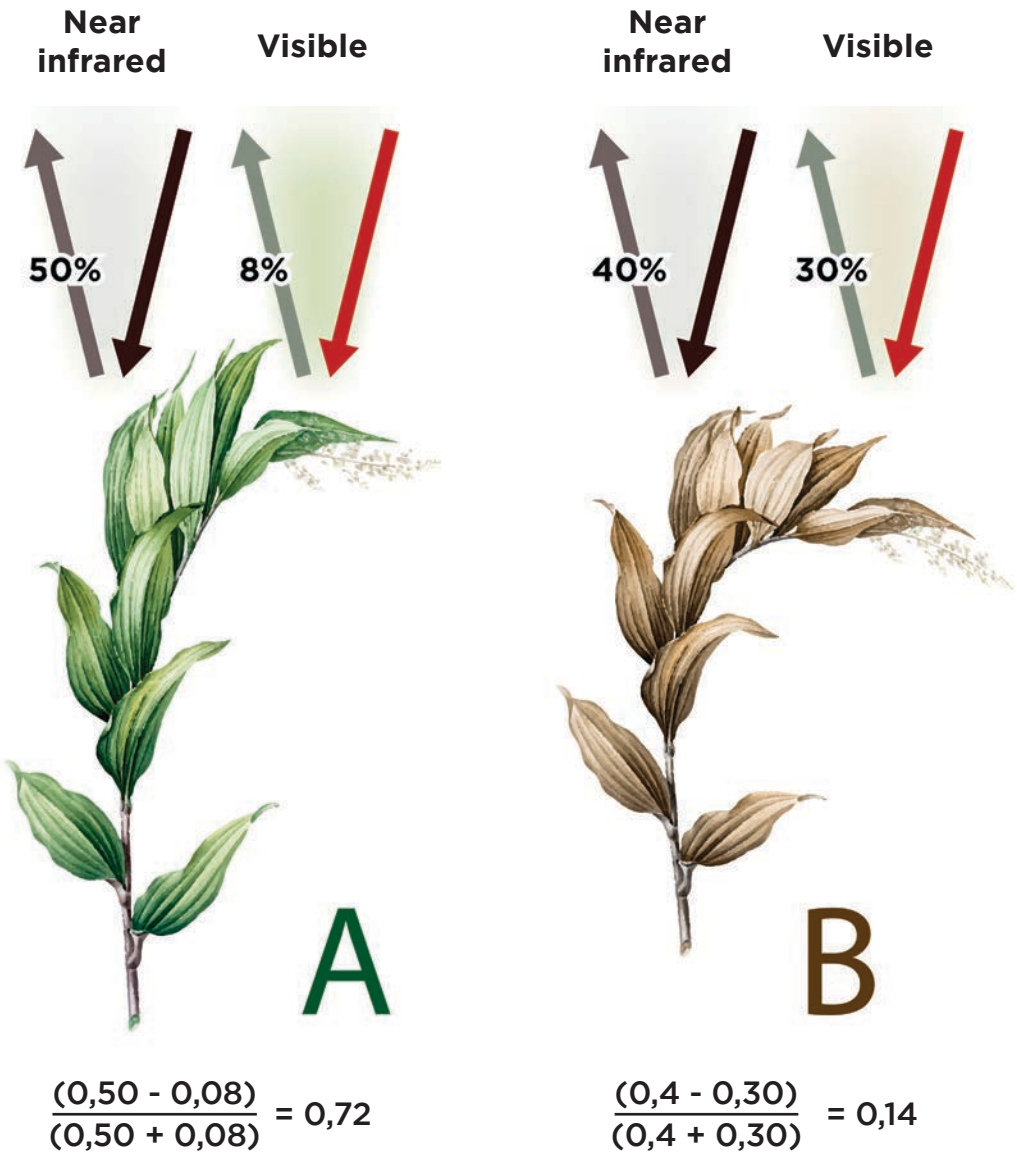


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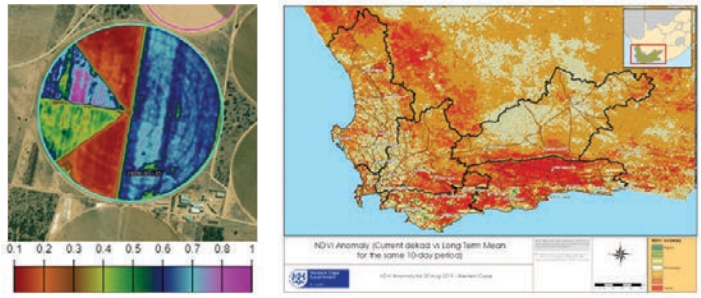
Figure 2: Two examples of vegetation indices at vastly different scales, from different sensors. The image on the left is a Sentinel-2 EVI showing variation in growth on a centre pivot, while the NDVI anomaly image on the right (from the Proba-V satellite) shows the extent to which prevailing vegetation conditions differ from the long-term mean for the same 10-day period.



The NDVI is only one of many vegetation indices that have been developed for agriculture. Others have been developed to minimise the effects of some of the above factors and to focus on specific aspects of agricultural monitoring. For example, the enhanced vegetation index (EVI), whilst similar to the NDVI, has been developed with a few extra input parameters. These help correct for distortions due to variable atmospheric conditions (haze, aerosols) as well as ground cover factors. It has the advantage that the signal does not become saturated as easily as the NDVI where crop canopies are lush and full. Therefore, it can often still detect variation within a full canopy, where the NDVI would be uniform at maximum value. Similarly, the soil-adjusted vegetation index (SAVI) was developed to minimise variations caused by variations in soil brightness and may produce better results than the NDVI in certain circumstances.

One of the fundamental applications of the NDVI (and other indices) is to regularly compare current conditions with previous seasons or with a long-term average of vegetation responses for a particular period. These differences (either in map or statistical form and known as anomalies) give us insight into the extent that current conditions differ from "normal" conditions. Obviously, to establish this long-term average, we need to have a reasonably long time-series history covering the range of vegetation conditions encountered. This is the basis of the vegetation maps that the department uses to help assess vegetation and drought conditions in the province (together with local knowledge and field visits). The use of vegetation indices can be applied at many different scales (Figure 2); from regional maps, right down to field, centre-pivot, and orchard (or even individual trees within an orchard if a high-resolution commercial sensor and drone platform is used). A future article will deal with some of these scale issues as well as the pros and cons of drone- vs. satellite-based sensors.

The department has made a simple web portal available that facilitates non-expert access to free Sentinel-2 and Landsat data and to explore various vegetation indices such as the NDVI, EVI, SAVI and many others. (Sentinel-2 being new, only has three previous seasons to which current conditions can be compared.) URL: gis.elsenburg.com/apps/s2v/. (See *AgriProbe* Vol 16 No 2 of 2019) AP

DYNAMIC QR CODES

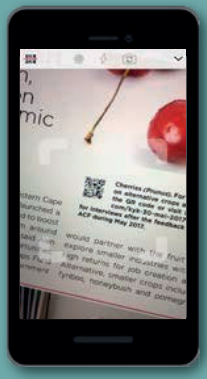
AgriProbe readers will be familiar with the QR codes that appear a number of times in the magazine as a fully integrated content and marketing solution across print and digital platforms. But not everyone knows what they are or how to use them.

A QR code (an abbreviation for Quick Response Code) is a square two-dimensional barcode that was originally designed for use in the automotive industry in Japan. The barcode is machine-readable, which means you can capture the QR code by means of a scanner app on a smartphone.

This low-tech solution is extremely useful as it makes it possible for you to access interactive material that will enhance your experience of text – for example, if *AgriProbe* runs a story on alternative crops and its uses, you will be able to see a video of the interviews simply by pointing your smartphone at the QR code in question. No effort required!

STEP 1

The first step is to download a scanner app from the app store on your phone (simply type in 'QR reader' and a variety of scanners will appear in the menu).



STEP 2

Once you have downloaded the app, open the app on your smartphone.

STEP 3

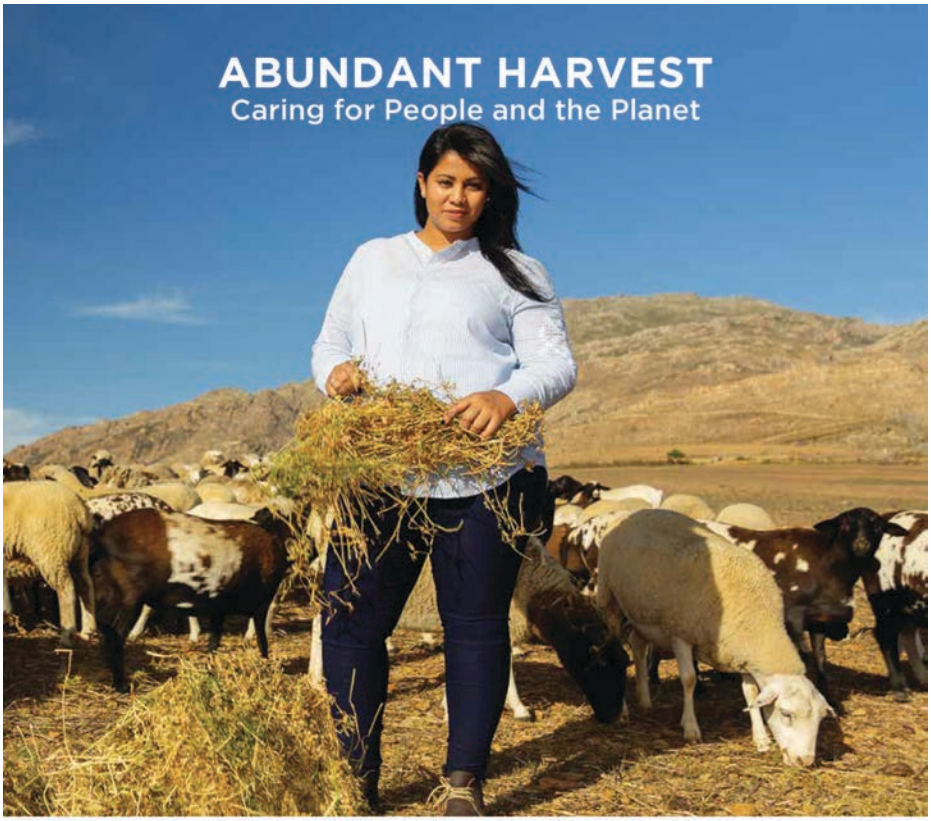
Point your smartphone's camera at a QR code appearing on the page of t he magazine.

STEP 4

Wait while the camera captures the barcode and directs you to the desired video or website.

Book highlights **sustainable resource initiatives in agriculture**

Giselle Terblanche, gisellet@elsenburg.com



The Western Cape Department of Agriculture recently launched the seventh book in its *Abundant Harvest series, Caring for People* and the Planet. Joyene Isaacs, head of the department at the time the book was written, had a vision to tell the good stories in agriculture that people often do not hear about. This vision came to fruition in the *Abundant Harvest* coffee-table book series.

Agriculture's dependence on natural resources and the sustainable management thereof lie close to her heart. Raising awareness about the fine balance between economic productivity and sustainability is critical at a time of increasing frequency and intensity of climatic disasters. As such, it was appropriate to look at the department's efforts in adapting to this impact and building resilience to climate change as an ideal topic for the seventh book in this series.

> Effective sustainable resource management nourishes agriculture.

Ashia Petersen, head of the Sustainable Resource Management Programme of the department, says her programme is committed to adapting to and building a climate change-resilient agricultural sector, through building healthy agro-ecosystems. "We try and stay relevant by proactively monitoring and evaluating the environmental risks and providing support in the event of a disaster. We encourage people to read about some of our successful interventions in this issue of the *Abundant Harvest*".

These include the removal of alien vegetation, helping farmers with effective and efficient water management, assistance with post-disaster recovery after fires, continuous monitoring of veld conditions as part of an early warning system, protecting the fragmentation and loss of agricultural land, and many more. The book also shows how communities are encouraged to take charge of managing their own resources. The community-based natural resource management (CBNRM) approach has seen many successes in the Western Cape.

According to Ms Isaacs, looking after our planet and our natural environment takes dedication and commitment. "The people in this publication demonstrate both those qualities, as well as a determination that can only be admired and applauded. We must take care of our planet. These stories highlight the behaviour and actions that are required."

"The agricultural sector, including workers and agri-workers, needs to focus on how the management of our natural resources affects the quality of life and food security for both present and future generations. Effective sustainable resource management nourishes agriculture, the lifeblood of the Western Cape's rural economy," says Dr Ivan Meyer, the Western Cape Minister of Agriculture.

If you would like to receive a copy of this book, download it online at **elsenburg.com** or request a hard copy by emailing Giselle Terblanche at GiselleT@elsenburg.com AP

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Amino acid composition, anti-nutritional factors and digestible energy content of **alternative grain legumes in pig diets**

An investigation into the potential use of **cannabis-based medications in veterinary medicine**

Scientific publications published in peer-reviewed journals in the field of Animal Science: **2016 to 2017**

Amino acid composition, anti-nutritional factors and digestible energy content of **alternative grain legumes in pig diets**

by T.S. Brand[1, 2, #], N. Smith[2] & L. Jordaan[2]

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Abstract: Samples of narbon beans, faba beans, field peas and lupins were collected in the Western and Southern Cape grain-producing areas of South Africa. Samples were analysed for amino acid, alkaloid, tannin, non-starch polysaccharides, starch and digestible energy contents and were compared as alternative protein sources for pigs. Faba beans, narbon beans and peas had significantly less threonine, serine, glycine, alanine, methionine, isoleucine, leucine, phenylalanine and histidine than the lupin cultivars. The *L. albus* lupin cultivar had significantly higher valine and tyrosine values than the other legumes. The alkaloid content of the lupins varied significantly between the sweet and bitter lupin varieties. The sweet *L. angustifolius* cultivars contained 49,1 mg alkaloids per kilogram dry matter and the bitter cultivars 15 204,5 mg alkaloids per kg dry matter. The faba beans, narbon beans and peas had significantly higher values for tannins and starch compared to lupins. The tannin content of the faba bean cultivars was 4,8 g/kg dry matter and the starch content 378,4 g/kg dry matter. The tannin content of the narbon bean cultivars was 2,6 g/kg and the starch content 355,5 g/kg dry matter. The tannin content of the pea cultivars was 3,5 g/kg dry matter and the starch content 388,0 g/kg dry matter. The lupin cultivars *L. angustifolius* (31,0 g/100 g) and *L. albus* (25,8 g/100 g) contained significantly more non-starch polysaccharides than the other crops tested. The lupin cultivars *L. luteus* (15,9 MJ/kg dry matter) and *L. albus* (14,2 MJ/kg dry matter) had significantly higher digestible energy values for pigs compared to the other legumes tested in this study. Narbon beans, faba beans, field peas and lupins can be used as alternative protein sources in pig diets in limited amounts.

Introduction

Feed formulations for monogastric animals are very complex due to the variety of feedstuffs available on the market and the specific requirements of the animals. Feed cost is the limiting factor in animal nutrition due to competition for the use of food/feed ingredients by humans and animals, especially pigs, as they have similar amino acid requirements (Adeniji & Azeez, 2008). Soya bean meal (SBM) is the most sought-after plant protein source for use in livestock feeds, despite being an expensive ingredient.

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Feed industries are continuously seeking alternative protein sources that are cost-effective. This has led to interest in the nutritive value of grain legumes (narbon beans, faba beans, field peas and lupins) as potential alternative protein sources (Florou-Paneri *et al.*, 2014). Grain legumes are grown in rotation systems due to their ability to fixate nitrogen in the soil. However, the use of grain legumes in monogastric nutrition has been limited due to the presence of secondary plant metabolites called anti-nutritional factors (ANF) (Jezierny *et al.*, 2010). ANF are compounds that reduce the utilisation of nutrients and/or feed intake (Soetan & Oyewole, 2009). Among the most important ANF in legume seeds are protein protease inhibitors (PI), lectins, saponins, phytates, alkaloids, tannins, and non-starch polysaccharides (NSP). Very little information is available on some of the more unconventional protein sources, regarding their nutritive values to pigs and the ANF contents.

The narbon bean (*Vicia narbonensis*) is a leguminous species that can be used for grain and straw production, or as a source of animal feed. The crude protein content of the grain varies from 26% up to 32% (Abd El Moneim, 1992).

The faba bean (*Vicia faba*) is an annual legume that is cultivated in regions with mild winters and adequate summer rainfall and is an important food legume in China, Egypt, Italy, Ethiopia, and Brazil (Adsule & Akpapunam, 1996). Faba beans have proven to be extremely adaptable and can be cultivated successfully in the Western Cape. They are well established as an ingredient in horse and ruminant diets, but recently have been given attention as a protein supplement in the diet of pigs (Blair, 2007). Raw faba beans are known to contain anti-nutritional factors such as protease inhibitors and tannins. In Australia, where the faba bean has been used for a number of years as a rotation crop with wheat, it is regarded as an important alternative to lupins. Apart from having the same beneficial effect on the soil, the faba bean has several additional advantages in that it appears to be more resistant to root diseases, has a high seed yield, and produces palatable protein-rich forage, which may be either grazed or ensiled (d'Hangest d'Yvoy, 1990).

Field peas are a good alternative in the cold season for regions not suited to grow soya beans. They are less sensitive to frost and may tolerate low temperatures (Miller *et al.*, 2002). Peas originated in the Middle East but are now grown in more temperate climates and can be found in Russia, China, Northern Europe, the north-western states of the USA, and the Prairie province of Canada (Castell, 1987). They have been well established in human diets and there is an increased use of field peas in pig nutrition (Blair, 2007). Potential ANFs found in peas include amylase, trypsin and chymotrypsin inhibitors, tannins (proanthocyanidins), phytic acid, saponins (hypocholesterolemic factors), hemagglutinins (lectins), and oligosaccharides.

Lupins are an important rotation crop in the grain-producing areas of the Western Cape and 10 000 tonnes of lupins are cultivated each year. Lupins have been used as a feed ingredient in ruminant diets, as well as for pigs and poultry; especially the *Lupinus albus*, *L. angustifolius* and *L. luteus* cultivars that have been adapted to contain lower alkaloid levels (Kim *et al.*, 2007). The utilisation of lupin seeds for domestic monogastric animal feeding is, however, limited by the presence of the bitter alkaloids that they contain.

The chemical composition and energy content (poultry and ruminants) of these legume cultivars have already been published by Brandt (1998) and Brand *et al.* (2004). The objective of the present study is to quantify the variation in anti-nutritional

factor content, amino acid composition and digestible energy value for pigs of different cultivars of grain legumes that are produced in the Western Cape.

Materials and methods

Two samples of each grain legume cultivar were collected annually in the Western Cape and Southern Cape grain-producing areas of South Africa and pooled over a two-year period. The cultivars that were selected for analysis are presented in Table 1.

The samples were analysed for amino acid content after hydrolysis in a sealed tube on a Beckmann Model 6300 amino acid analyser. The alkaloid content of the grain legumes was determined by spectrophotometry as described by Von Baer *et al.* (1978). This method is a quantitative determination of total alkaloids with bromocresol purple at 405 nm. The tannin content was determined by the modified Jerumanis procedure (Daiber, 1975). The non-starch polysaccharides content was determined by the method described by Englyst & Cummings (1988). The starch content was determined with spectrophotometry (MacRae & Armstrong, 1968). The digestible energy content was determined by the mobile nylon bag technique described by Brand *et al.* (1989). The DE values for pigs were corrected for over-estimation by the regression equation (y = 1,998 + 0,788x) of Brand *et al.* (2000). The amino acid, alkaloid, tannin, non-starch polysaccharides, starch and digestible energy contents were compared between grain legumes by analysis of variance using Statgraphics 5,0 (1991) and reported as least squared means with standard error on a dry matter basis.

Table 1: Grain legumes and cultivars selected for comparison of the anti-nutritional factor content

Grain legume	Cultivar
Narbon beans	ACT60188
Faba beans	Ascot
Peas	Glenroy
Peas	Alma
Lupinus albus	Astra
Lupinus albus	Buttercup
Lupinus albus	Hamburg
Lupinus albus	Kiev
Lupinus albus	Esta
Lupinus albus	Vladimir
Lupinus angustifolius	Moredou
Lupinus angustifolius	Eureka
Lupinus angustifolius	Helderberg
Lupinus angustifolius	Merrit
Lupinus luteus	Juno
Lupinus luteus	Borsaja

Results

Significant differences were found in the amino acid contents of the various grain legumes (Table 2). Faba beans, narbon beans, and peas had significantly less threonine, serine, glycine, alanine, methionine, isoleucine, leucine, phenylalanine, and histidine than the lupin cultivars. The *L. albus* lupin cultivar had significantly higher valine and tyrosine values than the other legumes. There were no significant differences observed for the values of lysine and arginine in the various grain legumes.

Low alkaloid levels were observed in the narbon bean (0,0 mg/kg), faba bean (0,0 mg/kg), pea (0,0 mg/kg), sweet *L. angustifolius* (49,1 mg/kg) and *L. luteus* (42,6 mg/kg) samples, which did not differ from each other (P >0,05) (Table 3). The *L. albus* and bitter *L. angustifolius* cultivars had higher (P ≤0,05) alkaloid levels than the other legumes, although the alkaloid levels

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Table 2: The total amino acid values, as percentage of dry matter, for narbon beans, faba beans, peas, and different lupin cultivars

Crop	Narbon	Faba	Peas	*L. angustifolius*	*L. luteus*	*L. albus*
Number of samples	2	2	4	8	4	12
Crude protein (g/kg)	237	260	247	339	394	382
Lysine (g/kg)	13,6 ± 1,5	12,9 ± 2,1	14,4 ± 1,5	14,8 ± 0,8	17,9 ± 1,5	16,7 ± 0,7
Methionine (g/kg)	1,0^{a} ± 0,1	1,0^{ab} ± 0,2	1,4^{bc} ± 0,1	1,2^{ab} ± 0,1	1,8^{c} ± 0,1	1,6^{c} ± 0,1
Threonine (g/kg)	6,9^{ab} ± 1,0	6,8^{a} ± 1,5	7,1^{ab} ± 1,0	9,6^{ac} ± 0,6	10,6^{acd} ± 1,0	11,8^{d} ± 0,5
Arginine (g/kg)	18,8 ± 9,4	24,1 ± 13,2	23,7 ± 9,4	38,3 ± 5,0	20,2 ± 9,4	38,2 ± 4,2
Serine (g/kg)	8,6^{a} ± 1,6	8,8^{a} ± 2,2	9,0^{a} ± 1,6	1,4^{b} ± 0,8	1,6^{b} ± 1,6	1,6^{b} ± 0,7
Glycine (g/kg)	7,8^{a} ± 1,8	9,3^{ab} ± 2,5	4,6^{a} ± 1,8	13,3^{b} ± 0,9	14,1^{b} ±1,8	14,4^{b} ± 0,8
Alanine (g/kg)	8,0^{ab} ± 1,5	8,2^{abc} ± 2,1	4,5^{a} ± 1,5	10,1^{bc} ± 0,8	11,2^{bc} ± 1,5	11,3^{c} ± 0,7
Valine (g/kg)	11,0^{a} ± 1,5	11,1^{a} ± 2,1	12,0^{a} ± 1,5	14,25^{a} ± 0,8	15,1^{ab} ± 1,5	16,9^{b} ± 0,7
Isoleucine (g/kg)	5,9^{a} ± 1,5	8,2^{ab} ± 2,1	8,3^{abc} ± 1,5	12,3^{bd} ± 0,8	12,8^{bde} ± 1,5	14,6^{e} ± 0,7
Leucine (g/kg)	15,0^{a} ± 2,7	16,0^{ab} ± 3,8	15,7^{a} ± 2,7	22,0^{b} ± 1,4	28,8^{c} ± 2,7	26,6^{c} ± 1,2
Tyrosine (g/kg)	5,3^{a} ± 1,2	6,8^{ab} ± 1,7	6,2^{a} ± 1,2	10,0^{b} ± 0,6	8,6^{ab} ± 1,2	14,1^{c} ± 0,5
Phenylalanine (g/kg)	9,3^{ab} ± 1,1	9,0^{a} ± 1,6	9,8^{abc} ± 1,1	12,0^{acd} ± 0,6	13,2^{d} ± 1,1	13,3^{d} ± 0,5
Histidine g/kg	4,3^{a} ± 0,6	4,3^{a} ± 0,8	4,7^{a} ± 0,6	6,7^{bc} ± 0,3	7,8^{c} ± 0,6	6,4^{b} ± 0,3

$^{a-e}$ Rows means with different superscripts differ (P <0,05)

of *L. albus* did not differ from that of sweet *L. angustifolius* and *L. luteus* cultivars. The bitter *L. angustifolius* cultivar was found to have the highest concentration of alkaloids of all the cultivars that were analysed (15 204,5 mg/kg). The lupin cultivars had lower (P ≤0,05) tannin levels compared to faba beans, narbon beans, and the peas, with faba beans having the highest concentration of tannins (Table 3).

Non-starch polysaccharides that were tested during the analysis included xylose, arabinose, galactose, and glucose, as well as the total NSP concentration (Table 4). Lupin cultivars had higher (P ≤0,05) NSP levels compared to the other grain legumes. Mannose levels were also analysed with all the cultivars containing below 0,4 g/100g. The *L. luteus* cultivar had a total NSP concentration similar to that of

Table 3: Total alkaloid and tannin content of the selected grain legumes for comparison

Cultivar	No. of samples	Total alkaloids (mg/kg)	Tannin (g/kg)
Narbon beans	2	$0{,}0^{ab} \pm 589{,}7$	$2{,}6^{b} \pm 0{,}4$
Faba beans	2	$0{,}0^{ab} \pm 589{,}7$	$4{,}8^{d} \pm 0{,}4$
Peas	4	$0{,}0^{a} \pm 417{,}0$	$3{,}5^{c} \pm 0{,}3$
L. albus	12	$1302{,}2^{bd} \pm 240{,}8$	$0{,}0^{a} \pm 0{,}1$
Sweet *L. angustifolius*	6	$49{,}1^{abc} \pm 373{,}0$	$0{,}0^{a} \pm 0{,}2$
Bitter *L. angustifolius*	2	$15204{,}5^{e} \pm 589{,}7$	$0{,}0^{a} \pm 0{,}4$
L. luteus	4	$42{,}6^{ab} \pm 589{,}7$	$0{,}0^{a} \pm 0{,}3$

$^{a-e}$ Column means with different superscripts differ (P <0,05)

Table 4: The non-starch polysaccharide values for narbon beans, faba beans, peas and different lupin cultivars

Cultivar	No. of samples	Xylose (g/100g)	Arabinose (g/100g)	Galactose (g/100g)	Glucose (g/100g)	Total NSP (g/100g)
Narbon beans	2	$1{,}25^{a} \pm 0{,}47$	$2{,}75^{a} \pm 0{,}37$	$0{,}54^{a} \pm 0{,}83$	$9{,}65^{bc} \pm 1{,}08$	$14{,}17^{a} \pm 5{,}18$
Faba beans	2	$1{,}69^{a} \pm 0{,}47$	$2{,}16^{a} \pm 0{,}37$	$0{,}43^{a} \pm 0{,}83$	$9{,}69^{bc} \pm 1{,}08$	$13{,}96^{a} \pm 5{,}18$
Peas	3	$1{,}17^{a} \pm 0{,}38$	$3{,}01^{a} \pm 0{,}30$	$0{,}62^{a} \pm 0{,}68$	$5{,}68^{a} \pm 0{,}88$	$10{,}48^{a} \pm 3{,}66$
L. albus	11	$3{,}59^{c} \pm 0{,}20$	$4{,}01^{b} \pm 0{,}16$	$9{,}48^{c} \pm 0{,}35$	$8{,}71^{b} \pm 0{,}46$	$25{,}80^{b} \pm 2{,}11$
L. angustifolius	8	$2{,}82^{b} \pm 0{,}23$	$4{,}37^{b} \pm 0{,}19$	$12{,}18^{d} \pm 0{,}41$	$11{,}66^{c} \pm 0{,}54$	$31{,}02^{c} \pm 2{,}59$
L. luteus	3	$4{,}12^{c} \pm 0{,}38$	$4{,}00^{b} \pm 0{,}30$	$4{,}43^{b} \pm 0{,}68$	$11{,}13^{c} \pm 0{,}88$	$17{,}77^{a} \pm 3{,}66$

$^{a-d}$ Column means with different superscripts differ (P <0,05)

narbon beans, faba beans, and peas, while the *L. albus* and *L. angustifolius* cultivars contained more (P ≤0,05) NSPs compared to the *L. luteus* cultivar, the narbon beans, faba beans, and peas, with the *L. angustifolius* having the highest concentration of total NSP of the cultivars analysed in this study.

Narbon beans contained significantly less starch than faba beans and peas, with very little to no starch being detected in the lupin cultivars (Table 5). The narbon beans also had the lowest digestibility energy (DE) values for pigs along with faba beans and *L. albus* (Table 5). *Lupinus luteus* was found to have the highest DE value for pigs of 15,92 MJ/kg dry material; this was followed by *L. angustifolius* and peas, which differed from each other (P ≤0,05).

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Table 5: The digestible energy values and starch content of different grain legumes for pigs

Cultivar	No of samples	Starch (g/kg)	Digestible energy for pigs (MJ/kg dry material)*
Narbon beans	2	$355,5^{b} \pm 7,1$	$13,55^{a} \pm 0,35$
Faba beans	2	$378,4^{c} \pm 7,1$	$13,93^{a} \pm 0,35$
Peas	4	$388,0^{c} \pm 5,0$	$14,25^{ab} \pm 0,24$
L. albus	12	$0,0^{a} \pm 2,9$	$14,18^{a} \pm 0,14$
L. angustifolius	8	$0,0^{a} \pm 3,6$	$14,89^{c} \pm 0,17$
L. luteus	4	$0,0^{a} \pm 5,0$	$15,92^{d} \pm 0,24$

$^{a-c}$ Column means with different superscripts differ (P <0,05)

*Determined with the mobile nylon bag technique (Brand *et al.*, 1989)

Discussion

The amino acid content of legumes analysed in this study showed deficiencies in lysine and methionine compared to the values for soya bean oilcake meal. The results of the amino acid analysis in this study were similar to the results obtained for narbon beans by Eason *et al.* (1990) but differed vastly from the results obtained by Hadjipanayiotou & Economides (2001) for narbon beans, faba beans, and field peas. Possible reasons for the difference in results obtained in the mentioned studies could be that different cultivars were used at the time or the plants were exposed to diverse growing conditions .

Alkaloid levels in raw materials are of importance when feeding monogastric animals as they are sensitive to low levels in feeds. Pearson & Carr (1977) observed feed rejection when the alkaloid content of the diets exceeded 0,03%. Erickson & Elliot (1984) found that the growth performance of pigs declined when the rations contained 0,04% alkaloids. Alkaloids either reduce or prevent intake of feeds by animals if the alkaloid concentration exceeds the animal's tolerance level. The alkaloid levels in lupins vary from 1 mg/kg to 50 000 mg/kg; sweet lupin seed is referred to as sweet due to it containing very low levels of alkaloids. It is therefore advised that bitter lupins produced in South Africa as well as alkaloid containing *L. albus* should not be used in monogastric feeds, as the study has shown that these feedstuffs contain high alkaloid levels (Table 3).

Tannins, or pro-anthocyanidins, are polyphenolic compounds that inhibit the activity of digestive enzymes including trypsin, amylase, and lipase (Yutste *et al.*, 1991). It is therefore suggested that the levels of especially faba beans are limited in diets of young animals and birds. Faba beans contain between 0,3% and 0,5% tannins (Kadirvel & Clandinin, 1974). Peas have been found to contain about 0,2% tannins, 4,8% pentosanes and no alkaloids (Jacyno *et al.*, 1992). The presence of these tannins may lead to a slight reduction in feed intake when high levels of faba beans are fed to swine (Singleton & Kratzer, 1969). Similarly, high inclusions of peas in pig diets could lead to a reduction in feed intake. In addition, tannins may inhibit the retention of certain dietary nutrients (McLeod, 1974; Marquardt *et al.*, 1976). Factors such as plant origin,

plant variety, the degree of processing and the proportion of NSP-rich hull in the final product determine the NSP content of vegetable proteins. The most important NSP constituents of the plant cell walls are pectic polysaccharides, which contain rhamnogalacturonan, arabinans, galactans, and arabinogalactans (Arora, 1983). Other neutral polysaccharides in vegetable proteins include cellulose, xylans, arabinoxylans, and glucoxylans. These structures are predominantly found in the hull fraction with only a small proportion present in the cotyledon (Kocher, 2001). Due to the negative relationship between the NSP content and digestibility levels of most grain legumes, the NSP levels should be limited, particularly in the diets of young animals. Faba beans also contain 3,2% pentosans (Jacyno *et al.*, 1992), which contribute part of the NSP content of the beans. When lupins are fed to monogastric animals, there is a need to account for the specific physiological effects of dietary fibre components such as oligosaccharides and soluble NSP. The non-starch polysaccharides may be subdivided into soluble and insoluble fractions. The former is soluble in water and include gums, pectins, mucilages, and some hemicelluloses. The insoluble fraction includes cellulose and most of the hemicelluloses (McDonald *et al.*, 1995). Monogastric animals cannot digest non-starch polysaccharides, as mammalian intestinal mucosa lack α-galactosidase activity. However, bacteria in the lower intestinal tract can metabolise these sugars to carbon dioxide, hydrogen and methane, resulting in flatulence. Much of the carbohydrate found in lupins is digested by microbial fermentation in the cecum

Photo: Wikimedia Commons.

Field peas, ***Lathyrus hirsutus.***

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and proximal colon (King, 1990). Due to high levels of non-starch polysaccharides in lupins, digestible energy (DE) may not be the most appropriate measure of the available energy content of lupins for pigs. This is due to a large proportion of the carbohydrates from lupins being digested in the hindgut (Traverner *et al.*, 1983). Different lupin species contain different levels of glycosides varying from 0,4 mg to 9,6 mg HCN/100 g (Todorov *et al.*, 1996). Some cultivars can contain up to 7,3% pentosanes, which are indigestible for pigs and poultry (Jacyno *et al.*, 1992). Evans *et al.* (1993) found that *L. angustifolius* contain approximately 4,7% arabinose and 3,6% xylose, which are the most important pentosanes in *Lupinus* species.

In this study, as well as in studies by Evans (1994), it was concluded that there is virtually no starch in lupin species. The main carbohydrate reserves are the non-starch polysaccharides, with the main components being galactose, arabinose, glucose, mannose, rhamnose, uronic acids, and xylose (Evans, 1994). Lupin hulls are predominantly composed of structural polysaccharides, namely cellulose, hemicelluloses, and pectins (Brillouet & Riochet, 1983; Evans, 1994).

The narbon beans, faba beans and *L. angustifolius* samples had significantly lower ($P \leq 0,05$) DE values for pigs compared to the lupin cultivars in this study. The lupin cultivars *L. luteus* (15,9 MJ/kg dry matter) and *L. albus* (14,2 MJ/kg dry matter) had higher ($P \leq 0,05$) DE values for pigs compared to the other legumes tested in this study. However, as stated previously, DE may not be appropriate to describe the energy content of lupins, as they contain virtually no starch and are high in structural NSP which cannot be fully utilised by pigs. The narbon beans also had the lowest DE values for pigs, although the value was only slightly lower than that of the other legumes.

Conclusion

It can be concluded that the use of grain legumes as a protein source in pig diets may be limited due to rather low concentrations of methionine and lysine. There is great variability in alkaloid content of various lupin species, and these should therefore be analysed before use due to the detrimental effect of alkaloids on utilisation of lupins. It is also clear that the lupin species *L. albus* and *L. angustifolius* contained significantly more NSPs compared to the lupin species *L. luteus*, narbon beans, faba beans and peas. NSPs will negatively affect the nutritional value of the *L. albus* and *L. angustifolius* lupin species. These carbohydrates are not digested by the endogenous enzymes of monogastrics, but rather digested in the lower digestive tract by microflora present in the ileum and ceca. The lupins contained no tannins and no starch when compared to the other legumes in this study. Faba beans had the highest tannin content, significantly higher than that of narbon beans and peas. The high starch value of the faba beans, narbon beans, and peas improves their nutritional value to monogastric animals. It can be concluded that narbon beans, faba beans, field peas, and lupins can be included in pig diets as alternative protein sources in limited amounts. Further studies on the palatability of these raw materials are necessary. Processing methods such as physical and heat treatments or enzyme supplementations can further improve the feeding value of grain legumes to pigs and should therefore also be evaluated.

Scan the QR code for the list of references used.

An investigation into the potential use of **cannabis-based medications in veterinary medicine**

by Dr Willem Christiaan Basson (BSc Agric, BVSc)

Introduction

Cannabis is a genus of flowering plants in the family Cannabaceae. It is indigenous to central Asia and three sub-species may be recognised: *Cannabis sativa*, *Cannabis indica*, and *Cannabis ruderalis*. Cannabis has an extensive history of medicinal purposes and as a recreational drug. It is a well-known fact that cannabis has been used for thousands of years across multiple cultures and religions worldwide. The first evidence of medicinal cannabis can be found in ancient China, followed by the Greeks, Romans, and early Christian sects in Ethiopia. In veterinary medicine cannabis can be used as an anti-emetic, anxiolytic, anti-inflammatory and analgesic (Hartsel *et al*., 2019). Trichomes are glands found on female plants that produce a resinous material with many cannabinoid precursors and terpenes having varying pharmacological properties. The body also produces its own cannabinoids called endocannabinoids which have various regulatory functions. THC (Δ9–tetrahydrocannabinol), CBD (Cannabidiol), and CBG (Cannabigerol) are the main cannabinoids and they form from cannabinoid precursors by means of a decarboxylation reaction catalysed by the application of heat. All three of these cannabinoids have medicinal properties with THC being well-known to be the main cannabinoid that exhibits behavioural and psychotropic effects. Cannabis plants can be classified according to "chemovar" or chemical variety (Reimann-Philipp *et al*., 2019). These are: Type I, THC-predominant, which is prevalent in recreational markets due to its mind-altering effects, Type II, which contains both THC and CBD, and CBD-predominant Type III. Most authors have introduced the concept of "the entourage effect" to describe the synergy of the chemical constituents of cannabis, noting that a minor chemical component complements the major chemical component, often contributing to the preparation's stability or efficacy.

The endocannabinoid system (ECS)

Russo described the ECS's role as "relax, eat, sleep, forget and protect" (2008). The ECS has a regulatory role over physiological functions in the central nervous system, autonomic nervous system, endocrine network, immune system, gastrointestinal tract and microcirculation. In 1988 specific cannabinoid binding sites in the brain were discovered and investigations revealed a wide distribution of these binding sites throughout the body. They can be found

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in all vertebrates and invertebrates. To date, the best-researched cannabinoid receptors are known as CB1 and CB2. Endogenous endocannabinoids are derivatives of arachidonic acid and resemble other transmitters like prostaglandin and leukotrienes (De Fonseca *et al*., 2004; Hartsel *et al*., 2019). Once produced, endocannabinoids act on cannabinoid receptors of surrounding cells and act as local mediators. The most well-known endocannabinoids are Anandamide (N-arachidonoyl ethanolamine) and 2-AG (2-arachidonoylglycerol). They exert a modulatory effect on the reward system and play a key role in behaviour modification. (Landa, Sulcova & Gbelec, 2016; Atakan, 2012; Grotenhermen & Müller-Vahl, 2012). Endocannabinoids are lipid precursors synthesised on demand and are chemical messengers. Once endocannabinoids release, they return to the presynaptic neuron, where they attach to cannabinoid receptors, inactivating the presynaptic neuron and limiting the number of neurotransmitters released. This influences the message at all levels: transmission, processing and receiving. They are especially active on glutamatergic and GABA-ergic synapses. Endocannabinoids also modulate excitability and synaptic plasticity by influencing potassium conductance and result in changes in synaptic strength. Comprehensively, endocannabinoids seem to act as local messengers that can change synaptic flow and information processing as well as regulating perceptions like nociception.

CB1 receptors predominantly occur in the central nervous system and are the most abundant. CB1 receptors are also found in peripheral tissues like blood vessels, heart, and the pituitary gland (Landa, Sulcova & Gbelec, 2016; Atakan, 2012; Grotenhermen & Müller-Vahl, 2012; De Fonseca *et al*., 2004). Activation of the CB1 receptor directly interacts with various neurotransmitters and neuromodulators in both the CNS and the PNS. The CB1 receptors mainly produce a retrograde inhibitory effect on the release of acetylcholine, dopamine, GABA, histamine, serotonin, glutamate, noradrenaline and D-aspartate (Manzanares, Julian & Carrascosa, 2006). Due to this extensive involvement in these systems and the distribution of CB1 receptors in the brain, they predominantly affect cognition, memory, motor movement, alertness, motivational behaviour, appetite, emotional responses and pain (Grotenhermen & Müller-Vahl, 2012; De Fonseca *et al*., 2004; Hartsel *et al*., 2019). CB2 receptors can be found in immune cells (predominantly in B-lymphocytes), spleen, tonsils, the peripheral nervous system, and to a lesser extent the brain. These receptors in the immune system are responsible for the regulation of cytokine release and in this way can produce an anti-inflammatory response.

Therapeutic possibilities in veterinary medicine

Hemp seed as an animal feed additive

Cannabis seeds have 20% to 25% protein, 20% to 30% carbohydrates, and 10% to 15% insoluble fibre. The seeds contain saturated fatty acids (palmitic, stearic, and oleic acids) as well as unsaturated fatty acids, particularly essential fatty acids (EFA) like linoleic (LA) and alpha-linolenic acid (ALA) (Hartsel *et al*., 2019). LA and ALA are omega-6 and omega-3 fatty acids respectively; they are considered essential fatty acids since they cannot be synthesised in dogs and cats and need to be supplemented via the diet. Since omega-6 promotes the pro-inflammatory eicosanoid cascade, diets rich in omega-3 and poor in omega-6 fatty acids essentially have a reduced pro-inflammatory nutrient profile. Seed oil made from cannabis seeds contain an omega-3 to omega-6 fatty acid ratio of 3:1 (Hartsel *et al*., 2019).

Pain management

Cannabis seems more promising in treating chronic pain or as an adjunct to opioid treatments (Russo, 2019; Manzanares, Julian & Carrascosa, 2006). Usually pain can be inhibited via endogenous anti-nociceptive descending pathways located in the supraspinal central nervous system. These structures are also important sites in opioid-induced analgesia, with CB1 receptors being more numerous than opioid receptors. Cannabinoid receptor agonists work by modulating the nociceptive thresholds, regulating neuronal activity and suppressing nociceptive neurotransmission at the level of the spinal cord and the thalamus. Furthermore, cannabinoid receptors have been observed to be up-regulated in chronic pain models, concurrently the periaqueductal grey area of the brain increases the release of anandamide following the initial painful event (Guindon & Hohmann, 2009; Manzanares, Julian & Carrascosa, 2006). CB2 receptors also work in synergism with opioid receptors. When activated in keratinocytes they stimulate the release of endogenous opioid β-endorphin, which binds to μ-opioid receptors on local primary afferent neurons (Manzanares, Julian & Carrascosa, 2006; Ibrahim *et al*., 2005).

Interactions between cannabinoids and non-steroidal anti-inflammatory drugs (NSAIDs) have been observed (Manzanares, Julian & Carrascosa, 2006; Hosking & Zajicek, 2014; Atalay, Jarocka-Karpowicz & Skrzydlewska, 2019). Like non-steroidal anti-inflammatory drugs, CBD's precursor CBDA selectively inhibited cyclooxygenase (COX)-2 activity. This is due to its carboxylic acid moiety in the chemical structure of CBDA. Furthermore, several NSAIDs up-regulate cannabinoid receptors by inhibiting fatty acid amide hydrolase (FAAH), the main enzyme associated with endocannabinoid metabolism, thus increasing the number of available endocannabinoids. *Cannabis sativa* also naturally produces organic compounds called terpenes, many of which also exhibit anti-inflammatory and neuroprotective properties. The terpenes of interest are α-pinene, β-myrcene and β-caryophyllene, all of which exhibit their anti-inflammatory effects in a CB2 receptor binding manner (Hartsel *et al*., 2019). THC especially demonstrates a significant synergism with opioids like morphine. Cannabinoid receptor agonists can stimulate the synthesis of endogenous opioid peptides, mediating anti-nociception via μ-opioid receptors. THC specifically enhances opioid anti-nociception by activating kappa and delta-opioid receptors (Manzanares, Julian & Carrascosa, 2006). At the cellular level, opioids and cannabinoids are hypothesised to activate descending analgesia through an indirect process of GABA "dis-inhibition", or the suppression of inhibitory GABA-ergic inputs onto output neurons, which constitute the descending analgesic pathway (Palazzo *et al*., 2010; Manzanares, Julian & Carrascosa, 2006; Hosking & Zajicek, 2014).

Anti-emetics

Cannabinoids exert their anti-emetic properties through interactions with the centrally located CB1 receptors associated with vagal afferent terminals and 5-HT3 receptors in the dorsal vagal complex, which mediate emesis. Anandamide, THC, and synthetic cannabinoids initiate an inhibitory effect on the 5-HT3 receptors and pre-synaptically, the release of serotonin, thus inhibiting the nausea/emesis response (Landa, Sulcova & Gbelec, 2016; Grotenhermen & Müller-Vahl, 2012). This is in contrast to conventional anti-emetics, which exert their effect by antagonising the receptors of emetogenic substances, such as dopamine, serotonin, acetylcholine, and substance P. The cannabinoid anti-emetic properties have recently gained significant

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interest due to their ability to act on both acute and delayed phases of emesis, as well as their broad-spectrum effectiveness ranging from oncologically induced nausea to motion sickness and bacterial toxin-induced nausea (Mikołajczak, Calavia Liano & Zakowicz, 2018).

Anxiolytics

THC tends to be anxiogenic while CBD has the opposite effect. When administered together, a higher concentration of CBD decreases the psychotropic effects of THC and increases its anxiolytic effects synergistically. CBD influences the limbic and para-limbic regions in the brain. This area is responsible for emotions, memory, reinforcing behaviour and regulating autonomic arousal and endocrine function during fearful stimuli. CBD has a wide safety margin and presents as a favourable candidate to treat anxiety-related disorders. It is believed that CBD regulates learned fear and fearful memory retention, thus it can be advisable to use CBD in overly fearful patients in conjunction with gradual conditioning against fearful stimuli (Papagianni *et al*., 2019). CBD exerts its anxiolytic effects in a dose-dependent manner by interacting with various receptors, particularly 5-HT1A. Common antidepressants like selective serotonin reuptake inhibitors (SSRIs) and tricyclic antidepressants (TCAs) work by being modulated by 5-HT1A receptors. These receptors also play a significant role in the activation of serotonin-releasing factors.

Antibiotics

CBC, CBG, and CBD are non-psychotropic and have been found to harbour anti-microbial activity in varying degrees. Although the anti-bacterial mechanism is poorly defined it has been suggested by Appendino *et al*. (2008) that the resorcinol moiety of these cannabinoids can be responsible for the pharmacological effect. MRSA (Methicillin-resistant *Staphylococcus aureus*), overexpresses NorA, an antibiotic efflux pump, which makes it resistant to fluoroquinolones. CBC, CBG, and CBD preparations showed potent inhibitory effects on NorA and TetK, a similar efflux pump found in tetracycline-resistant strains, suggesting its possible use in combating anti-microbial resistance (Appendino *et al*., 2008).

Cannabis use in cancer patients

Common side effects of chemotherapy include pain, myelosuppression, gastro-intestinal complications, immunosuppression, vomiting, reduced appetite, and allergic reactions. Cannabinoids not only have a promising role in pain and vomiting control but can theoretically slow the progression of cancer. CB2 receptor activation increases the apoptosis rate in neoplastic cells and decreases tumour growth by decreasing angiogenesis (Bulla *et al*., 2013; Repetti *et al*., 2019). Both CB1 and CB2 receptors can reduce angiogenesis by inhibiting the VEGF expression. This has been demonstrated in human gliomas, prostatic cancer and canine osteosarcomas (Bulla *et al*., 2013).

Conclusion

The legalisation history of cannabis use globally is complicated; even more so its history of criminalisation. However, Uruguay became the world's first country to legalise recreational cannabis use in 2013, followed by Canada in 2018. In 2019, Canada's cannabis industry contributed $8 billion to the economy, employing more than 9 200 people, although some social and legal challenges persisted (BNN, 2020). The United States of America also saw great economic success following the legalisation of cannabis in various states. In 2017 Lesotho became the first African country to legalise medicinal cannabis, followed by Zimbabwe and South Africa in 2018, with South Africa being the largest

contributor to stocks in Europe and the UK (Businessinsider.co.za, 2020). In recent days, the South African minister of finance, Tito Mboweni, openly advocated the legalisation of cannabis with the Department of Rural Development and Agrarian Reform, approving the establishment of a cannabis college in Lusikisiki, KZN to create job opportunities (Businesstech.co.za, 2020). Complete legalisation in South Africa is a possibility, however, we will face similar challenges experienced by other countries.

Since cannabis has been decriminalised in South Africa, pet owners will be more likely to treat their pets at home, often using cannabis preparations without proper guidance or proper formulation. Most of the cannabis preparations available online tend to have a skewed or inaccurate cannabinoid profile leading to a great variation in effects with even cannabis toxicities being reported. This is further complicated by the fact that no dosages and formulations for specific conditions have been established. Going forward, chemovars can be used to cultivate cannabis for specific conditions or diseases. Plants could be bred to cultivate quantified amounts of each cannabinoid. Plants could be subjected to cannabinoid profile benchmarks to guarantee the quality and safety of products developed from these plants. Seed banks can be used to regulate the distribution of genetics ensuring responsible cultivation.

The most promising application of cannabis in veterinary medicine is its use as an analgesic and anxiolytic, with the latter being applicable in behaviour medicine. For example, patients suffering from noise phobia, separation anxiety or motion sickness can be pretreated with cannabis before perceived fearful events. In cats, excessive nocturnal behaviour can be managed by the administration of cannabis at night. It is the author's opinion that veterinarians should become more aware of cannabis and its uses in pets as it becomes more freely available and owners become more likely to try it. Cannabis should not be stigmatised but rather considered as a useful adjunct to conventional therapies. Cannabis is essentially a CNS depressant, stimulant, and hallucinogen and can alter the behaviour of animals. It must, therefore, be used under veterinary supervision to limit unauthorised and unguided use in order not to infringe on animal welfare. AP

Scan the QR code for the list of references used.

Scientific publications published in peer-reviewed journals in the field of Animal Science: **2016 to 2017**

T S Brand[1,2]

[1]Animal Sciences, Research and Development Services, Department of Agriculture: Western Cape, Private Bag X1, Elsenburg 7607

[2]Department of Animal Science, University of Stellenbosch, Stellenbosch 7600

Introduction

Seventy-one peer-reviewed manuscripts were published from 2014 to 2018 by the Animal Science Division, Research and Development Services of the Department of Agriculture in the Western Cape. A peer-reviewed manuscript is a manuscript that has been thoroughly evaluated by other scientists and found to be scientifically sound and acceptable to be published in an internationally accredited journal. Twenty-seven manuscripts were published on sheep, 27 regarding research on ostriches, 12 involving dairy cattle, 2 regarding boer goats, 1 on broilers and 1 on technological application. Manuscripts were published on a range of subjects including nutrition, genetics, genomics, reproduction, animal health, meat science, animal behaviour, animal welfare, animal physiology, embryology and technology. Manuscripts were published by project leaders together with postgraduate students and co-workers at universities.

In *AgriProbe* Vol 16 No 4 we published the scientific publications published in peer-reviewed journals in the field of Animal Science for 2018. Please scan the QR code at the end of this article for the complete list.

2017

Bonato, M., Malecki, I.A., Brand, Z. & Cloete, S.W.P. 2017. Developing a female-only flock for artificial insemination purposes in ostriches: progress and future directions. *Anim. Reprod. Sci*. 180:85-91.

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The remainder of the list will be published in the September 2020 issue of *AgriProbe*.

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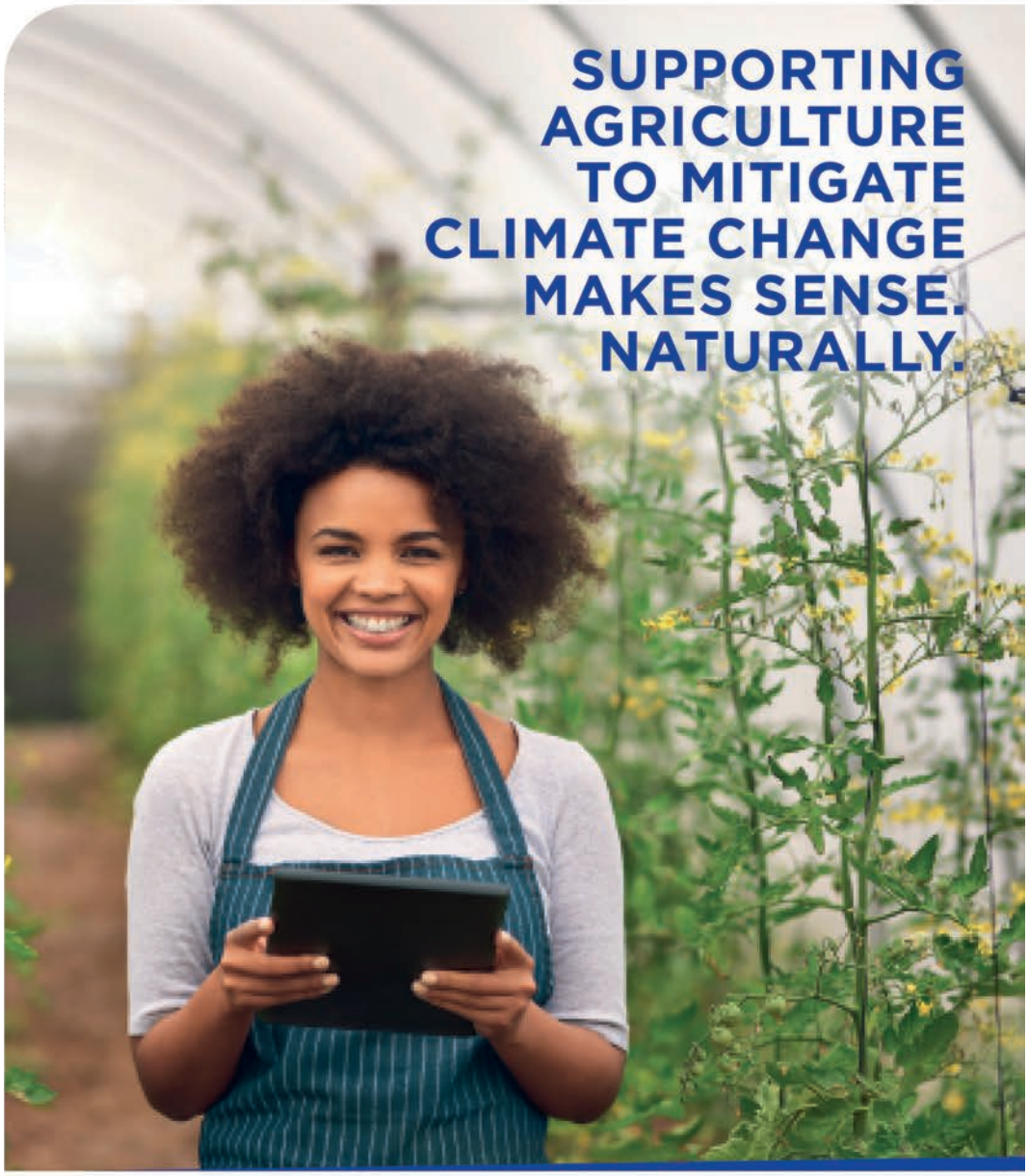
You can also contact Ms Wilna Brink (**wilnab@elsenburg.com**) or Loes Alexander (**loesa@elsenburg.com**) at the Elsenburg library if you need copies of any the above published manuscripts.



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