Western Cape Government
FOR YOU

# WESTERN CAPE DEPARTMENT OF AGRICULTURE PROGRAMME - RESEARCH AND TECHNOLOGY DEVELOPMENT SERVICES 2022-2023

# FORWARD

The Western Cape Department of Agriculture has the largest programme for agricultural research and technology development in South Africa. The Programme Research and Technology Development aims to stay at the forefront with cutting-edge problem-driven research focusing on data-led and evidence based research for our agricultural (commercial and small holder) producers.

The programme manages seven research farms which supports the research efforts in the Western Cape.

Our research efforts focus on improved agricultural production and maximising resource-use efficiency. The Programme RTDS has three subprogrammes, Agricultural Research, Technology Transfer Services, and Infrastructure Support Services (the research farms). Three directorates, Animal Sciences, Plant Sciences and Research Support Services, executes the research portfolio.

The Animals Sciences Directorate conducts research on herd management, breeding, nutrition and welfare of livestock (ostriches, beef cattle, dairy and small stock) with particular emphasis on improving production efficiency for food security. The Plant Sciences Directorate focusses on sustainable agronomic practices, vegetable and pasture production, alternative crops and crop protection.

The Research Support Services Directorate includes a Geographic Information System (GIS) Unit. This unit supports the research group and also offers various services related to spatial analysis, remote sensing, global positioning systems (GPS) mapping, spatial web and dashboard development and the management of a weather-monitoring network across the province. This Directorate also houses the Climate Change unit of the Department.

The Technology Transfer unit provides services that enhance research and offer solutions to technological challenges, including web and media updates, publications, design, photography/videography, and technology-driven solutions like electronics, sensors and cameras, drone technology and 3D-printing.

## WCDoA RESEARCH FARMS

- Elsenburg Research Farm, Elsenburg
- Langgewens Research Farm, Moreesburg
- Nortier Research Farm, Lamberts Bay
- Outeniqua Research Farm, George
- Oudtshoorn Research Farm, Oudtshoorn
- Tygerhoek Research Farm, Riviersonderend
- Worcester Research Farm, Worcester

Dr Ilse Trautmann
Deputy Director–General: Agricultural Research and Regulatory Services
Western Cape Department of Agriculture
Ilse.Trautmann@westerncape.gov.za

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# ABOUT US

The Department aims to stay at the forefront of technological advancements in agriculture by offering timely and relevant research and technology development services in the Western Cape's six districts. Their goal is to provide advanced scientific and technical advice to all agricultural stakeholders in the region, including commercial and smallholder farmers.

They emphasise the importance of converting research into actionable information that reaches farmers at the farm level, enhancing their sustainability and competitiveness in local, national, and international markets. Due to the pressures of industrial development on natural resources, the Department's resource scientists and geographical information center play a crucial role in ensuring the optimal utilisation of soil, water, and natural vegetation.

Their agricultural practices and research focus on maximising resource-use efficiency. The Department prioritises identifying research needs and strengthens partnerships and networking with industry organisations and other collaborators. The Department's program is divided into sub-programs, including Research, Technology Transfer Services, and Infrastructure Support Services. It operates through directorates such as Animal Sciences, Plant Sciences, and Research Support Services.

The Animal Sciences Directorate conducts research on herd management, breeding, nutrition, and welfare of livestock, with a particular emphasis on improving production efficiency for food security. The Plant Sciences Directorate focuses on sustainable agronomic practices, vegetable and pasture production, alternative crops, and crop protection.

The Technology Transfer Directorate provides services that enhance research and offer solutions to technological challenges. These services include web and media updates, publications, design, photography/videography, and technology-driven solutions like electronics, drone technology, and 3D printing. They also provide opinions and solutions to other programs, departments, and the public sector.

The Research Support Services Directorate, within the Research and Technology Development Services (RTDS) Program, includes a Geographic Information System (GIS) unit. The GIS unit supports research needs within the program and offers various functions and services related to spatial analysis, Remote Sensing, Global Positioning Systems (GPS) mapping, Spatial Web and dashboard development, and the management of a weather-monitoring network across the province.

Overall, the Department aims to drive innovation and knowledge transfer in agriculture, ultimately benefiting farmers and promoting sustainable practices in the Western Cape.

## OUR WCDoA RESEARCH FARMS

- Elsenburg Research Farm, Elsenburg
- Langgewens Research Farm, Moreesburg
- Nortier Research Farm, Lamberts Bay
- Outeniqua Research Farm, George
- Oudtshoorn Research Farm, Oudtshoorn
- Tygerhoek Research Farm, Riviersonderend
- Worcester Research Farm, Worcester

# CONTACT US

## CONTACT DETAILS FOR MORE INFORMATION WITHIN THE DEPARTMENT:


**Annelene Swanepoel**
Scientific Manager: Directorate Plant Sciences
Tel: (021) 808 5320
Annelene.Swanepoel@westerncape.gov.za

**Dr Chris de Brouwer**
Scientific Manager: Directorate Animal Sciences
Tel: (021) 808 5220
Chris.DeBrouwer@westerncape.gov.za

**Jackie Jordaan**
Deputy Director: Farm Services
Tel: (021) 808 5172
Jackie.Jordaan@westerncape.gov.za

**Dr Mike Wallace**
GIS Specialist Scientist: Research Support Services
Tel: (021) 808 5088
Mike.Wallace@westerncape.gov.za

**Arie van Ravenswaay**
Assistant Director: Innovation, Technology Design
and Transfer Technology Transfer Services
Tel: (021) 808 5085
Arie.VanRavenswaay@westerncape.gov.za

**Prof Stephanie Midgley**
Specialist Scientist for Climate Change
Tel: (021) 808 5080
Stephanie.Midgley@westerncape.gov.za

**Theresa Smit**
Office Manager: RTDS
Tel: (021) 808 7723
Theresa.Smit@westerncape.gov.za

# DIRECTORATE: ANIMAL SCIENCES

# PROJECT NAME: INVESTIGATING FEATHER MANAGEMENT PRACTICES IN COMMERCIAL OSTRICHES

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| PROJECT NUMBER: | AP/NP/O/AE87 |
| AUTHOR/SCIENTIST: | DR ANEL ENGELBRECHT - Anel.Engelbrecht@westerncape.gov.za |
| PROJECT START/END DATE: | 1 JANUARY 2019 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

With the increased focus on animal welfare and humane practices, current ostrich feather management practices need to be revisited. While live plucking of birds is prohibited in most countries, it is generally accepted that feathers can be taken from birds humanely, without causing excessive discomfort. However, the method and timing of feather removal is very important. Since ostrich feathers are a very important by-product of the ostrich industry, it is vital that feather gathering is done in a humane and sustainable manner to ensure optimal welfare and continued market access. The objective of this study is therefore to determine the effect of different feather gathering practices on welfare, production and product quality, to find the best sustainable option for the ostrich industry. Methods of evaluating pain and discomfort in ostriches will have to be investigated in order to find a suitable biomarker that can be used effectively to determine whether pain or discomfort is associated with the various feather harvesting practices. Both commercial and emerging farmers need to follow best practices to ensure humane treatment of ostriches to ensure a sustainable ostrich industry in the long term. Information collected with this study can help ostrich farmers to make informed decisions as to the optimal practices to follow, knowing what the effect of alternative management practices will be on welfare, productivity and income. It will also help to safeguard the feather industry by ensuring that the wellbeing of the ostriches is not compromised.

# PROJECT NAME: HEAT STRESS IN GROWING OSTRICHES

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| PROJECT NUMBER: | AP/NP/O/AE100 |
| AUTHOR/SCIENTIST: | MOLATELO KEKANA - Molatelo.Kekana@westerncape.gov.za |
| PROJECT START/END DATE: | 01 OCTOBER 2020 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Profitability in ostrich farming depends on successful rearing of chicks to slaughter age. High mortality rates of up to 80% in chicks, from hatching to 3 months of age, remain the most significant challenge facing the ostrich industry. Summer months in Oudtshoorn, where the industry is centred, are characterised by high environmental temperatures, ranging from 35 to 45°C on the extremely hot days. Ostrich chicks are subjected to these extreme temperatures and high solar radiation during their rearing season as they are mostly farmed outdoors. During the first few weeks of life, chicks are provided with shelter at night and shade nets during the day to mitigate the effects of high radiant heat exchange. Shade nets reduce heat accumulation from solar radiation with no effect on air temperature or humidity implying that additional cooling is necessary. Juvenile ostriches (6 months–12 months) in feedlots are also exposed to high environmental temperatures, mostly without provision of shade. There is limited information on how high environmental temperatures affect ostrich chicks. Environmental management such as providing shade, or misting systems, or both combined, have shown to provide immediate relief from the effects of solar radiation in other livestock. Therefore, the aim of the project is to evaluate the effects of shade provision and a mist cooling system on heat stress responses in growing ostriches. The research will benefit smallholder and commercial farmers by providing useful guidelines on management practices that will increase chick growth rate, welfare and survival through alleviation of heat stress.

# PROJECT NAME: QUANTIFYING THE EFFECT OF TREE SHADE ON THE THERMAL COMFORT AND PRODUCTION OF SA MUTTON MERINO AND DORMER EWES AND LAMBS DURING AUTUMN LAMBING


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| PROJECT NUMBER: | AP/NP/S/AS107 |
| AUTHOR/SCIENTIST: | DR ANSIE SCHOLTZ - Ansie.Scholtz@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2022 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Sheep form an integral component of most livestock production systems throughout the world by being able to adapt to a wide variety of environments. This is confirmed by the fact that sheep are the world's most diverse mammalian livestock species, contributing some 25% to the global number of farm animal breeds. In Southern Africa it is generally accepted that the western parts of the continent will become hotter and drier under the impact of climate change. Considerable areas of South Africa are already marginal owing to constraints of climate and soil. Given the ability of sheep to adapt to marginal conditions the species plays an important role in both the commercial and smallholder animal agricultural sectors in the country. Under increased challenge by external drivers such as increased temperatures owing to climate change, sheep and goats are reported to be more resilient than alternative livestock species and particularly dairy cattle. Nationally, sheep are by far the dominant small ruminant species in numbers. It is thus important to assess the extent to which heat stress could be mitigated by managerial intervention, like the provision of natural or artificial shade. Apart from one scientific study published in 2000, no other studies have investigated shade effects on our local sheep populations. There is a clear need for more studies on this aspect as to better understand the role shade may play in the amelioration of heat stress in sheep, particularly in breeds originating from temperate areas and putatively susceptible to heat stress.

# PROJECT NAME: SUSTAINABLE MANAGEMENT OF BREECH FLYSTRIKE IN SHEEP BY MANIPULATING TAIL LENGTH: THE GENETICS OF OVINE TAIL LENGTH AS WELL AS THE EFFECT OF DOCKING ON SHEEP PERFORMANCE AND WELFARE

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| PROJECT NUMBER: | AP/BR/S/AS112 |
| AUTHOR/SCIENTIST: | DR ANSIE SCHOLTZ - Ansie.Scholtz@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Breech and tail strike are the most common types of blowfly strike suffered by Merino and other wool sheep breeds. Tail docking, until recently, has been accepted as a management practice to prevent breech strike in these breeds. It has been argued that by docking the tail at the 3rd or 4th joint, the accumulation of faecal material and urine is reduced, resulting in animals less susceptible to breech and tail strikes. Not only are the three studies on which this argument was based, now questioned on their scientific merit but trends in animal welfare and ethical sheep production systems started questioning the practice of tail docking. International trends are focussing on quality rather than quantity and it is therefore expected that tail docking as an approved management method to control breech strike in wool sheep breeds will be met with criticism. Breeding is a recognised ethical and sustainable option to bring about change in traits of concern. The aim of this project is to explore the option of breeding for lambs with shorter tails, thereby eliminating the need for docking. Apart from informing industry on the feasibility of breeding lambs with shorter tails, it is also important to study genetic correlations of tail length with other traits of economic importance to be aware of the possibility of unwanted unfavourable correlated responses, should tail length be targeted in a breeding programme. This research will support future export opportunities with answers to questions on the validity of the practice of tail docking as a management practice to control breech strike.

# PROJECT NAME: THE MAINTENANCE OF THE ELSENBURG DAIRY HERDS TO PROVIDE RESEARCH MATERIAL FOR PRODUCTION SYSTEMS, RESEARCH, TRAINING AND ONGOING DATA COLLECTION

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| PROJECT NUMBER: | AP/NP/D/MB84 |
| AUTHOR/SCIENTIST: | MARLINÉ BURGER - Marline.Burger@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2018 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aim of this study is to maintain the Elsenburg Holstein herd as a resource dairy herd supporting research to optimise milk production from total mixed ration systems in the Western Cape region of South Africa. Since the Western Cape does not have rain throughout the year, these herds are fed a total mixed ration which can become very expensive. The aim is therefore to use these herds to find ways of farming more sustainably in the Western Cape. The herds have also been used as training material for students enrolled at the Elsenburg Agricultural College. The students are taught to do AI on the cows, how to do dehorning, castrating of bulls, Body condition scoring, branding, etc. as part of their practical training.

# PROJECT NAME: THE EVALUATION OF VARIOUS LEGUME-GRAIN SILAGE MIXTURES AS ROUGHAGE COMPONENT IN TOTAL MIXED RATIONS OF LACTATING HOLSTEIN COWS AND ITS EFFECTS ON MILK PRODUCTION POTENTIAL


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| PROJECT NUMBER: | AP/NP/D/MB97 |
| AUTHOR/SCIENTIST: | MARLINÉ BURGER - Marline.Burger@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2020 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Since the Western Cape does not receive year-round rainfall, it is a challenge to produce high quality forage for dairy cows, especially high quality lucerne hay and maize silage, which are summer growing crops and needs irrigation during the dry summer months. Instead, the region lends itself to the planting of winter rainfall cereal crops, which are mostlyused as silage in the roughage component of the dairy cow ration. These crops include oats, barley, triticale and rye. These cereal crops do not have the superior feeding value of lucerne hay and maize silage, being lower in crude protein (CP) content and yielding lower dry matter (DM) production levels. Using these cereal crops as the roughage component in the dairy cow ration leads to the supplementation of higher levels of concentrate per cow per day, which is more expensive. The planting of permanent pastures is also not a viable option unless there is access to stored water for irrigation. Total mixed ration systems are mostly used in this region by most commercial dairy farmers. Because these cereal roughages are of relative lower quality, more concentrates have to be fed to balance the diet. The costs of a total diet with oat hay as roughage base can be 40% higher than the cost of a similar diet using grass/legume grazing or good quality lucerne and maize silage. Higher feeding cost will increase the vulnerability of a total mixed ration based milk production system, thereby decreasing the sustainability of these systems. It is therefore important to keep doing research on this type of system to find ways to make it more profitable. The aim of thestudy is therefore to monitor and evaluate the milk production, reproduction performance, growth rates, health status, nutrition and genetic progress of the Elsenburg Holstein dairy herd using pure oat hay silage as the control and then testing different oat/legume mixtures of silage in an effort to increase the CP content of the roughage base.

# PROJECT NAME: IMPORTING GERMPLASM FROM AUSTRALIA TO IMPROVE RESISTANCE TO INTERNAL PARASITES OF TWO WESTERN CAPE MERINO RESOURCE FLOCKS


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| PROJECT NUMBER: | AP/BR/S/PM77 |
| AUTHOR/SCIENTIST: | DR PFUNZO MUVHALI - Pfunzo.Muvhali@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Sheep farming is an important livestock farming sector in South Africa and contribute greatly to the country's economy, as well as employment creation. Sheep are characterised by the ability to adapt to a wide range of environmental conditions. However, sheep farming encounters challenges regarding internal parasite infestations, which subsequently affect productivity. The most common method to combat gastro-intestinal parasites has been dosing. However, intestinal parasites are rapidly developing resistance to the all active compounds in major drenches, leading to farming with sheep becoming unsustainable in areas where widespread resistance occurs. Moreover, the global concern with the excessive use of chemicals in the agricultural production process suggests that the reliance on chemicals needs to be restricted. Alternative methods of gastrointestinal helminth control therefore need to be urgently found. An important component in almost all integrated pest management (IPM) programmes involves the issue of host resistance. This project seeks alternatives to chemical parasite control in Western Cape sheep involving an IPM approach. However, the basis of selection as a component of an IPM programme depends on whether the trait of interest is variable and heritable, as well as whether it can be measured directly. Gastro-intestinal parasite burdens are notoriously difficult to measure in live animals and indirect methods need to be employed. Faecal worm egg count (FEC) is commonly used as a proxy for the resistance of ovine livestock to gastrointestinal helminth infestation. Selection based on FEC in sheep as part of the national small stock improvement has been reported to result in marked responses in host resistance to infestation by gastro-intestinal helminths in Australia and New Zealand. Such efforts have been lacking in South Africa, and there is no provision for the recording of traits indicative of helminth resistance in the national small stock recording scheme. Studies has been done on genetic variation in FEC of local resource flocks under constitutional control. Although these studies suggested some genetic variation in FEC, reported genetic progress is unlikely to be fast. To accelerate genetic gains by importing germplasm from resistant Merino lines in the Mediterranean region of Western Australia to determine if genetic progress in FEC under local conditions will benefit from such an intervention.

# PROJECT NAME: EVALUATING PERFORMANCE OF OSTRICH MALES TRAINED FOR SEMEN COLLECTION WHEN RETURNED TO NATURAL MATING SYSTEMS

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| PROJECT NUMBER: | AP/BR/O/PM108 |
| AUTHOR/SCIENTIST: | DR PFUNZO MUVHALI - Pfunzo.Muvhali@westerncape.gov.za |
| PROJECT START/END DATE: | 31 APRIL 2022 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Poor egg fertility and hatchability, high embryo mortality, variable egg production, poor chick survival and variable chick growth are among the reproductive elements that constrain competitiveness of the ostrich industry. These constraining factors may be alleviated if the industry incorporates assisted reproductive technology such as semen collection for screening breeding males in pursuit of superior sperm quality and high fertilising ability. The assessment of ostrich semen was previously constrained by the poor and variable quality of semen collected from males using the manual massage technique. A breakthrough in addressing reproductive problems facing the ostrich industry was the development of animal-friendly methods for routine quality semen collection from male ostriches; the dummy female method. This led to the development of methods to assess semen quality, the quantification of seasonal variation in sperm quality and male libido, as well as investigations into semen collection frequency. Additionally, the relationship between sperm quality measures using advanced technology and the traditional visual score method of sperm motility indicated that ostrich farmers may not require expensive high-tech instruments to evaluate and select males for semen quality, but can instead use traditional and less expensive methods. Semen collection in ostriches involves selection of birds that demonstrate friendly behaviour towards humans and possess good breeding values for chick and egg production. However, previous research indicated that reproductive success of ostriches that express sexual behaviour towards humans may be compromised since such birds may show less interest towards their ostrich mates. It remains unclear whether males trained to respond to the dummy female and ejaculate in the artificial cloaca can perform optimally in a natural mating setting or when paired-off with a female. It is also unknown whether males initially trained for semen collection might be retrained after they were used in a natural mating system. This knowledge is integral to studies on the continuous assessment of semen traits in relation to female fertility under natural mating conditions. Against this background, the aim of this project is to evaluate the reproductive performance of male ostriches trained for semen collection in a natural mating system.

# PROJECT NAME: EXPLORING THE POSSIBILITY OF FAST-TRACKING GENETIC IMPROVEMENT OF SKIN QUALITY BY USING ASSISTED REPRODUCTION TECHNIQUES IN OSTRICHES

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| PROJECT NUMBER: | AP/BR-NP/O/PM111 |
| AUTHOR/SCIENTIST: | DR PFUNZO MUVHALI - Pfunzo.Muvhali@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The ostrich industry relies mainly on the production of meat, leather and feathers, with income being largely dependent on quality with regards to leather and feathers. Poor leather quality is caused in part by the excessive incidence of hair follicles on skins, which is becoming increasingly important for the industry sells leather in the competitive luxury market. The occurrence of air follicles in ostrich skin has been shown to be highly heritable and would therefore respond well to genetic selection. However, within the ostrich resource flock, where pair-breeding is used, genetic progress may be slow due to one male only being able to mate with one female in a breeding season. Assisted reproductive technology such as artificial insemination (AI) could be used to fast-track genetic improvement by disseminating semen from males with good breeding values for hair follicles to multiple females with good breeding values for the same trait. Alternatively, semen cryopreservation could also be used as a method to conserve superior genetics from male ostriches. Therefore, the aim of this project is to identify males with a lower hair follicle incidence and low breeding values for hair follicles, and propagate their germplasm across multiple similarly selected females, using AI, to investigate whether genetic progress can be fast-tracked compared to the conventional breeding program on the farm. The successful completion of this objective will demonstrate the utility of assisted reproduction technology to solve a pressing industry problem. This principle could later be extended to similar challenges faced by the industry.

# PROJECT NAME: SUPPLEMENTATION OF VIRGINIAMYCIN TO COWS GRAZING KIKUYU/RYEGRASS PASTURE

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| PROJECT NUMBER: | AP/NP/D/RM113 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE - Robin.Meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 01 AUGUST 2022 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aim of the study is to determine the effect of virginiamycin on milk production and milk composition of Jersey cows grazing kikuyu/ryegrass pasture in spring. Profitability of milk production is under pressure due to increasing input costs. Many different feed additives are available to nutritionists and farmers to include in the diet of dairy cows. Controlled applicable studies are needed to determine the cost effectiveness of feed additives for cows on pasture. Energy intake is the first limiting factor for cows on pasture to produce milk. Rumen pH of cows on pasture that are fed 6 kg of concentrate may get below pH 5.8. When this happens rumen health is compromised, fibre digestion is and milk fat % drops. Virginiamycin has the potential to stabilise rumen pH and improve rumen environment. This study will show if supplementation of virginiamycin will increase milk production and milk fat of Jersey cows grazing kikuyu/ryegrass pasture in spring.

# PROJECT NAME: EVALUATION OF A MANURE ADDITIVE TO REDUCE GHG EMISSIONS FOR SOUTH-AFRICAN DAIRY PRODUCTION SYSTEMS

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|---|---|
| PROJECT NUMBER: | AP/NP/D/RM114 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE/JAYDI STEMMET - Robin.Meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 10 AUGUST 2022 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

This study aims to evaluate the effectiveness of SOP lagoon at two different concentrations to reduce CH4, N2O and CO2 emissions from commercial dairy manure management systems under South African conditions. Global warming is a reality and emission of greenhouse gasses have been identified as a key issue. Ruminant production systems have been singled out as major contributors to methane emission and numerous studies to mitigate methane (CH4) emissions from these production systems have been conducted. A mature dairy cow will produce approximately 10% of their body weight in manure daily. The commercial dairy sector follow recommended manure management strategies to reduce environmental impact of manure and to improve soil fertility where manure is employed as organic fertiliser. Most dairy farms have two slurry dams in line to manage slurry from the dairy parlor and surrounding areas. Slurry water from the second dam is then irrigated on pasture. These dams have substantial CH4, N2O and CO2 emissions. Mitigation strategies need to be developed to reduce these emissions. A product, SOP Lagoon consists of calcium sulfate dihydrate (agricultural gypsum) and is expected to be effective in reducing NH3 and GHG emissions. It is important to generate accurate GHG emissions baseline figures from commercial dairy production systems to develop and evaluate country specific mitigation strategies.

# PROJECT NAME: EVALUATION OF A MANURE ADDITIVE TO REDUCE GHG EMISSIONS FOR SOUTH-AFRICAN DAIRY PRODUCTION SYSTEMS.

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| PROJECT NUMBER: | AP/NP/D/RM118 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE/MULLER CRONJE - Robin.meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JULY 2023 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

To determine the effect of allocating additional plantain pasture to cows just before the morning milking on pasture intake, grazing behaviour, milk production and response to concentrate. It is well documented that the first factor limiting milk production of cows in pasture-based dairy systems is energy intake. This is due to low energy density of pasture and limited intake capacity. Fresh pasture is allocated to cows after each milking. Pasture intake is affected by pasture allowance, pasture quality and level of concentrate feeding. Typically cows graze actively for 2-3 hour after they get in the paddock and then start ruminating. The rate of digestion of pasture depends on the digestibility of the pasture. Cows are milked 15:00 to 16:00 and again from 6:00 to 7:00 resulting in grazing/rumination time of 14 h at night and 8h during the day. It is therefore expected that the rumen will have its lowest fill just before morning milking. The question is if total pasture intake can be increased by moving cows to highly digestible pasture like plantain for one hour before morning milking and will this have a concentrate sparing effect? If cows produce the same amount of milk when plantain is added and they are supplemented with 4kg dairy concentrate per day compared to when 6kg of concentrate is fed per day with no plantain pasture, the profit per cow can increase by R240/cow/month. This may be a 30-40% increase in profit per cow. If this approach is effective a substantial increase in profitability of milk production can be expected.

# PROJECT NAME: MANIPULATION OF THE RUMEN ENVIRONMENT TO INCREASE RUMEN DEGRADABLE FRACTION OF FEEDSTUFFS

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| PROJECT NUMBER: | AP/NP/S/TB92 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/WALDO VAN RENSBURG (MSc US) - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 FEBRUARY 2020 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Protein sources are expensive. Protein sources with a high undegradable (bypass) protein content are used effectively by the animal due to the availability of amino acids in the small intestine. This is especially important for high producing animals. Manipulation of the rumen environment will increase the availability of rumen undegradable protein fraction of feedstuff to the animal. This is relevant to the animal feed industry because it can lead to a more efficient utilisation of dietary protein by ruminants, improving animal performance and reducing feed costs. It can also help reduce environmental pollution caused by excess nitrogen excretion from animals. It will overall reduce the carbon footprint of ruminants.

# PROJECT NAME: MODELLING THE GROWTH, FEED INTAKE AND BACK FAT THICKNESS OF SOUTH AFRICAN BOER GOATS

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| PROJECT NUMBER: | AP/NP/BG/TB93 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/JP VAN DER WESTHUIZEN - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 FEBRUARY 2020 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The goal of this study is to collect information that can be used in a growth and feed intake model for Boer goats. This information does not exist for Boer goats. This includes measuring growth, feed intake, fat deposition as well as the quality of the meat. A sensory analysis was done to determine differences in taste between the carcasses of the different species. This model can aid farmers farming with Boer goats to predict the growth of their goats and also to identify an ideal slaughter weight of kids. A sensory study of the differences between the meat of Boer goats and Dohne Merinos will be conducted by a panel of trained tasters to conclude whether differences exist in eating quality between the two species.

# PROJECT NAME: BACKGROUND STUDY TO COLLECT MORE INFORMATION ON EMBRYONIC LOSSES IN SHEEP IN SOUTH AFRICA

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|---|---|
| PROJECT NUMBER: | AP/NP/D/TB95 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/ELZE CILLIERS (MSc US) - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2020 - 31 MARCH 20215 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aim of this project is to provide information about the occurrence of embryonic losses in South African sheep. It has been estimated that embryonic losses can occur up to 30% in sheep and little to no rigorous studies have been conducted in South Africa. This study aims to quantify the effects of dietary energy and protein as well as the genetic effect on embryonic losses on South African ovine. The analysis of serum progesterone levels were also investigated to determine whether it can be used as an alternative method to detect embryonic losses in sheep. The project provided an opportunity to investigate the effects of dietary energy and protein levels on colostrum quality and milk quality as well as milk yield in sheep. Furthermore, the effect of dietary energy and protein on milk quality and yield was also used to investigate the subsequent differences in lamb growth.

# PROJECT NAME: DEVELOPMENT OF A MODEL FOR CROSSBRED LAMB PRODUCTION

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| PROJECT NUMBER: | AP/NP/D/TB96 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/PIETER THERON (MSc US) - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2020 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aim of the study was to monitor and compare the growth, fat deposition and feed intake of Merino and Dohne Merino crosses in order to construct predictive models for these traits. These models are being incorporated into the SheepStat™ feedlot production model which feed lotters can use to predict and optimise the performance of animals in their feedlots.

# PROJECT NAME: QUANTIFYING BETWEEN AND WITHIN ANIMAL COMPONENTS OF VARIATION IN COMMON INDICATORS OF HEAT STRESS IN WESTERN AND NORTHERN CAPE OVINE RESOURCE FLOCKS

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| PROJECT NUMBER: | AP/BR/S/TB102 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/NELIUS NEL/SHANNON STEYN/KUDA MAFUNGA - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2021 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Sheep form an integral component of livestock production systems in South Africa. The species being able to adapt to a wide variety of environments and different breeds are found in different climate regions of the country. It is generally accepted that the western parts of Southern Africa will become hotter and drier under the impact of climate change. It is thus important to assess the available breeds that form part of the available South African ovine genetic resource for their ability to withstand increased temperatures. It is also important to be able to quantify potential differences between breeds, as well as between individuals within breeds to understand the mechanisms underlying the ability of sheep to adapt to future heat stress conditions in the country. In this study ten South African sheep breeds are evaluated for their adaptability to increased heat conditions due to climate change.

# PROJECT NAME: THE CHARACTERISATION OF THE GRAZING HABITS OF BEEF CATTLE IN THE STRANDVELD REGION OF THE WEST COAST OF SOUTH AFRICA

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| PROJECT NUMBER: | AP/NP/BC/TB109 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/WILMIE HOUGH (MSc AGRIC) - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 20235 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The initial aims of this study are the quantification of the chemical composition of specific shrubs commonly found in the Strandveld area, and the identification of plant types preferred by Nguni and Bonsmara cattle (by the use of cameras fixed with straps on the heads of the cows). We also aim to determine and compare the grazing habits of these two breeds of beef cattle (cattle are fitted with Long Range Global Positioning System Ultra High Frequency (LoRa (GPS/UHF)) cattle collars). Lastly we'll be looking at the differences regarding rumination, eating, activity and oestrous times and duration between Bonsmara and Nguni cows (SenseHub BeefR), while also drawing a comparison between the two breeds' sensitivity to heat stress (by the use of rumen temperature loggers). Precision livestock farming (PLF) tools is important in future farming enterprises. The testing of this cutting edge technology will empower local beef producers in future by the possibility to gather real time information on grazing habits, selection of plant species as well as important information like the oestrus cycle of cows.

# PROJECT NAME: DEVELOPING A CLIMATE-LINKED PRODUCTION PREDICTION MODEL FOR EXTENSIVE SOUTH AFRICAN SHEEP FARMING ENTERPRISES

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| PROJECT NUMBER: | AP/NP/S/TB110 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/PIETER THERON PHD US) - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The study aims to quantify the relationship between historical weather patterns and sheep production in extensive enterprises. A better understanding of these relationships will lead to a better understanding of the potential impacts of future climate change on the sector. In this way a more resilient and adaptable South African sheep producing sector can be created.

# PROJECT NAME: INFLUENCE OF PRE-STORAGE INCUBATION AND SHORT PERIOD OF INCUBATION DURING EGG STORAGE ON EMBRYONIC DEVELOPMENT, HATCHABILITY AND CHICK QUALITY OF OSTRICH EMBRYOS

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| PROJECT NUMBER: | AP/BR/O/ZB115 |
| AUTHOR/SCIENTIST: | DR ZANELL BRAND - Zanell.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 10 AUGUST 2022 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

In South Africa, artificial incubation has become a crucial part of profitable ostrich farming. In spite of this, our perception of artificial incubation in ostriches is inadequate if evaluated against domesticated poultry. Difficulties with artificial incubation and chick rearing are presently among the most central constraints to the growth of the ostrich industry. This leads to excessive levels of reproductive failure, influencing the commercial feasibility of the marketable ostrich industry. The high levels of infertility and hatching failure (~ 20% for both) leads to low chick production, causing significant problem for the ostrich industry. It is thus of immense importance to all stages of ostrich production to improve the hatchability off eggs, especially the quality of chicks. The chicks pipping first have access to food and water sooner and this is beneficial to the viability and quality of the chick. Thus, developing appropriate pre-storage incubation schemes for hatching egg would have a positive effect on a hatchery. Optimising growth and development post-hatching by altering fairly constant environmental conditions, pre-incubation and during incubation, may be meaningful and of immense practical and scientific interest. The main aim thus is to improve the hatchability of ostrich eggs and contribute to an earlier pipping time with a smaller hatching window for chicks. Investigating pre-storage incubation will not only boost chick production, but will also profit the ostrich industry as an entirety. There is undoubtedly a huge potential in restoring the hatchability of stored eggs, and even improving post-hatch performance. The duration and temperature of pre-incubation storage are critical to further development of the embryo prior to and during incubation. There is evidence that strategically applied heat treatments during storage can advance the developmental stage of the embryo, taking it to a stage better able to survive storage. The theory is that these brief periods of incubation induce the repair/regeneration of embryonic cells, and thus minimise the damage induced by long-term storage. The objectives of developing appropriate pre-storage incubation schemes for hatching ostrich eggs would improve hatchability by reducing embryonic mortalities; and contribute to an earlier pipping time with a smaller hatching window.

# PROJECT NAME: INVESTIGATION INTO THE EFFECT OF INCUBATION TEMPERATURE ON SEX RATIOS OF OSTRICH EMBRYOS

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| PROJECT NUMBER: | AP/BR/O/ZB116 |
| AUTHOR/SCIENTIST: | DR ZANELL BRAND - Zanell.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The current economic climate demands more cost effective production systems. With feeding cost accounting for ~75% of the expenses of an intensive ostrich production unit, cost efficient feeding is also essential. Most ostrich breeders are kept in flock camps with various male: female ratios of which the most commonly used, is a ratio of 1:3 for number of males to females. This means that fewer males are needed for production systems. Adult male ostriches were also observed to be more aggressive than females, especially in the presence of females. This aggressive behaviour is not only dangerous for the handlers, but also cause injury to the ostrich. Thus rearing fewer males and more females to maturity will have positive economic implications for producers. Research on growing birds showed that even as younger birds, males are more aggressive and kick marks on certain areas of the skin was more in all-male groups than in all-female groups and mixed-gender groups. Further, separate-sex rearing had no influence on mortality or growth, while live weight and slaughter traits were also largely unaffected by gender. This means that females did not procure a lower income for products when slaughtered than males. To find out if incubation temperature has an effect on phenotypic development in ostriches will have exciting implications for the ostrich industry. Skewing the sex ratio at hatch in commercial ostrich could potential be economically beneficial for the producers, especially if only a simply changing the incubation temperature needs to be done. Against this background then, the aim of the present study is to investigate: the influence of incubation temperature on sex ratio; the influence of egg position during the laying sequence on sex ratios; if temperature-dependent sex-biased embryo mortalities are the cause of skew sex ratios; the effect of incubation temperature on the weight of hatchlings; the influence of incubation period (pipping time) on sex ratio; and to determine if temperature sensitive periods (TSP) for sex determination occur during certain stages of incubation for ostriches. Outcomes from this study potentially could decrease the number of aggressive birds in flocks, bring down feeding costs without affecting income. Skewing the sex ratio at hatch could have economic benefits for producers, especially if it could mean something as simple as changing the incubation temperature. Results may also help to evaluate current setter temperature settings and could potentially contribute to a higher hatchability with better chick quality. Thus, consequently benefit competitiveness of the ostrich industry as a whole.

# DIRECTORATE: PLANT SCIENCES

# PROJECT NAME: DEVELOPING NITROGEN FERTILISER MANAGEMENT STRATEGIES FOR WHEAT *(TRITICUM AESTIVUM)* UNDER CONSERVATION AGRICULTURE PRACTICES WITHIN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/SR/S/AVDM2 |
| AUTHOR/SCIENTIST: | ANNEMARIE VAN DER MERWE - Annemarie.VanDerMerwe@westerncape.gov.za |
| PROJECT START/END DATE: | 01 FEBRUARY 2023 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Study N reaction in soil and plants in conservation agriculture systems to improve wheat yield through efficient N use and establishing N fertiliser norms for wheat in a conservation agriculture system. Create fertiliser guidelines and norms for conservation agriculture in the Western Cape. Objectives of the project include monitoring inorganic soil N during the growing season to calibrate a soil response curve to N applications and evaluate crop response to N fertiliser rates. Evaluating efficiencies of different sources of top-dressed N evaluating the effect of foliar N spray applications on crop yield and quality to, and adapting current fertiliser N guidelines as dictated by these results.

# PROJECT NAME: THE EFFECT OF TILLAGE FREQUENCY ON SOIL QUALITY AND PLANT PRODUCTIVITY UNDER CURRENT AND BIOLOGICAL AGRICULTURAL MANAGEMENT SYSTEMS

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| PROJECT NUMBER: | PS/SR/S/JL6 |
| AUTHOR/SCIENTIST: | ANNEMARIE VAN DER MERWE - Annemarie.VanDerMerwe@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2018 - 31 MARCH 2030 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Assessing tillage effects on soil fertility, nutrient stratification and crop productivity in a dryland farming system. Long-term trials allow monitoring changes in crop yield and quality, as well as soil fertility with time. Furthermore, the impact of different tillage and soil nutrient management scenarios on the sustainability of wheat-based systems can only become apparent through long-term experiments. Objectives of the project include: to assess the effects of infrequent tillage on the stratification of selected soil chemical parameters to a depth of 450 mm in a dryland crop rotation system, to assess the effects of infrequent tillage on lime movement/soil pH to a depth of 450 mm one, two and three years after liming, to assess the effects of tillage of selected soil physical characteristics including soil texture, and aggregate stability and to determine the effects of tillage practices on wheat and canola yield and quality in a dryland crop rotation system.

# PROJECT NAME: EVALUATION AND CHARACTERISATION OF SPECIES AND CULTIVARS OF POTENTIAL STRATEGIC USE FOR IMPROVED PASTURE PRODUCTION

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| PROJECT NUMBER: | PS/SR/P/MML3 |
| AUTHOR/SCIENTIST: | DALENA LOMBARD - Dalena.Lombard@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JANAURY 2022 - 31 MARCH 2029 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

To continuously evaluate and characterise new species and cultivars of potential strategic use for improved pasture production in terms of yield, flowering characteristics, persistence and pest resistance in the Southern Cape. Its relevance is linked to the pastures for dairy research program of the Directorate for Plant Sciences; the need to evaluate new cultivars due to climate change and the possibility to replace certain species in the fodder flow program as well as assisting management and commercial and/or emerging farmers/producers in the making of management decisions. Objectives of the project include new species and cultivars are continuously entering the agricultural market and need to be evaluated in terms of sustainability for pasture production systems in the southern Cape. The correct selection of both species and cultivars plays a vital role in ensuring a fodder flow. Potential is determined by evaluating species and cultivars in terms of yield, disease resistance, persistence (in the case of perennial species) and potential as part of a mixed sward, mixed swards are becoming more important in terms of resilience, optimising fodder flow, and persistence in order to avoid annual oversowing, thus reducing disturbance and cost in an effort to improve fodder flow and the best cultivars and species identified in this research phase will be utilised in further research phases to develop best management practices, as well as for system trial evaluations.

# PROJECT NAME: THE EFFECT OF NINE CROP ROTATION SYSTEMS ON THE WEED SEEDBANK DYNAMICS OF THE HARDY LONG-TERM TRIAL

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| PROJECT NUMBER: | PS/PP/W/GWDRC2 |
| AUTHOR/SCIENTIST: | GERT CONRADIE - Gert.Conradie@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2023 - 31 MARCH 2031 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

One of the most common limitations limiting crop productivity and sustainability is weed pressure. There is a lack of knowledge of the effect of crop and crop/pasture rotation systems on the weed seedbank in the Swartland. Herbicide resistance also threaten economic sustainability because without herbicides, commercial production won't be viable. Various weed researchers stressed the need for alternative methods to manage weeds, especially in CA systems where farmers are limited regarding reduced tillage as an option for weed control. The objectives are to determine: the possible short term (1 year) effect of cropping sequence on the weed seedbank, the possible long term (4 years) effect of 9 different cropping systems on the weed seedbank and the ultimate aim of this study is to determine the short- and long-term effect of nine of the most feasible crop and crop/pasture systems identified for the Swartland on weed control.

# PROJECT NAME: THE MANAGEMENT AND FACILITATION OF THE "SKOG" (SWARTLAND KLEINGRAAN ONTWIKKELINGS GROEP) INITIATIVE AT LANGGEWENS RESEARCH FARM

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| PROJECT NUMBER: | PS/SR/TT/AS.GWDRC3 |
| AUTHOR/SCIENTIST: | GERT CONRADIE - Gert.Conradie@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2023 - 31 MARCH 2033 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The existing model of SKOG (Swartland Kleingraan Ontwikkelings Groep/Swartland small grain development group) has faced operational and administrative challenges over the years. The financial model has changed, with the Department of Agriculture taking a leading role in managing the research area and hosting annual information days. The logistics and work pressure among the representatives of the principals have become a challenge. The main concern is the increased need for administrative support from the SKOG Manager, which a departmental official cannot provide due to restrictions on involvement in financial matters. Thus, a re-arrangement of SKOG is necessary to streamline management and ensure adherence to departmental policies and legislation. The SKOG project, established in 1998, has evolved to meet the changing needs of producers and research expertise. There is a continued need for developing production guidelines and transferring technology and knowledge to the farming community. Agricultural businesses in the Western Cape are actively involved in sponsoring the annual information day and conducting research or demonstration trials relevant to the needs of producers. SKOG remains the only research hub and technology transfer and development event of this magnitude in the Swartland after 25 years. Potential beneficiaries: The project aims to address the needs of small grain producers in the Western Cape, particularly those in the Swartland area. The specific outputs for the target group include the development of production guidelines, transfer of technology and knowledge, access to research trials and demonstrations showcased during the annual SKOG Information Day. The project will benefit both commercial and emerging farmers in the region. Objectives of the project include amending the SKOG model to enable departmental officials to fulfill their roles within SKOG and ensure adherence to departmental policies and legislation; streamline the management of SKOG and reduce administrative burdens on the SKOG Manager; to continue the collaboration between the existing principals (Western Cape Department of Agriculture, Overberg Agri Pty Ltd, KaapAgri Pty Ltd, and the Protein Research Foundation) through a new agreement drafted by the Western Cape Government Legal Services; to continue conducting practical research and applicable extension actions for small grain production practices in the Swartland and to maintain SKOG as a showcase for departmental research at Langgewens, as well as research executed by SKOG collaborators from the private sector and other research institutions.

# PROJECT NAME: THE INFLUENCE OF PLANTING DENSITY, TIME OF APPLICATION, AND SPRAY VOLUME ON DEPOSITION PARAMETERS OF FUNGICIDES USED ON WHEAT IN THE WESTERN CAPE


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| PROJECT NUMBER: | PS/PP/P/GJVC4 |
| AUTHOR/SCIENTIST: | DR GERT VAN COLLER - Gert.VanColler@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MAY 2020 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

In order for application of foliar fungicides to be effective, the fungicide must reach its target area, deposition quantity, quality and uniformity must be sufficient to achieve control, and timing of application must be optimal, among several variables. Factors like growth stage and seeding density can also significantly affect fungicide deposition, given the changes in number and orientation of leaves, and the resultant biomass that needs to be covered adequately with a fungicide. Reaching the target area and achieving adequate deposition quantity, quality and uniformity is especially difficult in a crop like wheat, given the vertical orientation of leaves that must be covered with a boom sprayer spraying directly downwards. Given the costs that producers must bear, it is imperative that the optimal curative and protective effect is achieved with every fungicide application, so as to ensure the lowest possible disease levels and longest possible protection against further infections. To ensure this, the deposition of fungicides applied to wheat at different growth stages, sown at different seeding densities, must be evaluated using different spray volumes, to identify practices resulting in optimal disease control. Objectives include: Evaluate the effect of different planting densities (160, 200, 240 plants m-2) and spray volumes (150 L ha-$^{1}$, 200 L ha-$^{1}$, 300 L ha-$^{1}$) applied with a tractor-mounted boom-sprayer at constant forward speed on fungicide deposition at the advanced tillering (Feekes 4-5, Zadoks 30) and flag leaf stages (Feekes 9-10; Zadoks 40). Evaluate deposition achieved at lower spray volumes (50 L ha-$^{1}$, 100 L ha-$^{1}$, 150 L ha-$^{1}$) applied with a tractor-mounted boom sprayer at constant forward speed and 150 L ha-$^{1}$ applied with a tractor-mounted boom sprayer at three different forward speeds at growth stage Feekes 8 / Zadoks 37. Evaluate the same parameters as previous objective, but under windy conditions, at growth stage Feekes 9-10; Zadoks 39. Determine fungicide deposition achieved with an airplane and UAV, operated at industry standards, compared to 150 L ha-$^{1}$ applied with a tractor-mounted boom sprayer at constant forward speed at Feekes 9-10; Zadoks 40.

# PROJECT NAME: INTEGRATED MANAGEMENT OF BLACKLEG OF CANOLA IN THE WESTERN CAPE BY MEANS OF CULTIVAR RESISTANCE AND CHEMICAL CONTROL

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| PROJECT NUMBER: | PS/PP/P/GJVC6 |
| AUTHOR/SCIENTIST: | DR GERT VAN COLLER/HUIBRÉ SCHREUDER (PHD, US) - Gert.VanColler@westerncape.gov.za |
| PROJECT START/END DATE: | 11 MARCH 2021 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Blackleg, caused by *Leptosphaeria* maculans and *Leptosphaeria* biglobosa, is the most devastating disease of canola globally, including the Western Cape. Management of blackleg relies largely on integrating host resistance with chemical control. The use of host resistance is the most durable, cost-effective and environmentally friendly approach, but must be managed carefully due to the large number of genetically distinct races of the pathogen occurring globally. Furthermore, the occurrence and frequency of races of the pathogen within a country or region is not static, but changes in response to the major resistance genes present in canola cultivars. The pathogens are heterothallic, meaning that the different mating types (similar to male and female) are present in separate individuals. Sexual reproduction occurs easily and in large numbers in canola stubble and results in offspring carrying genetic material from both parents. This ability, coupled with the seedborne nature of the pathogens, allows for the introduction of new races into production regions. The use of azole fungicides is a key aspect of disease management, but the high genetic variability of the pathogens, coupled with repetitive use of the same active ingredients, allows for the build-up of tolerance toward fungicides over time, and present a real threat to future canola production. The aim of this project is to evaluate the resistance of local canola cultivars against blackleg in different production regions, to determine the fungicide sensitivity of the local pathogen populations to a range of fungicides, and to screen the efficacy of selected foliar fungicides for the control of blackleg under field conditions. Objectives include collection of canola stubble from cultivar evaluation trials for isolation of *Leptosphaeria* species and for use as inoculum in field trials, the evaluation of disease resistance of local canola cultivars to blackleg at four locations, namely Tygerhoek Research farm and Uitkyk farm near Riversdal in the southern Cape, and at Langgewens Research farm and Waterboerskraal farm (Hopefield) in the Swartland, determining the efficacy of registered and unregistered fungicides to blackleg of canola at the same four locations, and determine the fungicide sensitivity and EC50 values of selected *Leptosphaeria* isolates representative of all production regions.

# PROJECT NAME: INVESTIGATING PATHWAYS OF INFECTION OF *LEPTOSPHAERIA* SPP. CAUSING BLACKLEG OF CANOLA IN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/PP/P/GJVC9 |
| AUTHOR/SCIENTIST: | DR GERT VAN COLLER/ZANDER FÖLSCHER (MSC, US) - Gert.VanColler@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Blackleg of canola is a stubble-borne disease, but can also be disseminated via infected seed of canola as well as fodder brassicas (cover crops). The risk that farmer-retained seed holds for local producers in terms of infection and dissemination of blackleg has to date not been resolved. The practice of planting withheld seed has increased drastically in recent years due to the popularity of canola, as well as shortages of new seed. Unfortunately, due to gene-segregation occurring in withheld seed from hybrid cultivars, the resultant plants will have decreased resistance against blackleg. The first aim of this project will be to determine the contribution of farmer-retained seed and alternative host crops like fodder brassicas (cover crops) to the genetic diversity of *Leptosphaeria* spp. causing blackleg of canola in the Western Cape. This is obtained by the linkage of this project to a current study focussing on population genetic characterisation and identification of races of *L. maculans* occurring on canola in different production regions of the Western Cape, conducted by Stellenbosch University. The second aim of this study is to determine the disease severity and potential yield-loss caused by blackleg on canola cultivars grown with retained seed. Objectives include: collect retained seeds from the 2021 and 2022 seasons from multiple commercial farmers in the three canola production regions (Overberg, Swartland, and the Southern Cape) of the Western Cape and determine the incidence of blackleg pathogens in retained seeds. Conduct surveys with multiple farmers in the three canola production regions concerning their practices with retaining or distributing retained seeds. Obtain *L. maculans* isolates from cruciferous cover crops and *Brassica* weeds in the three canola production regions (Overberg, Swartland, and the Southern Cape). Determine which avirulence genes are present in the samples gathered from alternative hosts and determining the effect of withheld canola seed on blackleg disease levels and yield “in field trials at Langgewens research farm and Ultkyk farm near Riversdale over two seasons.

# PROJECT NAME: THE INFLUENCE OF SPRAY VOLUME, AND TIMING AND METHOD OF APPLICATION, ON DEPOSITION PARAMETERS OF FUNGICIDES ON CANOLA IN THE WESTERN CAPE


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| PROJECT NUMBER: | PS/PP/P/GJVC10 |
| AUTHOR/SCIENTIST: | DR GERT VAN COLLER - Gert.VanColler@westerncape.gov.za |
| PROJECT START/END DATE: | 05 MAY 2023 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

In order for application of foliar fungicides to be effective, the fungicide must reach its target area, deposition quantity, quality and uniformity must be sufficient to achieve control, and timing of application must be optimal, among several variables. The growth period of cultivars can also significantly affect fungicide efficacy, given the large variation in flowering periods between cultivars. Reaching the target area and achieving adequate deposition quantity, quality and uniformity is especially difficult in a crop like canola, given the 3-dimensional architecture of the plant at 30% flowering, when fungicide application against Sclerotinia stem rot is commonly done. To date, no information is available on the fungicide deposition achieved at the 3-5 leaf stage, when fungicides are applied against blackleg, or at 30% flowering, when fungicides are applied against SSR. The aim of this project, therefore, is to quantify the deposition of fungicides applied to canola at different growth stages, using different spray volumes, tractor forward speeds, and application with a tractor, airplane and UAV, in order to identify practices resulting in optimal fungicide depostition. Additionally, fungicide deposition achieved at the 3-5 leaf stage will be correlated against the blackleg disease severity index, in order to correlate deposition achieved to level of control. Objectives include: determine fungicide deposition quantity, quality and uniformity achieved at the ~ 5-leaf growth stage with three spray volumes (100, 150 and 200 L ha-$^{1}$) applied with a boom sprayer and correlate with blackleg disease severity at the end of the season. Determine fungicide deposition quantity, quality and uniformity achieved at the ~ 30% flowering stage with three spray volumes (100, 150 and 200 L ha-$^{1}$) applied with a boom sprayer and to determine fungicide deposition quantity, quality and uniformity achieved with an airplane and UAV operated at industry standards with the identified optimal fungicide application with a tractor-mounted boom sprayer and determine the cost-effectiveness of each treatment.

# PROJECT NAME: WHEAT CULTIVAR RESPONSE TO FOLIAR DISEASES AS INFLUENCED BY DIFFERENT FUNGICIDE SPRAY PROGRAMMES


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| PROJECT NUMBER: | PS/PP/P/GJVC11 |
| AUTHOR/SCIENTIST: | DR GERT VAN COLLER - Gert.VanColler@westerncape.gov.za |
| PROJECT START/END DATE: | 05 MAY 2023 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Given the variation in resistance of different wheat cultivars to foliar diseases, the same fungicide spray programme applied to different cultivars may vary in cost-effectiveness for the producer. Furthermore, the effect of disease control achieved by chemical control on agronomical parameters like grain-straw ratio, biomass, leaf-area index and others is mostly unknown, but information that producers need. The aim of the study will be to measure the cost-effectiveness of a 1) no-input programme (seed-treatment only) to a 2) low-medium cost fungicide spray programme and a 3) high-cost fungicide spray programme on the most popular wheat cultivars in the Western Cape during the course of three growing seasons. Objectives include: To perform visual disease assessment of foliar diseases on a scale of 0 – 9 for each treatment at five different occasions spaced throughout the growing season (from commencement of symptoms until hard-dough stage. To measure selected agronomical parameters on all treatments (throughout growing season and post-harvest) and determine cost-analysis of different treatments.

# PROJECT NAME: EVALUATION OF ORANGE FLESHED SWEET POTATO CULTIVARS IN THE WESTERN CAPE OF SOUTH AFRICA TO ENHANCE VITAMIN A INTAKE

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| PROJECT NUMBER: | PS/RVA/V/JVZ2 |
| AUTHOR/SCIENTIST: | DR JACQUES VAN ZYL - Jacques.VanZyl2@westerncape.gov.za |
| PROJECT START/END DATE: | 1 NOVEMBER 2016 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

From the locally available plant foods, the orange-fleshed sweet potato deems to be a strategic crop to help mitigate the deficiency of vitamin A in South Africa and it is thus essential that the best possible cultivars are selected for production in the regions of the Western Cape of South Africa. These characteristics make orange fleshed sweep potato an excellent food security crop and it is less labour intensive than most other staple crops and produces good yields when planted at the appropriated times. Vitamin A deficiency is a serious public health problem in the developing world and especially in the countries of the eastern, central and southern Africa. Currently, globally, there are 19 million pregnant woman and 190 million preschool children at risk of vitamin A deficiency (World Health Organization of the United Nations, 2009). The prevalence of vitamin A deficiency in Africa is 49.9%, which is only second to South-East Asia (World Health Organization of the United Nations, 2009). The hidden hunger, as this micronutrient deficiency is also known, prevents people from surviving and thriving as productive members of society and thus holds back entire countries in a cycle of poor nutrition, poor health, persistent poverty, lost productivity and reduced economic growth. The ultimate aim of this project is the evaluation of orange fleshed sweet potato cultivars for adaption to local growing conditions and is of crucial importance to research and extension personnel that serve the vegetable industry in order to combat vitamin A deficiency by promoting suitable sweet potato cultivars. The project will simultaneously increase small holder and commercial farmer's access to orange fleshed sweet potato vines, increase in nutritional knowledge, create a demand for orange fleshed sweet potato and ensure sustainability through market development due to increased demand.

# PROJECT NAME: NUTRIENT AND WATER USE EFFICIENCY IN HYDROPONIC PRODUCTION SYSTEMS OF VEGETABLES IN GREENHOUSES

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| PROJECT NUMBER: | PS/RVA/V/JVZ3 |
| AUTHOR/SCIENTIST: | DR JACQUES VAN ZYL - Jacques.VanZyl2@westerncape.gov.za |
| PROJECT START/END DATE: | 01 FEBRUARY 2023 - 31 MARCH 2031 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Optimum crop nutrition drives economic sustainability in modern agricultural systems. Between 30 and 50% of crop yields can be attributed to fertiliser inputs in a range of cropping systems. Excessive fertiliser application is however an economical and environmental concern especially where nutrients applied is leached to the environment resulting in environmental damage such as eutrophication. An average of 10-30 kg of N ha-[1] per year is lost in intensive open field production. A major agricultural challenge is to maintain yields and product quality while improving the efficiency of resource use. Crops grown hydroponically are grown with particularly high nutrient levels to maintain optimal concentrations of nutrients in the root hydroponic system is used by crops and up to 1000 kg N ha-[1] per year can be lost in solution is not re-used result in nutrient rich water running to waste where it can contribute to the pollution of groundwater and rivers. Soilless production can however be an environmentally friendly technology with a high water use efficiency and nutrient use efficiency when the application of water and nutrients is better managed to match the plants need and to re-use the drained fertigation water as is practiced in the so-called closed system. Although conversion to a closed or semi-closed system can result in considerable fertiliser savings, the nutrient levels in the drained nutrient solution needs to be monitored and adjusted regularly to avoid yield losses. The main aim of the project is to develop an alternative method to manage the nutrient concentrations in re-circulating systems, the overall objective of this study is to quantify nutrient uptake and the rate of change in recycled nutrient solutions for a range of crops planted in commercial hydroponic systems. This will support the development of simulation models to predict the water and nutrient uptake of crops and the use of quick diagnostics to monitor changes in nutrient use in real time. This will ultimately enable growers to adjust the application rate of nutrients pre-emptatively, reducing the complete reliance on laboratory analysis.

# PROJECT NAME: CONSERVATION AGRICULTURAL PRODUCTION IN THE SANDY SOILS OF THE SWARTLAND PRODUCTION AREA

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| PROJECT NUMBER: | PS/SR/C/JAS5 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS/RENS SMIT - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2018 - 31 MARCH 2030 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The overriding aim of this project is to further improve cash crop farming systems within the Swartland and more specifically in the areas where sand is the predominant planting medium. A further objective of the trial is to compare standard production practices currently employed in the area to full conservation agriculture production principles of minimal soil disturbance, diversity trough crop rotation and maximum retention of crop residues on the soil surface. Although most of the producers in the area is using no-till knifepoint seeders soil is still being either scarified or disk-ploughed ranging from yearly to every third or fourth year. This practice burns organic material from the soil, which is already low in these sandy soils and also causes a breakdown of the soil structure. The trial will include a comparison of this normal practice to no disturbance of the soil before the planting action. From this aim flows the introduction of zero-till disk seeders in comparison to the knifepoint seeders on production outputs to help handle the build-up of residue on the soil surface which will help minimise soil loss through wind and water erosion, which is a widely occurring phenomenon in the sandy soils. Both the first aims combine to increase possible soil health of the area and thus possibly improve yield of wheat production in the area. It will also help improve the mitigation of climate chance effects in the sandy soil. Alternative crops and cover crops will also be introduced to evaluate their possible contribution to enhance production and biodiversity in the area as well as giving more possibilities and alternative methods of reducing the ryegrass seedbank. The aim is therefore to evaluate possible alternatives to the current used production methods in the sandy soils of the Swartland region thus unlocking higher yields and healthier crops in order to be able to cope with the climate changes that occur over the next 10 years. The aim is also to develop a walk and talk with producers from the sandy production areas annually. Objectives of the project include improving soil health: show the benefit of an improved soil health on general management of cropping systems, show the impact of increased carbon on the availability of other nutrients and show the impact of increased organic material to soil structure and climate resilience. Improving yields: show that healthier soils relates to increased yields. Lower mechanical input costs: show that minimal disturbance of the soil over time leads to lowering input costs and subsequent improved soil health can still be profitable. Benefits from alternative and cover crops: show that the inclusion of cover crops is beneficial to improved soil health and ecosystem biodiversity, show that cover crops can be used as an alternative method of managing weed control and show that alternative cash crops can be introduced into the sandy soils.

# PROJECT NAME: THE POTENTIAL ALLELOPATHIC EFFECTS OF COVER CROPS ON THE PRODUCTION OF SPECIFIC WEEDS AND WHEAT PRODUCTION IN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/SR/C/JAS7 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 1 APRIL 2019 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aim of this project is to improve on existing knowledge about the effect of weeds on wheat production in the Western Cape through a study of the allelopathic effect of cover crops on the weeds. Knowledge gained will provide producers with information on the effectiveness of cover crop use as an alternative weed control strategy. Objectives of the project include: studying weed seedbank dinamics within and following cover crop production and the effect of the cover crop's ability to suppress weed in the following wheat production year.

# PROJECT NAME: QUANTIFYING NITROGEN FIXATION OF SELECTED LEGUMES AND SUBSEQUENT WHEAT PRODUCTION IN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/SR/CS/JAS16 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01APRIL 2021 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The study aims to give more accurate advice to producers about the amount of nitrogen being fixed by the available legumes also, to determine the productiveness of the legume crops and to determine the amount of fertiliser needed following a specific legume. This project will be valuable in that producers can cut their nitrogen inputs if they have a cleare picture of what amount of nitrogen is available in the soil following a legume. Objectives include: to determine the amount of nitrogen produced by 4 pea, 4 lupin, 1 fababean and 1 chickpea cultivars, he wheat quality and production following the legumes, the quality and the quantity of the rhizobia fixation and weather the rhizobia inoculated with, is the rhizobia that's found in the nodule.

# PROJECT NAME: COMPARING SOIL BIOLOGICAL PROPERTIES UNDER REGENERATIVE AGRICULTURE AND CONSERVATION AGRICULTURE PRACTICES AND RELATING THEM TO CROP PRODUCTIVITY

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| PROJECT NUMBER: | PS/SR/CS/JAS20 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2021 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

This study aims to evaluate the impact on soil biological properties of certain Regenerative Agricultural practices compared to the Conservation Agriculture management practices typical of the Western Cape winter cereal and canola systems. It is envisaged that the results of this study will help evaluate the various agronomic practices/strategies in terms of their effects on soil microbiology and their potential to improve system productivity and support sustainable intensification. The project will provide more information on the effectiveness of a regenerative approach to agriculture in the Western Cape and provide the industry with sound scientific advice. Objects of the project include testing the addition of an organic supplement and minimal synthetic inputs, testing the effects on soil biological health, esting the effects on soil physical/chemical properties and comparing plant performance in yield and quality compared to best practice CA.

# PROJECT NAME: CANOLA *(BRASSICA NAPUS L.)* CULTIVAR AND PLANT DENSITY EFFECT ON WEEDS SUPPRESSION


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| PROJECT NUMBER: | PS/SR/CS/JAS22 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS/ROBIN LAIKEN RIET (MSc, BSc) - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2023 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Canola cultivation was first introduced in South Africa in the 1990s. Since then, the expansion of canola production has increased and thus also the demand for better control of weeds. The use of herbicides without varying the mode of action often leads to herbicide resistance in weeds (Lemerle et al. 2017). Herbicide resistance in weeds is the driving factor for development of more sustainable weed management programmes. This resulted in the development of herbicide-resistant canola cultivars (Clearfield and triazine tolerant types) (Human 2020). These variations in the genetic make-up of canola allowed the use of more herbicide options to control weeds. Many farmers moved away from seasonal tillage practices that would otherwise bury weed seeds and act as a weed control practice (Mwendwa et al., 2018). With conservation agriculture, producers use crop rotation and herbicides to control weeds. The dependency on herbicides, poor variation of the mode of action, especially when proper rotation practices is not followed could lead to herbicide resistant weeds. This could decrease the worth of the herbicide application and endanger canola production. To mitigate possible herbicide resistance problems, alternative weed management strategies to help alleviate the dependency on herbicides, need to be investigated. One such strategy is higher seeding densities. This however add to the production cost, especially with the high price of canola seeds (OPDT OIL & PROTEIN SEEDS DEVELOPMENT TRUST OAC OILSEEDS ADVISORY COMMITTEE n.d.). Producers could potentially be increasing their production cost by just implementing a higher planting density to compensate for seedling loss due to poor establishment(Hartman and Jeffrey 2021). There could however be a trade-off between a higher seeding density and using less herbicides. Economically and environmentally or possible wider row-spacing and better weed control. Canola is less competitive and more vulnerable to weed damage in the early stages of the crop's life cycle (Storrie et al. 2023). At this stage weed suppressive morphological features are developing and account for the pivotal weed suppressive structures. Some studies have found that at lower canola planting densities a better canopy can develop with less intra-competition within the crop(Ma et al. 2016). Due to the difference in cultivar performance, in both allelopathic ability and morphological weed suppressive features, often general practices such as plant densities and row-space adjustment, are overlooked(Asaduzzaman & Luckettet al. 2014). The aim of this study to is investigate the weed-suppressive ability of canola using different planting densities and cultivars with and without the use of herbicides. Objectives of the project include comparing weed suppression of canola at various planting densities. Comparing weed suppression of TT-type cultivar and Clearfield-type cultivar and determine if the alternative weed management strategy is effective compared to using a combination of seeding density and herbicides.

# PROJECT NAME: THE EVALUATION OF SUSTAINABLE WEED MANAGEMENT OPTIONS FOR PATERSON'S CURSE' (*ECHIUM PLANTAGINEUM L.*) SUPPRESSION AND CONTROL

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| PROJECT NUMBER: | PS/PP/W/MIF3 |
| AUTHOR/SCIENTIST: | DR MIKE FERREIRA - Mike.Ferreira@westerncape.gov.za |
| PROJECT START/END DATE: | 1 APRIL 2017 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Globally, Paterson's curse is a significant environmental and agricultural weed in areas with Mediterranean-type climatic conditions. In the Western Cape and especially along the Cape West Coast, it severely affects both conservation and agricultural land. On agricultural land, it invades agronomic and horticultural field margins and hedge rows as well as overgrazed pastures. Managing weeds at all stages of their life cycles, should restrict weed emergence, reduce weed growth and reproduction, and minimise plant competition with crops and indigenous fynbos vegetation. The primary focus of this research is the field evaluation of sustainable weed management options for Paterson's curse' suppression and control with the minimum application of agricultural chemicals. Suppression of paterson's curse and minimising its seed production: 1. Integrated Weed Management targets susceptible stages in a plant's life cycle. For Paterson's curse, this can be achieved by minimising weed seedling establishment when utilising living and introduced biomass mulches. 2. Without using herbicides, seedlings that escape this tactic, may be controlled by strategic mowing before flower buds open. Over time, the weed seedbank is effectively depleted. Increasing sustainable agricultural production and environmental health: 1. The reduced occurrence of Paterson's curse may improve sustainable agricultural production in the affected areas. This may lead to the diminished application of herbicides, leading to less spray drift and increased air and water quality. 2. In addition, living and introduced biomass mulches improves soil health by ensuring soil cover of previously disturbed areas invaded by weeds. In an environmental setting this may promote native plant rehabilitation. In conclusion, agricultural research projects aim to address the challenges facing the agricultural sector through innovative and sustainable solutions. This project clearly has industry relevance and objectives, from enhancing sustainable agricultural production to improving environmental health.

# PROJECT NAME: DEVELOPMENT OF DAIRY SYSTEMS BASED ON FORAGE HERB PASTURES IN THE SOUTHERN CAPE

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| PROJECT NUMBER: | PS/SR/P/JVDC7 |
| AUTHOR/SCIENTIST: | JANKE VAN DER COLFF - Janke.VanDerColf@westerncape.gov.za |
| PROJECT START/END DATE: | 1 APRIL 2019 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The continued sustainability and profitability of pasture based dairying in the southern Cape is under strain due to challenges in maintaining high forage quality and yields under current economic and environmental conditions. The main challenges for producers are the high rate of weed ingression in long term no-till pastures, high fertilisation costs and pressure on irrigation water supply. A potential strategy to address some of the above points, could be the selection of species that are high yielding, possess a high forage quality and are more stress tolerant than the current pasture species being used viz. kikuyu (Pennisetum clandestinum), ryegrass (Lolium spp.) and clover (Trifolium spp.). Both plantain and Tall Fescue can potentially fulfil this role. However, before systems can be adapted for the inclusion of these alternative pasture species, systems based on these species need to be evaluated and their production potential quantified. The aim of this study is to determine the whole system production potential and efficiency of three pasture systems based on the current system (Kikuyu-ryegrass), monocultures of alternative species (Tall fescue and plantain) and mixtures of alternative species (Tall fescue, plantain, red clover, Lucerne and chicory). In essence the project will aim to develop a toolbox that can be utilised to select, combine, place and monitor plant species in a managed landscape on farm scale to assist in improving productivity (Sanderson et al. 2007). The practical portion of the study took place from April 2019 to May 2022. The study consisted of four farmlets of approximately 4 ha each, characterised by different pasture systems viz. Kikuyu-ryegrass, forage herb and tall fescue monocultures and mixed pastures. Each system had a “mini-herd” of 25 cows in milk allocated to it. Parameters that were measured included forage quality, pasture yield, water utilisation efficiency and animal measurements. The four systems functioned as independent, closed and self-sustaining farmlets. Preliminary data analysis has shown that the inclusion of forage herbs within a system can reduce the rate of weed ingression into pastures, does not impact negatively on winter pasture yield, greatly increases milk yield during the summer/autumn period and resulted in a similar or higher milk yield per ha than the kikuyu-ryegrass system. Data analysis will continue to determine further effects and interactions within each system. New research that will stem from this study will focus on how to best manage changes in botanical composition within complex forage herb pasture mixtures over years.

# PROJECT NAME: DEVELOPMENT OF A RENOVATION MANAGEMENT PLAN FOR PASTURE MIXTURES IN THE SOUTHERN CAPE

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| PROJECT NUMBER: | PS/SR/P/JVDC8 |
| AUTHOR/SCIENTIST: | JANKE VAN DER COLFF - Janke.VanDerColf@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2023 - 31 MARCH 2027 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Pasture mixtures containing the forage herbs plantain (Plantago lancelata) and Chicory (Chicorium intybus) have been found to improve milk yield relative to kikuyu-ryegrass pastures, particularly from spring to autumn. Irrespective of this, there still seems to be a large degree of hesitancy amongst producers and consultants to transform notable areas of the pasture platform to forage herb based systems. This hesitancy is largely based on the lower degree of predictability of mixtures in terms of yield, persistence and changes in botanical composition. Push back has further been linked to a lack of concise management guidelines in terms of what species combinations are most suitable and when management interventions in terms of renovation, over-sowing or complete re-establishment should occur. The aim of this study will be to develop establishment and renovation management guidelines for diverse pasture mixtures that contain a grass, legume and forage herb and when intensively grazed by dairy cows in the southern Cape. Nine different pasture mixtures and two renovation strategies will be evaluated in terms of pasture yield and the impact on sward composition over years.

# PROJECT NAME: INVESTIGATING SMOTHER CROPS FOR THE IMPROVEMENT OF INSECT DIVERSITY IN SMALL GRAIN CROPPING SYSTEMS OF THE WESTERN CAPE

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| PROJECT NUMBER: | PS/PP/E/JML4 |
| AUTHOR/SCIENTIST: | KIM VAN DEN HEEVER - Kim.VanDenHeever@westerncape.gov.za |
| PROJECT START/END DATE: | 1 APRIL 2020 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aim of this research project is to study the interactions of smother crops and beneficial insects and other problem species present, using various combinations of crops to improve their activity in such a system. The goal of this research is to provide grain producers in the Western Cape with scientific information on how to grow smother crops in an integrated pest management system, reducing herbicide, fungicide and insecticide use and consequently contribute to sustainable agriculture. The reduction of pesticide use and their influence on the environment as well as on non-target species is a topic that is widely investigated worldwide. The outcome of this research will also assist small grain farmers in applying sustainable pest management practices to improve the sustainability of their farming practices. By broadening the array of weed and problem insect management options available, it is expected that producers will manage these pressures more effectively. The adoption of smother crops as part of normal agricultural practice can benefit sustainable agriculture and be part of an integrated pest management strategy. This research strives to provide more environmentally friendly and non-chemical solutions to common crop problems. Objectives of the project include increasing the alternative botanical habitat and food sources through the use of smother crops it is expected that there will be increased insect predators for biological control in the agroecosystem. An integrated approach allows crop protection measures to be planned optimally leading to better control and the reduced use of pesticides that limit resistance and keep input costs low.

# PROJECT NAME: DEVELOPING A BIOLOGICAL ALTERNATIVE PRODUCTION SYSTEM IN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/SR/C/LTS3 |
| AUTHOR/SCIENTIST: | LISA SMORENBURG - Lisa.Smorenburg@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 TO 31 MARCH 2035 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Cash crop production in the Western Cape is under severe pressure with high input costs and low commodity prices as well as the added effects of climate change. The aim of this project is to investigate the feasibility of a pure regenerative agricultural approach to production in the Western Cape. This includes a move away from artificial inputs in the production system, such as herbicides and inorganic fertilisers. The inclusion of cover crops is aimed at restoring the natural ecosystem services to provide for the cash crop fertiliser needs. By initiating pollinator strips on the verge of the trial site a safe place for beneficial insects will be provided in order to serve as a source of natural pest management. This also affords the opportunity to stack production enterprises such as honey production with the cash crop and animal production. By showing the potential of such a production system, both commercial and small holder farmers could be more sustainable in their production methods without relying on artificial inputs, which could lower their production costs tremendously and possibly open new markets to these producers.

# PROJECT NAME: MONITORING OF SCLEROTINIA STEM ROT OF CANOLA IN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/PP/P/LN1 |
| AUTHOR/SCIENTIST: | LIZETTE NOWERS - Lizette.Nowers@westerncape.gov.za |
| PROJECT START/END DATE: | 1 MARCH 2019 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Sclerotinia Stem Rot (SSR) is a fungal disease of major economic importance in canola production worldwide and also in the Western Cape. SSR is a sporadic disease that is influenced by numerous parameters including a conducive climate, cropping history, tillage practices and use of fungicides. The aim of this project is to develop industry orientated management strategies, designed specifically for the Western Cape. The formulation of these strategies is dependent on collecting data of the parameters that influence the disease. This project is conducted by evaluating the disease incidence throughout the canola producing areas of the Western Cape and all relevant data is recorded at the evaluation sites.

# PROJECT NAME: REHABILITATION OF ABANDONED POTATO CIRCLES IN THE SANDVELD AREA OF THE WEST COAST DISTRICT

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| PROJECT NUMBER: | PS/RVA/R/NS5 |
| AUTHOR/SCIENTIST: | NELMARIÉ SAAYMAN - Nelmarie.Saayman@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2017 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The Sandveld region along the west coast is known for its potato production circles. Production on some of these lands decreases to such a state that it is not economically viable anymore to produce potatoes and the lands lay fallow or was withdrawn due to diseases. Other lands are close to drainage lines and wetlands and pose a problem for the natural environment, especially seen in the light of the endangered veld types that it is situated in, such as the Leipoldtville Sand Fynbos. The Sandveld Environmental Management Framework (EMF) as part of its sustainability priorities identified the adjustment of agricultural practices to stem the degradation of wetlands and rivers, and to prioritise their rehabilitation to a better ecological state. The EMF also refers to the loss of Leipoldtville Sand Fynbos that compromises the ecosystem status of this endangered vegetation type. The aim of the project is to rehabilitate the old lands with indigenous plant species to a more productive semi-natural state that will improve the ecosystem services (the biodiversity – plants and soil; provide fodder and shelter for animals; lower wind erosion) and mitigate the impact of climate change. Both commercial and small holder farmers will know what method and which species are the best to use to rehabilitate/restore old potato lands to a semi-natural state that is productive and provide fodder for animals.

# PROJECT NAME: DEVELOPMENT OF VELD MANAGEMENT PRINCIPLES AND GUIDELINES FOR SUSTAINABLE LAND-USE IN THE WEST COAST STRANDVELD AS A MEANS TO MITIGATE THE EFFECT OF CLIMATE CHANGE


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| PROJECT NUMBER: | PS/RVA/R/NS7 |
| AUTHOR/SCIENTIST: | NELMARIÉ SAAYMAN - Nelmarie.Saayman@westerncape.gov.za |
| PROJECT START/END DATE: | 4 MAY 2021 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Both the Fynbos and Succulent Kroo biomes are recognised as biodiversity hotspots and thus the conservation and sustainable utilisation thereof is very important. It is necessary to have clear management guidelines for the sustainable utilisation of the natural, undisturbed vegetation used for extensive livestock grazing. Unfortunately, most of the research done over the years in South Africa on veld and grazing management was in the summer rainfall grassland and Nama Karoo. Very little research was done in the winter rainfall region) and specifically along the west coast. Seventy five percent of South Africa consists of rangelands that are used for extensive farming and in the West Strandveld bioregion 71% of the bioregion consists of rangelands and can be used for extensive livestock or wildlife farming. There are however no clear veld management guidelines for this area. The impact of grazing in a specific season in the west coast strandveld is unknown. Ephemerals plays an important role in the grazing management along the west coast, but have never been measured before. A seasonal grazing trial was done at Nortier Research Farm from 1988 to 1997, but the data were never published, except for an MSc thesis that James West (2005) did on the data from one season. The aim of this study is to develop veld management guidelines for the west coast strandveld in an effort to mitigate the impact of climate change on the vegetation and animal performance and ensure sustainable land-use. Objectives of the project include to determine the effect of stocking rate and season of grazing on the cover and species composition in the following year and between seasons, to determine the length of rest from grazing needed for the recovery of veld condition (cover and species composition) to its original state after grazing in the different seasons, to determine the role of ephemerals on the cover of the perennial species in the following year depending on the season of grazing and stocking rate applied as well as the rainfall of the previous season and year, to determine the impact of season of grazing and stocking rate on the cover and dry matter production of ephemerals, and the climate's role in the vegetation changes, including the impact of rainfall on ephemerals; and whether it overrides the impact of grazing on the vegetation.

# PROJECT NAME: DRY MATTER PRODUCTION OF KEY SHRUB SPECIES AND WILLDENOWIA INCURVATA IN THE WEST STRANDVELD OF THE WESTERN CAPE, SOUTH AFRICA

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| PROJECT NUMBER: | PS/RVA/R/NS8 |
| AUTHOR/SCIENTIST: | NELMARIÉ SAAYMAN - Nelmarie.Saayman@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2028 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Browse is an important part of fodder in the winter rainfall region as shrubs are the main growth form in the Succulent Karoo and Fynbos biomes, with grasses comprising less than 30% of the plant cover in the West Strandveld bioregion. Most of the Succulent Karoo and parts of the Fynbos are currently used for extensive farming with livestock and/or wildlife species. Little is known about the impact of browsing on shrubs with some research done on trees in the Savanna and dwarf shrubs in the Nama Karoo. Less is known about the browse production of these shrubs and how much fodder it can supply to the browsing animals or the nutritional value of the plants or the role of phenology on the plant production over the various seasons of the year. The aim of the study is to characterise the productivity dynamics of shrubs, quantify the available browse material of key shrub species and relate this to canopy volume as a means of determining available browse using rapid, non-destructive techniques. This can be used to enhance sustainable utilisation of indigenous vegetation for browsing livestock and wildlife, with a focus on both animal performance and managing uncertainties imposed by climate change. It can then be used as a basis to develop similar guidelines for other areas within the winter rainfall region. Objectives of the project is to determine the above-ground dry matter production of the key species, determine the relationship between the canopy volume and browse of the key species - *Determine the relationship between partial canopy volume and available browse of key species at different browsing heights of livestock and wildlife species,* determine the role of phenology on the variation in the dry matter production over the various seasons of the year of the key species, determine the utilisation factor of the key species and develop a method to determine browsing capacity of key species at different height levels according to the browsing height of livestock and game species.

# PROJECT NAME: EFFECT OF DROUGHT STRESS AND IRRIGATION ON THE PHYSIOLOGY AND BIOCHEMISTRY OF TWO HONEYBUSH (*CYCLOPIA*) SPECIES

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| PROJECT NUMBER: | PS/RVA/A/PK.GSM1 |
| AUTHOR/SCIENTIST: | DR PIPPA ANN KARSEN/GUGU MABIZELA - Pippa.Karsen@westerncape.gov.za |
| PROJECT START/END DATE: | 01 FEBRUARY 2023 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

This research project aims to address climate change's impact on honeybush production by investigating how Cyclopia species adapt to water scarcity. It focuses on the effects of drought stress on the accumulation of phenolic compounds, osmolytes, and antioxidants in Cyclopia subternata and Cyclopia genistoides plants, which are essential for honeybush tea quality. The objectives include studying carbohydrate accumulation, phenolic content, and antioxidant capacity under drought stress, understanding the physiological changes in Cyclopia species during drought, and assessing their recovery after re-watering. This study is crucial due to the increasing global demand for honeybush tea and the need to conserve natural populations. It concentrates on two honeybush species rich in health-beneficial phenolic compounds. Drought stress is a significant challenge for honeybush cultivation, impacting plant growth and physiology. Plants have developed adaptive strategies, including antioxidant systems and osmolyte accumulation, to cope with drought. Understanding how drought affects honeybush and its biochemical mechanisms is essential in the context of climate change. The research also explores mechanisms like transpiration rate, photosynthesis, and stomatal conductance during drought and recovery, aiming to determine suitable irrigation methods for Cyclopia species. This study is valuable for sustainable honeybush cultivation and conservation, considering the changing climate. The expected outputs include capital development, published articles, farmer's events, and conference presentations.

# PROJECT NAME: EFFECTS OF SOIL PITTING FOR RESTORATION PURPOSES ON SOIL-SURFACE TEMPERATURE

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| PROJECT NUMBER: | PS/RVA/R/RS2 |
| AUTHOR/SCIENTIST: | RUDI SWART - Rudi.Swart@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2023 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The arid regions of the Western Cape, as well as arid regions elsewhere are often characterised by bare areas caused by poor rangeland management and mining activities. It has been found that the surface temperature of these bare areas fluctuate much more severely between day and night time, than the surface temperature of areas that are covered in vegetation. It is believed that this severe temperature fluctuation on bare soils greatly inhibits seedling establishment. Brush-packing these bare areas creates a suitable micro-climate that has been shown to be an effective measure to allow seedling establishment. It has also been shown that digging hollows in bare areas is an effective way to establish new vegetation. It thus follows that these hollows may have an effect on soil surface temperature that would create a more favourable environment for seedlings to establish. This project aims to determine how these hollows affect soil temperature and whether they can provide a suitable micro-habitat for the establishment of perennial plants. Understanding the effects of these hollows on soil temperature may improve the general understanding of how they can be used in land restoration projects and possibly reduce the need of brush-packing and thereby reducing restoration costs and to measure and compare the soil surface temperature of bare ground and of restoration hollows. These measurements will be taken once during the coldest time of day and once during the warmest time of day. Measurements will be taken during summer and winter in the Western Cape, February and July respectively.

# PROJECT NAME: ELITE PASTURE EVALUATION TRAILS FOR LOLIUM AND OTHER TEMPERATE SPECIES BASED ON AGRONOMIC AND INTERACTION TRAITS

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| PROJECT NUMBER: | PS/SR/P/SBA1 |
| AUTHOR/SCIENTIST: | SIGRUN AMMANN - Sigrun.Ammann@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JANAURY 2016 - 31 MARCH 2026 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Evaluate varieties of temperate pasture species used for dairy production. These varieties should be the most modern varieties that are on the market. The data assists farmers in choosing the best performing varieties for improved pasture production based on local, independent data. The information can additionally be used to determine useful combinations for mixtures to achieve maximum production, persistence and quality. The persistence and yield stability data over years are an opportunity to move closer to the objective of reducing the need for annual pasture planting through over-sowing or that over-sowing can be more strategically used and in that way reduce costs and improve fodder flow. Varieties are evaluated for various parameters that determine their performance and their adaptability to the local climate and soil conditions as well as parameters that are important for complimentary in mixed swards. The primary parameter is always yield since maximum biomass production is required to feed the grazing animals. In addition forage quality is determined on a seasonal basis, since forage quality influences milk production. Other parameters are disease resistance especially leaf rust, flowering behaviour, persistence and growth form. Adaptability to local climatic conditions is mainly manifested in the yield, disease resistance and persistence. Flowering is influenced mainly by the minimum temperatures. Parameters that can assist in designing mixtures are seasonal production, flowering behaviour, forage quality, persistence and growth form. Persistence and yielding stability over years is important for resilience in pasture production.

# PROJECT NAME: IMPROVING THE SUMMER PRODUCTION AND FORAGE QUALITY OF DAIRY PASTURES BY USING THE FORAGE HERBS CHICORY AND PLANTAIN


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| PROJECT NUMBER: | PS/SR/P/SBA2 |
| AUTHOR/SCIENTIST: | SIGRUN AMMANN - Sigrun.Ammann@westerncape.gov.za |
| PROJECT START/END DATE: | 1 MARCH 2016 - 31 MARCH 2027 |
| PROJECT STATUS: | IN PROGRESS |


## AIM AND INDUSTRY RELEVANCE

Using forage herbs to improve the production and quality of pasture during the warmer months of summer and into early autumn while retaining year-round productivity. A high quality pasture alternative with improved yield and persistence for increased milk production especially in the summer and early autumn when grass quality is often poor. The data assists farmers in choosing varieties that are both summer and winter active. Understanding the basic dynamics of pasture mixtures consisting of forage herbs, grasses and legumes in terms of composition and yield with the associated forage quality. These principles can be used by farmers to decide on which pasture mixtures will be most beneficial for their specific objectives. The adoption of these types of mixed pastures can improve milk production and resilience in terms of variable climatic conditions, mainly rainfall and temperature. To use plantain and chicory to improve warm season production and importantly forage quality to improve milk production at a time when grass pastures are at their lowest quality. The use of these species also opens the opportunity to assess multi-year pastures which may reduce the need for annual over-sowing while retaining yield stability and quality. Apart from evaluating varieties of these species for both summer and winter active growth, disease resistance and flowering behaviour, intensive work is done on forage herb -grass-legume mixtures. Data is collected on changes in mixture composition, yield of various mixture combination compared with pure stands and forage quality. Other parameters include flowering, persistence and sward structure in terms of plant height. The effect of autumn versus spring planting is also investigated.

# PROJECT NAME: DETERMINING HERBAGE QUALITY FOR RYEGRASS AND OTHER CULTIVARS OF VARIOUS GENETIC ORIGINS RELATED TO PASTURE MANAGEMENT PRACTICES

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| PROJECT NUMBER: | PS/SR/P/SBA3 |
| AUTHOR/SCIENTIST: | SIGRUN AMMANN - Sigrun.Ammann@westerncape.gov.za |
| PROJECT START/END DATE: | 1 APRIL 2019 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Evaluate pasture varieties, especially ryegrass and ryegrass bred for high sugar content or other quality parameters in relation to various management practices such as nitrogen fertilisation, harvest frequency an diurnal effects to improve particularly the carbohydrate to protein ratio. This can result in improved milk production and lower environmental impact through better protein utilisation. Pasture management options for improved pasture quality. A lower impact on the environment can be assumed by optimising the carbohydrate: protein ratio as far as possible. Objectives include: to intensively assess forage quality parameter of grasses bred for improved quality in relation to various management parameters that can lead to improved milk production. Determine the best combination of management factors that will result in the most optimal carbohydrate to protein ratio and a favourable fibre content.

# DIRECTORATE: RESEARCH SUPPORT SERVICES

# PROJECT NAME: MAPPING, MEASURING AND MONITORING THE FOOTPRINT OF AGRICULTURE IN THE WESTERN CAPE

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| PROJECT NUMBER: | RU/S/I/MW4 |
| AUTHOR/SCIENTIST: | DR MIKE WALLACE - Mike.Wallace@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JANUARY 2020 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The aims of this project are threefold: to synthesise "lessons learned" and best practices from previous iterations of "The Flyover" census into a new Terms of Reference document to guide our own future surveys and to inform our sister departments. To establish and execute a recommended workflow to guide the process of incorporating the data into the Department's databases, including the ground-truthing/field-validation, interim updating thereof and subsequent data dissemination and to investigate opportunities to modify and adapt the methodologies in response to budget constraints and new technologies (for example Artificial Intelligence and machine Learning). This step will encompass a literature review and interactions with researchers in other countries regarding their local methodologies for crop/ commodity/infrastructure surveys. Reliable, timely, accurate and detailed information regarding agricultural production has become an essential component in the management and development of our sector. Furthermore, the agricultural sector does not operate in isolation. Data on agricultural land use and infrastructure is of equal importance to many other allied sectors and agencies – for example, conservation, water management, disaster management, municipal planning (through their mandatory Spatial Development Frameworks), supporting spatial planning legislation (SPLUMA/ PDALB), alternative energy development, food and freight flow modelling and planning, urban expansion planning and in various economic development planning and analysis arenas. As in other industries, accurate, reliable and timely information is very important for informed decision making. Also, in our country's development milieu, to develop appropriate strategies for agricultural investment and to identify agricultural hubs and land reform strategies, it is necessary to have accurate baseline information (including spatial data) on regional agricultural production, as well as existing, associated agri-infrastructure.

# PROJECT NAME: DEVELOPING AND MAINTAINING A WEATHER INFORMATION AND MONITORING PORTAL FOR THE WESTERN CAPE

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| PROJECT NUMBER: | RU/SI/MW5 |
| AUTHOR/SCIENTIST: | DR MIKE WALLACE - Mike.Wallace@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JANAURY 2020 - 31 MARCH 2025 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The project emanates from the outcomes of the 2016 SmartAgri project recommendations where it was stated as a concern that freely available, near real time data was scarce in the province. The need was identified for a distributed weather station monitoring network with the ability to view and/or extract live or archived data. Thus the aim is to provide both a network of automated weather stations representative of the SmartAgri Climate Zones, as well as an easy online portal to make the data freely and easily available to all our stakeholders. The WCDOA weather station portal is a Web based application developed in-house that provides easy access to the data of the weather stations (https://gis.elsenburg.com/apps/wsp/#). The purpose of the Weather Station Portal (WSP) is to develop a Web-based interface that our industry stakeholders and officials can easily access without authentication. The WSP provides functionality to view tabular and graph data for any selected weather station at daily or hourly intervals over a selected period, as well as a map component to view the spatial distribution of the weather stations as map markers with current weather parameter values. There were traditionally three main role players in the provision of climate data in South Africa, namely the South African Weather Service (SAWS), Department of Water and Sanitation (DWS) and the Agricultural Research Council (ARC). Most weather station data relevant to the agricultural sector were provided by the ARC who maintain some 500 automatic weather stations across SA. s a consequence of both SAWS and the ARC's business models, these climate data are only available at a considerable cost. Furthermore – none of these sources are publically accessible in real time online. This project will provide highly relevant and free data to all sectors of the agricultural industry to support better planning and promote better understanding of our highly variable and changing climate across the regions.

# PROJECT NAME: HISTORIC AND FUTURE MODELLING AND MAPPING OF EARLY SEASON TEMPERATURE PATTERNS AND EXTREMES, AND IMPACTS FOR POME AND STONE FRUIT PRODUCTION IN SOUTH AFRICA

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| PROJECT NUMBER: | RU/RM/SM1 |
| AUTHOR/SCIENTIST: | DR STEPHANIE MIDGLEY - Stephanie.Midgley@westerncape.gov.za |
| PROJECT START/END DATE: | 11 FEBUARY 2021 - 31 MARCH 2024 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Climate variability and change are already impacting on pome and stone fruit production in South Africa. The industry identified the need to better understand historical and projected future temperature patterns and temperature extremes in the early season, from flowering to fruit set to early fruit and leaf growth. High temperature events in this period can be devastating for fruit set and yield and lead to substantial financial losses. This project provides a scientific assessment of the changing climatic risks and impacts in the early season, and potential adaptation options for pome and stone fruit growers in different production regions to mitigate against crop losses. Objectives of this project are to determine the final scope and methods of the study: *Focused knowledge review, parameters and criteria for quantitative modelling of different fruit types, discussions with experts in deciduous fruit reproductive biology and chilling models, agreement on approach and models to be used for these aspects.* Conduct quantitative climatic (historic and projected future) modelling of temperature-related processes occurring in the spring period that influence yield and fruit quality for primary production regions and present these as maps: *Quantitative modelling and mapping (historic and projected future and change between the two periods) of key indicators of temperature patterns and extremes, changes in temperature dynamics at the transition from winter to spring, and photosynthesis of young leaves and fruit as influenced by temperature. Interpret impacts of modelled changes on flowering, fruit set, yield and fruit quality for each fruit type and each region, and draft set of adaptation options and* expert-led interpretation, risk profiles and adaptation: *workshop with industry experts to validate results and draft interpretation, develop adjusted risk profiles per fruit type and region, and finalise a list of effective adaptations.*

# PROJECT NAME: THE EFFECT OF CURRENT AND FUTURE CLIMATE CHANGE ON CANOLA PRODUCTION IN THE SWARTLAND REGION OF SOUTH AFRICA

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| PROJECT NUMBER: | RU/RM/SM3 |
| AUTHOR/SCIENTIST: | DR STEPHANIE MIDGLEY - Stephanie.Midgley@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022 - 31 MARCH 2026 |
| PROJECT STATUS: | ONGOING |

## AIM AND INDUSTRY RELEVANCE

The aim of this research project is to identify the effect of climate change on canola yield potential in the Swartland region of the Western Cape; to research the effect climate has on the actual yield of different canola cultivar classes; and to identify the current and future canola production potential for the Swartland region. The popularity of including canola as a cash crop in rotation with wheat in the dryland crop production area of the Swartland in the Western Cape Province has grown significantly in the past few years, and demand for canola products continues to rise. Production can be increased by increasing the hectares under production, and by increasing the yield, which is currently not reaching its potential. Yield is influenced by temperature, rainfall, carbon dioxide ($CO_2$) concentration, nutrition, and management practices. The influence of the current climate is not well understood, and production potential (yield, and suitable areas) will change under climate change (warming, changing rainfall, rising $CO_2$). Farmers need science-based information on the influence of climatic factors, suitable production areas and adaptive management practices in order to increase production efficiencies and income. A growing canola industry will play an important role in agricultural development in the Western Cape, job creation and food security. The objectives of the project include determining the effect of temperature and $CO_2$ on canola yield potential; determining the effect of temperature and $CO_2$ on the physiological growth response of canola; researching the current climatic effect on canola actual yield; and revise the Hardy-Wallace model for current canola production potential and determine future canola production potential of the Swartland region in South Africa.


# LONG-TERM PROJECTS

# PROJECT NAME: THE MANAGEMENT, LONG-TERM CONSERVATION AND SELECTION OF THE OSTRICH RESOURCE FLOCK AT OUDTSHOORN RESEARCH FARM

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| PROJECT NUMBER: | AP/BR/0/AE18 |
| AUTHOR/SCIENTIST: | DR ANEL ENGELBRECHT - Anel.Engelbrecht@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2012 - 31 MARCH 2032 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The ostrich flock at the Oudtshoorn research farm was developed as a research resource from a donation of commercial breeder birds made by local producers in 1964. As such, the Department has a responsibility to maintain this unique and valuable resource, and to provide information and breeding material to the ostrich industry. This responsibility is part of the contractual agreement between the Department and the ostrich industry. Breeding material obtained from the flock is made available to the industry by auctioning young breeder birds annually and through the selling of day-old chicks to producers. This project will combine information on parentage determination and the estimation of genetic parameters to enable a comprehensive breeding plan for utilisation by the South African ostrich industry. The completion of such a plan would contribute to the global competitiveness of the local ostrich industry. It would also contribute to establishing structure and direction for the future for the ostrich industry in South Africa. The progeny of the resource flock are also used in various research studies and it is therefore important to maintain this resource. This project's purpose is therefore to ensure the management, long-term conservation and selection of the ostrich flock at the Oudtshoorn Research Farm to aid ostrich research and to benefit the ostrich industry as a whole.

# PROJECT NAME: THE MANAGEMENT AND LONG-TERM CONSERVATION OF THE SOUTH AFRICAN MEAT MERINO (SAMM) SHEEP RESOURCE HERD AT ELSENBURG RESEARCH FARM

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| PROJECT NUMBER: | AP/BR/S/AS20 |
| AUTHOR/SCIENTIST: | DR ANSIE SCHOLTZ - Ansie.Scholtz@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2012: LONG-TERM |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The South African Mutton Merino (SAMM) was imported to South Africa in the 1930's, as the then German Merino. Elsenburg played an important role in the establishment of the SAMM breed in South Africa. Selection for multiple births achieved a lot of attention in the Elsenburg SAMM flock. This resulted in the flock having a very high reproduction rate in the late 1990's and early 2000's which was unfortunately linked to a high lamb mortality rate up to weaning age. This is worrying since reproduction is identified as a key contributor to the economic success of local small stock farmers.
There is some evidence that the multiple birth rate of the flock has been reduced since the introduction of rams from industry sources. In the Merino breed, with a reputation for poor reproductive performance, it was demonstrated that the reproduction rate of Merino ewes could be improved substantially by selection. At this stage it is unsure if the same progress will be achieved in a breed like the SAMM which is reputed to be a highly prolific breed. It is also important to consider the consequences of such selection on other traits of economic importance. Research on the flock demonstrated that recent genetic change for weight and wool traits were negligible. The resource flock is thus perfectly pitched for studies on the genetics of reproduction in the breed, given its history of selection for birth rate. It is important to determine how a trait like ewe rearing ability would change under selection for a correlated trait like number of lambs weaned per ewe mated. The project has so far contributed markedly to the scientific knowledge as far as its contribution to the scientific literature is concerned. The objective of the project is therefore to continue with research, primarily on genetic parameters for reproductive traits, as wells as selection for a trait related to output in terms of lambs. Immediate aims focus on the estimation of genetic parameters for ewe reproduction and ewe rearing ability in the flock.

# PROJECT NAME: THE MANAGEMENT, SELECTION, AND LONG-TERM CONSERVATION OF THE DORPER SHEEP RESOURCE HERD AT ELSENBURG RESEARCH FARM

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| PROJECT NUMBER: | AP/BR/S/AS21 |
| AUTHOR/SCIENTIST: | DR ANSIE SCHOLTZ - Ansie.Scholtz@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2012 - 31 MARCH 2031 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The composite Dormer breed was developed at Elsenburg during the 1940's as a cross between the Dorset Horn and the German Merino (presently the SA Mutton Merino). The objective with the formation of the breed was to develop a fast-growing white-wool breed for terminal crossbreeding on Merino-type ewes. The Dormer adapted well in this role and produced slaughter lambs of the desired quality when used on Merino type dams. Currently the Dormer is by far the most numerous terminal sire breed in South Africa as reflected by the number of records submitted to the National Small Stock Improvement Scheme. Direct genetic variation were reported for growth to weaning in the Elsenburg Dormer flock. These studies also reported maternal genetic variation, while a strong negative direct-maternal genetic correlation was reported in some instances. Selection decisions are obviously complicated by such a correlation. Genetic parameters for reproduction in the Elsenburg Dormer flock were low, but consistent with those in a Merino flock wherein worthwhile genetic progress in reproduction was reported. Currently there are no estimates of genetic correlations between growth and reproduction in the Elsenburg flock or the breed. The direction of this correlation can thus only be speculated upon. However, this information is of cardinal importance for informed decision on a future selection strategy for the breed. The project so far has contributed markedly to the scientific knowledge as far as selection for growth is concerned. The objective of the project is to continue with selection and further research on the Elsenburg resource flock. Immediate aims focus only on selection for direct breeding values and maternal breeding values. Another immediate aim is to quantify the impact of selection for growth on the conformation and culling decisions by the breed representative.

# PROJECT NAME: THE MANAGEMENT, LONG-TERM CONSERVATION AND SELECTION OF THE FINE WOOL MERINO RESOURCE FLOCK AT TYGERHOEK RESEARCH FARM

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| PROJECT NUMBER: | AP/BR/S/AS33 |
| AUTHOR/SCIENTIST: | DR ANSIE SCHOLTZ - Ansie.Scholtz@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2013 - 31 MARCH 2031 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

A fine-wool resource flock has been maintained at the Tygerhoek Research Farm since 1998 based on requests from the wool industry. Industry structures were instrumental in establishing the flock using genetic material from the well-known Cradock fine wool flock. Research to reduce fibre diameter by importing germplasm from a superfine wool stud in Australia was supported by a grant from Cape Wools SA. Fibre diameter in the Tygerhoek flock was reduced by >1% per annum, leading to a 2µm reduction in fibre diameter since 1998. It is important to conserve the fine-wool line to have access to genetically superfine wool animals when needed for specialist knitwear. Indirect changes in other traits resulting from the reduction in fibre diameter should also be determined. The close collaboration with industry throughout the existence of the flock as well as the participation of the flock in various industry-funded projects provides a further motivation for the continued maintenance of the flock.

# PROJECT NAME: THE MANAGEMENT, LONG-TERM CONSERVATION AND SELECTION OF THE MERINO SHEEP RESOURCE FLOCK AT ELSENBURG RESEARCH FARM

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| PROJECT NUMBER: | AP/BR/S/CN22 |
| AUTHOR/SCIENTIST: | DR CONELLIUS NEL - Nelius.Nel@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2012 - 31 MARCH 2032 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The Elsenburg Merino flock is a long-term selection experiment that serves as proof of concept for the South African sheep breeding industry. Traditional views in sheep breeding maintained that reproductive traits cannot be improved by genetic selection. To assist in refuting this notion, the selection experiment began in 1986 by screening two lines, the H-Line (positive selection) and the L-Line (negative selection) from the same founding base population of Merino sheep. By the early 2000's, the mean value for number of lambs weaned in the H-Line was nearly 30% higher than that of the L-Line, which was a major result given the low expectation of genetic change in reproductive traits. The study is the only one of its kind currently seen for sheep worldwide and has already played an important role in promoting the genetic selection for reproductive traits in the wider industry. Currently, the Elsenburg Merino flock continues to contribute on an academic as well as a practical level, as the resulting differences in the H-Line has become an example of genetic selection for overall health and welfare. For example, survival to weaning of H-Line lambs is roughly 20% higher that of L-Line lambs, and H-Line lambs cope better with the cold stress conditions that is common in a winter lambing season. In turn, H-Line ewes show better mothering ability and produce more milk. These factors are highly favourable to better animal health and welfare which are becoming increasingly important in the modern market of animal products. Unfortunately, although the recording involved in testing and selecting the H-Line sheep are relatively simple, widespread adoption of health and welfare traits in the wider industry has been disappointing. The Elsenburg Merino selection experiment thus continues to promote the high potential of genetic selection in attaining better production, health and welfare in sheep.

# PROJECT NAME: CONSERVATION FARMING PRACTICES FOR POTATO PRODUCTION IN THE SANDVELD

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| PROJECT NUMBER: | PS/RVA/V/JVZ1 |
| AUTHOR/SCIENTIST: | DR JACQUES VAN ZYL - Jacques.VanZyl2@westerncape.gov.za |
| PROJECT START/END DATE: | 15 JANUARY 2013 - 31 MARCH 2029 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Potato production is one of the most important agricultural activities in the Sandveld. The extremely high soil loss as a result of wind erosion, "sand blasting" of young potato plants in newly established potato fields, lower water holding capacity of soils, the tendency of soils to develop compaction layers and the uncertain (future) water supply, have major negative effects on the sustainability of potato production in the region. The Sandveld has been internationally recognised as a biodiversity hotspot with high conservation status, current potato production practices impact negatively on vegetation and habitats that surround potato lands, due mainly to physical damage to plants and habitats from wind-blown sand, and the deposition of sand and excessive nutrients into the natural vegetation. Experience in other parts of the world and locally indicate that conservation farming practices have had positive effects on conservation of natural resources and have improved crop production. Potatoes are produced in the Sandveld in an area of between 6000 – 7000 ha annually, potato production forms the core economic activity in this area of the Western Cape. The turnover can be in the order of R400m per year and the industry provides employment to approximately 3250 workers. The potato production area of the Sandveld is found within a biodiversity hotspot. It is located in one of the richest plant kingdoms in the world, associated with important biodiversity features and thus potato production potentially has a massive impact on biodiversity of the Sandveld region. Some of these features include the Greater Cederberg Biodiversity Corridor, the Verlorenvlei World Heritage Wetland and the fact that the Northern Sandveld has been declared an area of global biodiversity significance. Soils of the Sandveld are mostly deep, well-drained sands with a low clay content which results in low water and nutrient retention capacity, high permeability and high wind erosion potential. These sands are also prone to moderate compaction and have a low nitrification potential. The project generates data that is used to help establish the potato "best practice" guidelines in the Sandveld for tillage and cover crop management. The information generated from the project benefits both the commercial and emerging farmers in establishing sustainable potato farming systems which will ensure profitable potato farming for the future generations. The objective of this project is to evaluate the effect/influence of conservation farming practices on soil loss (due to wind erosion), potato yields, the physical, biological and chemical status of soil, and water use efficiency in the potato production system. A further objective is to develop conservation farming guidelines which could be incorporated into the best practices management options for potato production in the Sandveld.

# PROJECT NAME: AN EVALUATION OF PRODUCTION DYNAMICS OF EIGHT CROP ROTATION SYSTEMS IN THE SWARTLAND

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| PROJECT NUMBER: | WPC/05/5.1/96/NAV/PP/28 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS/RENS SMIT - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 1996 - 31 MARCH 2031 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

The long-term systems trial was launched to illustrate the value of conservation agricultural practices. Minimal soil disturbance through no-till, crop rotation and retention of crop residue on the soil surface strive to build resilience in the soil through carbon sequestration. The project evaluates five cash crop systems and 4 crop/pasture systems. The value of this production method has shown its worth through several very dry years, where yields were stable, and systems were still profitable. The trial also helps inform on changing climatic conditions. A secondary role of the project is also to show stable production under lower inputs. The project forms part of the Global Long-Term trial Network.

# PROJECT NAME: AN EVALUATION OF CONTINUOUS CASH CROP PRODUCTION (INCLUDING SMALL GRAINS, CANOLA, OTHER ALTERNATIVE BROADLEAF CROPS AND GREEN MANURE COVER CROPS) UNDER CONSERVATION AGRICULTURAL PRACTICES ON HIGH POTENTIAL SOILS OF THE RIVERSDALE FLATS

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| PROJECT NUMBER: | PS/SR/C/JAS1 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 1996 - IN PROGRESS |
| PROJECT STATUS: | ONGOING |

## AIM AND INDUSTRY RELEVANCE

To determine the short- and long-term effects of six of the most feasible crop rotation systems identified for the high potential soil of the Riversdale area on: crop yields, weed control, disease suppression, soil production potential and economically sustainable land-use in the Riversdale area. The work is aimed at providing local producers with viable cash crop rotation systems for the specific production area. The main long term aims include - Economics: What is the long-term effect of crop rotations on farm income in the Riversdale "vlaktes"? Sustainable production: How do rotation systems influence crop yield and quality over time? Alternative crops. What are the long-term effects of incorporating green manure cover crops in crop rotation systems? Weed control: How does rotation system influence weed seed-banks over time? Sustainability of soils: What influence does crop rotation system have on the maintenance and improvement of the organic carbon content of soils? Disease suppression: The occurrence and intensity of diseases over time? Reducing of inputs: How do input requirements for optimal crop production change over time for the different rotation systems? The main short term aim is - Production: What is the production potential of wheat, canola and lupins in a specific season when applying the crop production protocols recommended for the area concerned? Alternative crops: What are the effects of incorporating crops such as cover crops on cereal production in the traditional cereal production systems practiced in the southern Cape? What is the effect of previous season's crops (wheat, canola, lupins, barley, oats and coriander (koljander) on the quantity and quality of crop production in the following season? How do these effects change over time? Economics: Are there any short-term differences in the gross margins attained among the rotation systems being tested? Production: Does increased frequency in canola production have an effect on sustainability in terms of disease pressure and economic sustainability?

## PROJECT NAME: THE CONSERVATION OF THE PERCHERON STUD AT ELSENBURG

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| PROJECT NUMBER: | AP/BR/H/MB35 |
| AUTHOR/SCIENTIST: | MARLINÉ BURGER - Marline.Burger@westerncape.gov.za |
| PROJECT START/END DATE: | 15 NOVEMBER 2012 - 31 MARCH 2032 |
| PROJECT STATUS: | IN PROGRESS |

### AIM AND INDUSTRY RELEVANCE

There are only 150 registered female Percheron horses in South Africa. With only a few mares per stud inbreeding can become a p oblem and with only a few pure bred mares in South Africa the survival of the breed will always be in threat. The Elsenburg stud with 12 females is one of the largest of the 33 Percheron studs and with the best gene pool of pure bred mares. The aim with the Elsenburg Percheron stud is the conservation of a draft horse breed by keeping and breeding with as wide as possible spectrum of genetic material of pure bredPercherons, place breeding material at disposal to the public at affordable prices and place the horses in the stud at disposal for training of students at Elsenburg. In the past few years the Percheron has increased in popularity due to their ability to do traction work on farms helping farmers to complete certain jobs on the farm like ploughing without the use of fossil fuels. More and more farmers are using them in the place of tractors to do certain kinds of jobs around the farm that can save on tractor and diesel costs while also reducing the production of GHG at farm level. The breed is becoming more popular and with the small number of breeders still left in South Africa, Elsenburg is the main source of genetic material and horses for the public and other breeders.

# PROJECT NAME: LONG-TERM MONITORING OF THE VELD CONDITION IN THE ARID AREAS OF THE WESTERN CAPE

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| PROJECT NUMBER: | PS/RVA/R/NS3 |
| AUTHOR/SCIENTIST: | NELMARIÉ SAAYMAN - Nelmarie.Saayman@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2014 - 31 MARCH 2031 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Long term monitoring provides objective information on trends of that what is monitored and the information can be used to verify remotely-collected data and models (e.g. satellite data, long-term grazing capacity norms, veld condition, impact of climate change, desertification and the impact and occurrence of drought). Using these trends one can make recommendations to improve veld through possible change in management, restoration actions, early provision of supplementary feed, early decrease in stock numbers to prevent degradation in vegetation and livestock during droughts etc. If the veld condition improves over time then it can counteract to some extent the effect of climate change, the impact of drought and desertification and the animals will be in a better condition, reproducing better leading to a better income. It is also important to know when the veld is degrading in order to take timeous steps in adapting the management to prevent the necessity of active restoration. Since management of veld is much more cost-effective than repairing degraded land through active restoration. The aim of this project is to initiate long-term monitoring sites where the changes in the veld condition of the arid regions of the Western Cape can be monitored through measuring of the species composition, plant cover and soil erosion potential at permanently marked sites across the Central Karoo, Little Karoo, Ceres-Karoo and West Coast districts where the farms are mainly used for extensive livestock farming.The main aims of the project include - determine changes and trends in the species composition of the arid regions of the Western Cape. Determine changes and trends in the plant cover of the arid regions of the Western Cape and determine changes and trends in the soil erosion potential of the arid regions of the Western Cape.

# PROJECT NAME: CULTIVAR EVALUATION OF OIL AND PROTEIN SEEDS IN THE WINTER RAINFALL REGION

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| PROJECT NUMBER: | PS/SR/C/PJAL1 |
| AUTHOR/SCIENTIST: | PIET LOMBARD - Piet.Lombard@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2004: LONG-TERM |
| PROJECT STATUS: | ONGOING |

## AIM AND INDUSTRY RELEVANCE

During 2021, two trials were planted at two different planting dates at Langgewens and Tygerhoek, as well as an elite trial at both localities. Floods during May resulted in the one planting date trial and Elite trial being written off at Tygerhoek. The trials at Caledon and Hopefield were severely damaged by porcupines and guinea fowl and consequently written off. In the 2021 season, a total of 13 cultivars were tested in the cultivar evaluation program. Climate: The rainfall at Langgewens in the Swartland was only 6 mm less than the long-term average, although the rainfall during June, July and September was lower than the long-term average. Rainfall in late August reduced the effect of the dry September. Tygerhoek in the Southern Cape received as much as 397 mm of rain during May 2021. The rainfall in the months since May was below average with the exception of July, which received 22 mm more than the long-term average. Results: Swartland: The average yield in the Swartland ranged from 3683 kg ha-1 (Langgewens 1st planting) to 1596 kg ha-1 at Eendekuil. The conventional group of cultivars consisted of three cultivars in total. The cultivar Diamond (3054 kg ha-1) realised the highest seed yield followed by Quartz (2747 kg ha-1) and the new cultivar Hyola 90013. The seed yield of both Quartz and Hyola 90013 were significantly lower than those of Diamond. Five CI cultivars were tested in 2021, and 43Y92 (2747 kg ha-1) realised the highest yield within the group. The new CI cultivar 44Y94 produced the 2nd highest yield (2714 kg ha-1) followed by 44Y90 (2646 kg ha-1). The new TT cultivar Blazer TT, was the highest yielding TT cultivar with 2649 kg ha-1, followed by Alpha TT and Hyola 350TT. The three cultivars did not differ significantly from each other. The average yield of the TT cultivars was 14.3% less than the conventional cultivars in 2021. The yield of the CI cultivars was on average 4.9% less than those of the conventional group of cultivars. Southern Cape: In the Rûens (Southern Cape) the trial averages varied between Tygerhoek 1st (3309 kg ha-1) planting date and Riversdale (3208 kg ha-1). The average yield of the new longer growing cultivar 45Y95, was 3746 kg ha-1. The CI cultivar with the second highest yield in 2021 was 43Y92 (3682 kg ha-1). None of the five cultivars within the group differed significantly from each other. The conventional cultivar Quartz (3449 kg ha-1) was the highest yielding conventional cultivar in the Southern Cape, as it was in 2020. Quartz was followed by Hyola 90013. The cultivar Diamond was unable to perform according to its yield potential, due to the Sclerotinia infection in the three trials. Trials were only sprayed once for Sclerotinia. Blazer TT was the highest yielding TT cultivar (3395 kg ha-1) within the TT group. Alpha TT was the second highest yielding cultivar and the seed yield was not significantly lower. As was the case with Diamond, Hyola 350TT's yield was also lower than the cultivar's potential due to the occurrence of Sclerotinia infection in the trials. The average seed yield of TT cultivars was 7% and 17.9% lower than the conventional and CI cultivars respectively. The seed yield of the CI cultivars was 10.9% better than the conventional group. Conclusion: As in the 2020 season, the weather conditions was favourable for seed production. The cool August and September resulted in a longer than normal growing season. The longer growing season favour the longer growing cultivars, however those cultivars don't perform as well in a normal to shorter growing season.

# PROJECT NAME: WINTER GRAIN CULTIVAR EVALUATION IN SWARTLAND AND SOUTHERN CAPE

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| PROJECT NUMBER: | PS/SR/C/PJAL4 |
| AUTHOR/SCIENTIST: | PIET LOMBARD - Piet.Lombard@westerncape.gov.za |
| PROJECT START/END DATE: | 01 SEPTEMBER 2009: LONG-TERM |
| PROJECT STATUS: | ONGOING |

## AIM AND INDUSTRY RELEVANCE

During 2022, four cultivar trials were planted in the Overberg/Southern Cape, and five (+1) were planted in the Swartland. All the trials have been harvested, and the data has been included in the report. The number of cultivars in the National cultivar trials increased to 17 in 2022, as PANNAR included several new cultivars. It was a challenging growing season as the rain started late in most areas, and the entire cultivation area received below-average to well below-average rainfall. All six Swartland trial yield data for 2022 have been included, although the quality for Waterboerskraal was not determined. The trials at Pools and Eendekuil first sprouted in 2022 (May 30). This explains the high average yield (3229 kg/ha) in the Pools trial. Both sites were very dry, but the sandy soil at Eendekuil likely contributed to the low average yield. The Philadelphia trial delivered the best average yield in the Swartland, namely 3229 kg/ha. The top three cultivars in the Swartland were SST 0127 (2728 kg/ha), SST 0166 (2629 kg/ha), and SST 0187 (2607 kg/ha). These three cultivars did not significantly differ from each other. The SST 015 cultivar showed a significant variation in yield; it produced very low yields at Eendekuil and Pools, while performing well in the other trials. It was observed that there was a high incidence of Fusarium crown rot with SST 015 at Eendekuil. The average quality per cultivar in the Swartland met the highest grade, although the protein content at Langgewens ranged from 9.5 to 12%. The average protein content for all cultivars was higher than the minimum requirement for the highest grade (>12.5%). The average HLM (Hectoliters Mass) for all cultivars was also above the >76 requirement for supergrade (Table 2). For the Overberg/Southern Cape, yield data for four trials were included for 2022. The trial at Caledon (Roodebloem) delivered the highest average yield of 4084 kg/ha, while the Riversdal (Uitkyk) trial had the lowest yield. The top three cultivars in the Southern Cape were SST 0147 (3898 kg/ha), SST 0117 (3861 kg/ha), and SST 0127 (3858 kg/ha). These three cultivars were followed by SST 0166, SST 056, SST 0187, and Steenbok. None of the mentioned cultivars significantly differed from each other. Unlike in the Swartland, the average seed yield was higher, but the protein content of the cultivars was lower. The protein content of the cultivars ranged from 10.6-11.7 (B2/B3). The average HLM for all the cultivars was also above the >76 kg/hl requirement for supergrade. All the cultivars had an average B2 classification, except PAN 3855, Ratel, and SST 0127, which were classified as B1 when protein content and HLM were calculated together.

# PROJECT NAME: EVALUATION OF ADVANCED OILSEED AND PROTEIN CROPS FOR THE WINTER RAINFALL REGION OF THE WESTERN CAPE

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| PROJECT NUMBER: | PS/SR/C/PJAL6 |
| AUTHOR/SCIENTIST: | PIET LOMBARD - Piet.Lombard@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2022: LONG-TERM |
| PROJECT STATUS: | ONGOING |

## AIM AND INDUSTRY RELEVANCE

This wheat cultivar trial, as with the canola, is supported and funded by industry and supported by breeders/seed companies. It forms the basis of all recommendations and the data is very much sought after. This is also being linked with other component trials to also link cultivars with other production and quality traits, adding considerable value to the basic cultivar evaluation being done.

# PROJECT NAME: MAINTENANCE AND MANAGEMENT OF THE OUTENIQUA JERSEY HERD

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| PROJECT NUMBER: | AP/NP/D/RM36 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE/PIETER CRONJE - Robin.Meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 01 DECEMBER 2012 - 31 MARCH 2032 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

To maintain the Outeniqua Jersey herd as a resource herd, supporting research to optimise milk production from pasture systems. The Outeniqua dairy herd of 350 to 400 cows in milk is managed as a research facility. Cows graze irrigated kikuyu, ryegrass, fescue, cocksfoot, plantain and red clover pasture and are supplemented with 4 to 6kg concentrates/ cow/day. The herd provides cows to research projects on Outeniqua Research Farm and is the largest dairy research herd in South Africa. The research focus is to optimise sustainable milk production from pasture systems. The project reports on production, reproduction and genetic progress of the Outeniqua dairy herd. Dairy farmers and study groups regularly visit the Outeniqua Research Farm and research results are presented at the annual Outeniqua Information day.

# PROJECT NAME: DISTRIBUTION OF SUPERIOR GENETIC MATERIAL TO DEVELOPING FARMERS: BEEF CATTLE

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| PROJECT NUMBER: | AP/BR/C/TB10 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 DECEMBER 2011 - 01 DECEMBER 2026 |
| PROJECT STATUS: | IN PROGRESS |

## AIM AND INDUSTRY RELEVANCE

Developing farmers in South Africa are hampered by a lack of good genetic material. Normally they can only afford to get hold of dairy type heifers for farming purposes. The purpose of this project is to provide registered Bonsmara bulls to the developing or future commercial farmers to produce upgraded meat type heifers and weaned beef calves. Specific breeding objectives are followed in the Kromme Rhee Bonsmara herd for example low calf birth weight of calves (ease of calving), short inter-calving interval of cows (high fertility), low cow maintenance and acceptable average growth rate of offspring. More than 120 bulls were distributed over the project period. There are currently 60 bulls at 45 beneficiaries in the Western Cape Province. The project are managed in close collaboration between RTDS, APSD as well as the veterinary Department of the Province.


# COMPLETED PROJECTS

# PROJECT NAME: DETERMINATION OF VARIANCE COMPONENTS FOR SKIN TRAITS CONTRIBUTING TO A SELECTION INDEX FOR OSTRICHES IN SOUTH AFRICA

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| PROJECT NUMBER: | AP/BR/O/AE89 |
| AUTHOR/SCIENTIST: | DR ANEL ENGELBRECHT - Anel.Engelbrecht@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2018 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The aim of the study was to identify factors contributing to skin value, determining genetic and environmental parameters for ostrich skin traits, as well as evaluating the performance of pure and crossbred ostriches for skin traits. Skin size (SSZ), skin grade (SG) and quill value (QV) were assessed as predictors of skin value, using multiple regression techniques. Pearson's correlations among independent variables indicated that SG was the dominant driver of skin value, as indicated by a high negative correlation (-0.88) with skin value. Scores for skin traits such as nodule size (NSZ), nodule shape (NS), hair follicles and pitting mostly failed to detect the variation in skin value accounted for by QV and SG, respectively. Single-trait heritability estimates were subsequently derived for slaughter and skin traits of domesticated South African Black (SAB) ostriches, as measured on processed, untanned skins. Heritabilities for skin size and skin thickness (ST) were 0.37±0.06 and 0.20±0.05, respectively. Heritability estimates from multi-trait analysis ranged from low (0.08±0.04) for pitting scores to high (0.42±0.06) for hair follicle scores. Genetic correlations of slaughter weight (SLW) with SSZ and ST were 0.92 and 0.15, respectively. A positive genetic correlation was also found between SLW and NSZ. A high genetic correlation of 0.71 was observed between scores for NS and NSZ. Genetic improvement of most skin traits should therefore be attainable. Selection for a higher slaughter weight would result in bigger nodules with an improved shape, and therefore improved nodule acceptability. Evaluation of purebreds showed that the naturally occurring Zimbabwean Blue (ZB) and Kenyan Red (KR) birds outperformed their SAB contemporaries for most size-related traits ($P<0.05$). Heterosis were found for SLW, SSZ, SW, crown length, crown shape and NSZ when the SAB were crossbred with either of these two wild species, however, crossbred birds generally had higher scores for HF. Crossbreeding could therefore be used to improve slaughter weight and size-related skin traits in hybrids, but could compromise skin quality through the increased scores for hair follicles, which is undesirable. The feather quality of these birds also need to be considered though, as the domesticated ostrich (SAB) was specifically bred for improved feather quality compared to the natural breeds.

# PROJECT NAME: USE OF PROBIOTICS FOR OSTRICH CHICKS TO IMPROVE HEALTH AND SURVIVAL

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| PROJECT NUMBER: | AP/NP/O/AE98 |
| AUTHOR/SCIENTIST: | DR ANEL ENGELBRECHT - Anel.Engelbrecht@westerncape.gov.za |
| PROJECT START/END DATE: | 01 SEPTEMBER 2020 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

High chick mortalities up to 3 months of age remains one of the main challenges that the ostrich industry faces. Gut dysbiosis has recently been linked to ostrich chick mortalities. Dysbiosis is defined as an imbalance of gut microbiota. Various factors may cause a disturbance of the balance in the intestinal ecosystem and become risk factors for pathogenic infections. These factors include an unstable and immature microflora, poor water quality, nutritional factors (i.e. sudden changes, poor digestibility, and periods of starvation), environmental stresses (i.e. cold/heat stress) and enteropathogens. During the first few hours and days after hatching chicks become inoculated with both health-promoting and disease-causing bacteria. The health of the young chick is determined, in part, by which bacteria dominate the digestive tract. It is therefore critical that a healthy gut microbiota is established as quickly as possible after hatching. A healthy intestinal microbiota prevents the establishment of harmful bacteria by competitive exclusion and plays an important role in the digestion of fibre and modulation of the immune system. Chicks hatched in incubators and reared intensively in commercial conditions are not exposed to the same bacteria as those hatched naturally in a natural environment. The high incidence of enteritis and high mortality rates in artificially hatched and reared ostrich chicks are likely indicative of this failure of artificially reared chicks to acquire a healthy intestinal flora (Huchzermeyer, 1998). In a commercial environment, where gut bacteria cannot be naturally derived from parents, this can be aided by giving the young animals probiotics. A probiotic introduces desirable live microorganisms into the gut and changes the composition of the microbiota. When given in sufficient quantities it confers a health benefit to the host. Probiotic preparations can therefore potentially also be helpful in assisting with the initial gut colonisation of ostrich chicks with beneficial bacteria, thereby decreasing gut-associated disease and mortalities. No scientific evaluations of the use of commercial probiotics for ostriches have been published so far. This study therefore aims to evaluate two of the available probiotics for use in ostrich chicks.

# PROJECT NAME: EFFECT OF PRUNING ON THE ESTABLISHMENT AND EARLY GROWTH OF ROOIBOS (*ASPALATHUS LINEARIS*) SEEDLINGS WITH SPECIFIC REFERENCE TO SOIL MICROBES AND ROOT DEVELOPMENT

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| PROJECT NUMBER: | PS/SR/S/AM3 |
| AUTHOR/SCIENTIST: | ANELIA MARAIS - Anelia.Marais@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JUNE 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Many producers have observed that the lifespan of plants has decreased over the years. The common practice of pruning seedlings (roots and stems) may potentially affect seedling establishment. The hypothesis was that pruning of seedlings may adversely affect the following: root development, adventitious root development, nitrogen fixation by Rhizobium bacteria and mycorrhizal associations. This investigation was launched to investigate the effect of the farming practice of root and stem pruning of rooibos seedlings to evaluate the establishment and initial growth of rooibos. Many growers have shown that the lifespan of the plants has decreased over the years. The common practice of pruning seedlings (roots and stems) can presumably have an effect on the establishment of the seedlings. The hypothesis was that pruning the seedlings could adversely affect the following: root development, cluster root development, nitrogen fixation by Rhizobium bacteria and Mycorrhizal associations. Unfortunately, problems have been encountered with the software and the output for statistical analyses could not be obtained. The data is currently with the developers of the mini-rhisotron, who have acknowledged that there is an error in their software, and will attempt to extract the data. The data could not be processed further and is therefore temporarily unusable. Due to the fact that the developer of the software is in the US, by the end of the project there was no prospect of successful completion of this project. The project is therefore closed without available results. If the developers' efforts to make the software functional is successful in future, the results will be made available, and a report added to complete the project. Communication continues with Bio-Science, developers of RootSnap! and the mini-rhizotron.

# PROJECT NAME: DEVELOPING LONG-AND SHORT-TERM MANAGEMENT STRATEGIES TO ENHANCE SOIL QUALITY/HEALTH IN THE GRAIN PRODUCING AREAS OF THE WESTERN CAPE

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| PROJECT NUMBER: | PS/SR/S/JL3 |
| AUTHOR/SCIENTIST: | ANNEMARIE VAN DER MERWE - Annemarie.VanDerMerwe@westerncape.gov.za |
| PROJECT START/END DATE: | 02 JANUARY 2015 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Study a series of soil parameters that will react (positive or negative) to soil and crop management strategies during the sensitive period of adopting CA. The long-term performance of disc and tine planters in no-till systems will be evaluated as well as the optimum conditions for using these planters. The influence of stubble quantity, whether left on the surface, partially mixed or fully mixed with topsoil will be tested and stubble management strategies developed. The expected rate of improvement of soil as a result of adopting CA will be determined and producers can use these results to adjust their management strategies. Quantifying the effect of soil disturbance (or management) on weeds, diseases and pests will assist in developing crop protection strategies. If the situation permits, new technologies will be included as component studies. Both commercial and emerging farmers will be able to use the outcomes of this study as a decision-making tool to make informed decisions on soil and crop management under CA. Evaluate the effects of different degrees of soil disturbance on soil physical and chemical properties, within applicable crop rotation options: to evaluate the effects of different degrees of soil disturbance on disease, pests and weed population dynamics, within applicable crop rotation options. To relate the consequences of altering the soil's physical and chemical properties because of different degrees of soil disturbance on soil biological activity within applicable crop rotation options and demonstrate the effects of tillage practice and crop rotation on crop production and quality, weed control and plant protection management options.

# PROJECT NAME: THE EFFECT OF CROP ROTATION SYSTEMS AND TILLAGE PRACTICES ON FUSARIUM CROWN ROT OF WHEAT IN THE WESTERN CAPE

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| PROJECT NUMBER: | PS/PP/P/GJVC7 |
| AUTHOR/SCIENTIST: | DR GERT VAN COLLER - Gert.VanColler@westerncape.gov.za |
| PROJECT START/END DATE: | 26 MARCH 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Fusarium crown rot (FCR) of wheat is a destructive disease endemic in the Western Cape which occurs on grains and grassy weeds. It causes yield losses by blocking of vascular tissue, resulting in dead stalks and heads carrying little to no grain. FCR is expected to increase in severity in the coming years, since hot and dry conditions after flowering increases the severity of the disease. FCR is managed by integrating agronomical practices like crop rotation and tillage with host tolerance. The aim of this project, therefore, was to determine the effect of crop rotation in combination with different tillage practices (conventional tillage, minimum-till, no-till and zero-till) on FCR disease incidence and severity of wheat, and to investigate the effect of the different tillage practices on selected agronomical parameters, including stubble decomposition rate. This project has produced valuable information for producers, since it was shown that conservation agricultural practices like crop rotation with broad-leaf crops and zero-tillage can significantly lower disease levels. This is valuable information in combatting FCR, especially during drought conditions. Objectives determine the effect of crop rotation and different tillage practices on the incidence and severity of FCR and its effect on selected agronomical parameters. Determine selected agronomical parameters of wheat grown under different crop rotation systems and tillage practices. Conduct real-time PCR to quantify infection by F. pseudograminearum of wheat crown tissue collected at Langgewens and Tygerhoek Research farms during 2020.

# PROJECT NAME: DEVELOPING MANAGEMENT STRATEGIES TO IMPROVE PRODUCTIVITY AND SUSTAINABILITY OF LUCERNE IN LONG-ROTATION LUCERNE/CROPPING SYSTEMS

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| PROJECT NUMBER: | PS/SR/S/JL5 |
| AUTHOR/SCIENTIST: | DR JOHAN LABUSCHAGNE - Annemarie.VanDerMerwe@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MARCH 2016 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The study assessed the impact of cover crop treatments on herbage production in a lucerne pasture over multiple years. Although annual and total herbage production slightly improved with cover crop treatment, the differences were not statistically significant ($p>0.05$). Following the termination of the oats cover crop, lucerne was established in 2017, and oversowing attempts were made annually until 2021. Oversowing success varied each year; 2018 and 2019 faced challenges due to dry conditions and competition from established lucerne. In 2020 and 2021, oversowing was successful, resulting in reduced lucerne production during the first and second regrowth cycles. However, by the third regrowth cycle, lucerne production rebounded. Weeds became more prominent during peak rainy seasons, and specific oversown crops, such as WW ryegrass, negatively impacted lucerne persistence. In 2021, oversown species outperformed lucerne in herbage mass during the second growing season. During the third and fourth regrowth cycles, particular oversown crops, including WW ryegrass, oats, and specific mixes, significantly contributed to herbage production.Notably, oversown crops like WW ryegrass, oats, stooling rye, forage barley, and mixes 1 and 3 outperformed lucerne during the second growing season. In the third regrowth cycle, contributions from WW ryegrass (60%), oats (20%), mix 1 (40%), and mix 3 (30%) were significant. During the fourth regrowth cycle, WW ryegrass, mix 1, and mix 3 contributed 35%, 20%, and 11%, respectively, to the total herbage produced. Oversowing with clover-medic, forage radish, and canola proved unsuccessful in any season within the study, primarily due to poor establishment and weed issues. These species should only be considered as part of a mixture rather than as single crops when sowing into established lucerne.

# PROJECT NAME: CONSIDERATIONS FOR LIMING SOIL FOR BARLEY PRODUCTION: SOIL TILLAGE, PLACEMENT, FORM AND FINENESS OF LIME

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| PROJECT NUMBER: | PS/SR/S/JL7 |
| AUTHOR/SCIENTIST: | DR JOHAN LABUSCHAGNE - Annemarie.VanDerMerwe@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2020 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Soil acidity, particularly in the subsurface, threatens the sustainability of no-tillage crop production systems. A field experiment was conducted over three years on a clayey loam (Witfontein soil form) no-tillage system in the western Rûens region of South Africa, receiving an average rainfall of 529 mm yr-1. Initial soil pH(KCl) was 5.4, 5.2 and 5.0 in the 0 – 5, 5 – 15 and 15 – 30 cm depths, respectively. Treatments existed of lime incorporation through once-off strategic tillage, surface application of calcitic lime and pelletised lime (surface applied and in-row placement). Barley (Hordeum vulgare L.) crop parameters were monitored in Years 1 and 3. At 30 months, the incorporation of 2 Mg ha$^{-1}$ calcitic lime through once-off strategic tillage with a disc, chisel or ripper plough did not increase ($p > 0.05$) soil pH(KCl) relative to the exclusive surface application of 2 Mg ha$^{-1}$ calcitic lime in none of the depth increments (0 – 5, 5 – 15 or 15 – 30 cm). Whether surface-applied or placed in-row, pelletised lime treatments did not show any superiority to surface-applied calcitic lime in alleviating soil acidity  The management of acid soils for barley through liming production is a timely process wherein the lack of crop responses within the first two to three years is indisputable. Considering lime incorporation through once-off strategic tillage in no-tillage conservation agriculture systems is often a valuable agronomic tool in terms of reducing subsurface acidity and redistributing stratified nutrients. Nevertheless, an economic return on crop yield due to lime incorporation should not be expected within the first two to three years, particularly on moderately acid soils. Once-off strategic tillage with a ripper and chisel plough implements were most effective in decreasing acidity and reducing titratable acidity within the subsurface (5 – 30 cm depth) after 30 months. Micro-fine pelletised lime was not superior to regular class-A calcitic lime in terms of acid soil neutralisation or alkalinity movement down a soil profile, regardless of the quantity applied or placement thereof. Despite the high production cost of pelletised lime, making this product unlikely to be adopted on a large scale by dryland crop farmers, it has some favourable management implications. These include the ease of application using normal fertiliser spreaders, in-row placement during planting, reduced soil traffic, improved fuel-use efficiency, and minimised wind losses. However, when compared to class-A calcitic lime, there were no evidence of soil or crop benefits justifying the replacement of class-A calcitic lime with micro-fine pelletised lime.

# PROJECT NAME: AN ECONOMIC AND BIOLOGICAL EVALUATION OF SHORT- AND LONG-ROTATION CROP AND CROP/PASTURE PRODUCTION SYSTEMS IN THE SOUTHERN CAPE

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| PROJECT NUMBER: | WPC/05/5.1/02/NAV/PP/29 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 1996 - 28 FEBRUARY 2022 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The main objective of this study was to determine the extent to which identified critical drivers promote the long-term sustainability of different crop rotation systems for the Middle Rûens area of the Overberg. This study focused on long and short-crop rotation systems. This study used existing crop rotation trial data from Tygerhoek Experimental Farm Riversdale and Napky Farm Trials in the Overberg, which was managed according to CA principles. Rotation systems tested a mix of cash crops only and cash crops and pastures. Wheat, barley and canola were the main cash crops. Data was collected from these trials from 2002 to 2020 and included climatic data, soil analysis data, all input costs, yields and prices of crops for each year, and all livestock information. The data was separated into two main sections for analysis, namely the ecological data (yield and quality) and the economic data (gross margins and input costs). Including pastures in crop rotation systems increased yields and thereby increased gross incomes for the specific systems. The systems containing only cash crops had consistently lower yields and higher allocatable variable costs. This resulted in the systems, including a pasture component having higher gross margins on average when compared to the continuous cash cropping system. Climatic conditions, cultivar choice and soil type were important determining factors when it came to crop yield and quality. The resiliency of the systems to drought also improved over time as the yields recovered quickly after particularly dry years, such as 2019. The systems trial also indicated that over time, carbon accumulation occurs, although at a slower rate than in other places around the globe. The weed seedbank that formed part of the trial indicated that proper rotation planning could alleviate weed issues in the systems, but also that the animal factor plays a significant role in weed control in that it lowers the need for chemical control.

# PROJECT NAME: THE POTENTIAL OF MIXED COMER CROPS AS DRYLAND FODDER OR PASTURE

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| PROJECT NUMBER: | PS/SR/C/JAS12 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2020 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Farming in a Mediterranean-type climate can prove difficult facing current climatic conditions. Tillage and the removal of crop residue exposing bare soil surface to environmental stresses lead to the degradation of soil structure. Cover crops have the possibility to be utilised in mixed farming systems to improve soil structure, water relations and soil biological life. Identifying treatments providing superior biomass production and excellent fodder quality will be advantageous in diversifying systems with fewer input costs. Eight mixed cover crop treatments were compared to the two pure control pastures over a two-year period at the Langgewens Research Farm in Swartland, South Africa. The eight mixtures had significantly higher ($p<0.05$) dry biomass yields than the two control pastures (medics and oats) for most of the grazing events. The top-performing treatment in the 2020 season produced dry matter of over 9 tons/ha and over 8 tons/ha during the 2021 season. The dry matter production of the mixed cover crop treatments outcompeted the two controls on multiple occasions. Biomass sampling indicated the possibility of multiple grazing events in one season. This study also showed significant differences ($p<0.05$) between the mixed cover crop treatments and the two single specie control pastures in all eight fodder quality parameters tested. The legume-based treatments, during both production seasons, produced fodder with higher protein content than cereal-based treatments. Results highlighted the use of mixed cover crop treatments according to the specific biomass and forage quality needed by the producer. Producers can diversify farming systems even further with the inclusion of mixed cover crops in current rotation systems.

# PROJECT NAME: THE INTEGRATION OF LIVESTOCK INTO CASH-CROPPING SYSTEMS TO REDUCE ITS CLIMATE CHANGE POTENTIAL

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| PROJECT NUMBER: | PS/SR/CS/JAS19 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Over the last decade, awareness of anthropogenic activities' contribution to Climate Change has increased dramatically. Reduction of these contributions, greenhouse gases (GHG) emissions, is critical. The Intergovernmental Panel on Climate Change (IPCC) identified the economic sector of 'Agriculture, Forestry and Other Land' as one of the top direct emitters of greenhouse gases (24% of total emissions). (IPCC, 2014) This implicates the agricultural sector as a key role-player in the global effort to reduce emissions. To achieve this, context-specific management practices must be developed. In the Western Cape region, there is a need to identify practices which can decrease small grain cropping systems global warming potential. Identification of such practices requires an in depth look at the entire system's lifecycle, including its inputs and outputs, and a quantification of direct and indirect GHG emissions. Life cycle analyses (LCA) need to be done for various agricultural systems to determine their net impact and to target points of improvement. Agriculturally important direct emissions of GHGs are carbon dioxide, methane, and nitrous oxide, so quantification should form part of the analysis. In this study the agricultural practice in question is livestock integration into crop systems. Incorporating a pasture-livestock phase into cash crops is a suggested means of reducing these emissions, through increased soil carbon sequestration and replacing nitrogen fertilisation with biological nitrogen fixation of the legume pasture (medics). To determine if the incorporation has an effect, it must be analysed according to the parameters mentioned above (LCA and direct GHG emissions quantified). Three system types will form part of the trial: 1) a cash crop only system; 2) a cash crop system with legume in its rotation; 3) a crop-livestock system using a legume pasture. The cash crop system will consist of wheat and canola and represent a system fully reliant on nitrogen fertiliser. The cash crop with a legume system is to differentiate the effects of having legumes present in the system from a livestock integrated system. This system makes use of some biological nitrogen fixation to reduce the nitrogen fertiliser requirement. The crop-livestock system will make use of leguminous (medics) pasture phases and represents an integrated system. The overall aim is to compare a livestock incorporated vs cash crop system regarding its climate change potential.

# PROJECT NAME: ASSESSMENT OF EARTH WORMS AS A BIO-INDICATOR OF SOIL HEALTH IN CONSERVATION AGRICULTURE SYSTEMS

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| PROJECT NUMBER: | PS/SR/CS/JAS21 |
| AUTHOR/SCIENTIST: | DR JOHANN STRAUSS - Johann.Strauss@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The adoption of conservation agriculture (CA) principles aims to increase crop production while improving overall soil health. One benefit of adopting these principles is an increase in biological activity, such as earthworms. Earthworms are essential to soil ecosystem engineers and are very sensitive to management practices, making them suitable as potential soil health indicators. Since conservation agriculture could promote the numbers and activity of earthworms, they can most likely be used as soil health indicators in these systems. However, this has received very little attention in the Mediterranean climatic region of the Western Cape province. This study assessed whether conservation agricultural practices increase earthworm populations, and whether earthworms have the potential to be used as indicators of soil health in these systems. The study was based on two experimental farms in the Western Cape province, each with a mixture of different CA crop rotations, varying levels of legume incorporation, and two conventional tillage sites used as controls. Earthworm samples were collected using three different sampling techniques: hand-sorting, mustard extraction and a combination of the two methods during four sampling stages based on crop growing season. The influence of the sampling method, sampling stage and farming system on earthworm abundance and generic richness was tested. Earthworm abundance and generic richness were also correlated against different soil variables to investigate whether earthworms can be indicators of soil health parameters. The hand-sorting method proved sufficient for obtaining a good representation of earthworm fauna in these systems. CA practices, even those with increased utilisation of legume crops, did not necessarily benefit earthworm populations. However, a strong link between soil moisture and earthworm abundance and generic richness appears to be the most important factor driving earthworm numbers in this dry region. Furthermore, earthworm abundance only correlated with a few soil variables, indicating that earthworms could be better indicators of soil health in general in this region. The exception was a strong correlation between earthworm abundance and soil organic carbon content, indicating that earthworms could potentially be used as an indicator of this agriculturally important soil variable. Based on the results of this study, practices which conserve water and increase carbon content in the soil will likely increase earthworm populations in this region and improve the services they provide.

# PROJECT NAME: THE DEVELOPMENT OF SUSTAINABLE PRODUCTION SYSTEMS FOR WEED MANAGEMENT IN ROOIBOS PLANTATIONS

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| PROJECT NUMBER: | PS/PP/W/MIF4 |
| AUTHOR/SCIENTIST: | DR MIKE FERREIRA - Mike.Ferreira@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2018 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Similar to most crop production processes, weeds are the most persistent constraint in rooibos tea fields. However, the weed spectrum in rooibos tea fields is unique in that it flourishes in semi-arid climatic conditions and nutrient poor sandy soils that limits the occurrence of common weeds encountered in grain cropping systems. The greatest challenge in this regard remains intra-row weeds where bitterbos superficially resembles rooibos tea plants and very often becomes part of the harvested rooibos tea and eventually contaminates the final product. This primary focus of this research is the field evaluation of biomass mulches, either as living or introduced mulches that form the basis of comparative treatments. In conclusion, agricultural research projects aim to address the challenges facing the agricultural sector through innovative and sustainable solutions. This project clearly has industry relevance and objectives, from enhancing crop yield to developing ecological weed management strategies and ensuring job security.

# PROJECT NAME: INVESTIGATION OF THE SYNERGISTIC EFFECTS OF BIOSTIMULANTS ON WATER STRESS TOLERANCE AND NUTRITIONAL UPTAKE DURING THE TRANSPLANTATION OF HONEYBUSH CUTTINGS (*CYCLOPIA GENISTOIDES*)


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| PROJECT NUMBER: | PS/RVA/A/PAK3 |
| AUTHOR/SCIENTIST: | DR PIPPA ANN KARSEN - Pippa.Karsen@westerncape.gov.za |
| PROJECT START/END DATE: | 01 MAY 2015 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |


## AIM AND INDUSTRY RELEVANCE

This study investigates the cultivation of honeybush, a plant belonging to the Cyclopia genus from the Fynbos Biome of the Cape Floral Kingdom in South Africa. This biome is characterised by unique plant species adapted to its acidic, nutrient-poor soils and specific climatic conditions. Honeybush has established symbiotic relationships with Rhizobium spp. and mycorrhizae, particularly adapting to low pH soil conditions. However, climate change poses new challenges, including decreased precipitation, elevated temperatures, and expanding aridity. The study focuses on understanding the current method of establishment success of propagated honeybush seedlings and the use of cuttings to ensure true-to-type plants, and the potential use of the biostimulant glycine betaine to mitigate abiotic stress during transplantation. The research explores various factors influencing honeybush survival and growth, including irrigation, cutting age, species suitability, and the effects of glycine betaine. The findings reveal that honeybush cuttings face high mortality rates when established under dryland conditions. However, irrigated cultivation significantly improves survival rates. The research emphasises the importance of suitable irrigation practices to ensure high survival rates during establishment. The study also examines the use of glycine betaine as a biostimulant to counteract abiotic stress. It is shown that glycine betaine can enhance survival rates and growth of cuttings under water-deficit conditions. However, the effects vary depending on the plant species and propagation type, with seedlings often exhibiting better acclimatisation to stress. Different factors, including cutting age, species type, and micro-environmental conditions, influence honeybush survival rates and growth during establishment. Resprouter and reseeder species show distinct responses to stress, with resprouter cuttings being particularly vulnerable due to underdeveloped root systems. Furthermore, the study highlights the economic and practical benefits of using cuttings for cultivation over seedlings. The research contributes valuable insights for honeybush cultivation by providing recommendations for optimal irrigation practices, addressing the challenges posed by abiotic stress, and highlighting the importance of selecting suitable plant material and propagation methods. In conclusion, this study contributes to the understanding of honeybush cultivation in the context of changing environmental conditions. The research emphasises the importance of irrigation, cutting age, species suitability, and the potential benefits of biostimulants for improving establishment success. These findings are crucial for promoting sustainable honeybush cultivation and addressing the challenges posed by climate change.

# PROJECT NAME: THE EFFECT MORINGA OLIEFERA SUPPLEMENTATION ON MILK PRODUCTION, MILK COMPOSITION AND METHANE EMISSION OF DAIRY COWS GRAZING RYEGRASS IN SPRING

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| PROJECT NUMBER: | AP/NP/D/RM104 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE - Robin.Meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

To determine effect of Moringa oleifera on milk production, milk composition and methane emission of dairy cows grazing ryegrass pasture in spring. Global warming is a reality and emission of greenhouse gasses have been identified as a key issue. Ruminants have been singled out as major contributors to methane emission and numerous studies to mitigate methane emissions of ruminants have been conducted. Moringa oleifera is a softwood tree native of India occurring wild in the sub-Himalayan regions of Northern India. It contains antioxidants and flavonoids that have the potential to mitigate methane emissions. If Moringa oleifera reduces methane emissions of dairy cows on pasture it can be used as a mitigation strategy to reduce greenhouse gasses. The study is conducted at the Outeniqua Research farm near George.

# PROJECT NAME: *ASPERGILLUS ORYZAE* SUPPLEMENTATION TO COWS GRAZING KIKUYU/RYEGRASS PASTURE

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| PROJECT NUMBER: | AP/NP/D/RM105 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE - Robin.Meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 1 SEPTEMBER 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The aim of the study is to determine the effect of *Aspergillus oryzae* metabolites (AOM) on milk production and milk composition of Jersey cows grazing kikuyu/ryegrass pasture in spring. Profitability of milk production is under pressure due to increasing input costs. Many different feed additives are available to nutritionists and farmers to include in the diet of dairy cows. Controlled applicable studies are needed to determine the cost effectiveness of feed additives for cows on pasture. Kikuyu/ryegrass pasture under irrigation is commonly used as forage for dairy cows in the southern Cape. It is well documented that the first limiting factor for cows on pasture to produce milk, is energy intake. Dry matter intake is limited by the cow's rumen capacity as well as rate of digestion. Fungi have the capability to break lignin-hemicellulose bonds and improve fibre digestion. Supplementing Aspergillus oryzae metabolites (AOM) as nutrient source for the natural rumen fungi, may increase the number and efficacy of fungi in the rumen. This may then increase intake and supply of energy to the cow. Supplementation of Aspergillus oryzae metabolite product at 3g/cow/day to Jersey cows grazing ryegrass pasture during spring increased 4% fat corrected milk production, energy corrected milk, milk fat % and milk protein % significantly.

# PROJECT NAME: EXTERNAL AND INTERNAL VALIDATION OF NUTRITION MODELS TO PREDICT PERFORMANCE OF GRAZING DAIRY COWS

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| PROJECT NUMBER: | AP/NP/D/RM106 |
| AUTHOR/SCIENTIST: | PROFESSOR ROBIN MEESKE/COURTNEY MACPHAILE - Robin.Meeske@westerncape.gov.za |
| PROJECT START/END DATE: | 01 SEPTEMBER 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The aim is to determine which nutritional model has the highest accuracy in predicting dairy production parameters in South African conditions using Jersey cows on a pasture system. In South Africa 80% of milk is being produced from pasture based systems and concentrate. In grazing cattle, protein and energy balance as well as optimal microbial protein synthesis should be used as outputs as milk production primarily relies on these nutrients. In grazing systems total protein and rumen degradable protein are generally oversupplied and energy and rumen undegradable protein and amino acid supply can often be limiting. Nutritional models are used to evaluate and predict the performance of cows exposed to different grazing and supplementation programs. Models that are available include: Cornell Net Carbohydrate and Protein System (CNCPS), e-Cow, Nutritional Research Council (NRC), Cornell-Penn-Miner model (CPM dairy), Agricultural modelling and training systems (AMTS). In this project results of previous studies conducted at Outeniqua Research Farm are used to evaluate nutritional models. The outcome of this project may improve efficiency of supplementary feeding to cows on pasture systems and assist nutritionists to choose appropriate nutritional models. More accurate formulation of concentrates will increase profitability, efficiency and sustainability of milk production from pasture systems.

# PROJECT NAME: CLIMATE CHANGE RESPONSE STRATEGY FOR THE DECIDUOUS FRUIT INDUSTRY OF SOUTH AFRICA

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| PROJECT NUMBER: | RU/RM/SM2 |
| AUTHOR/SCIENTIST: | DR STEPHANIE MIDGLEY - Stephanie.Midgley@westerncape.gov.za |
| PROJECT START/END DATE: | 11 FEBRUARY 2021 - 31 JULY 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Agriculture is one of the most vulnerable sectors to climate change owing to the direct impacts on crop phenological processes, yield and product quality, soil water and irrigation water supply, and the risks associated with pests and diseases. The South African deciduous fruit industry must ensure its sustainability and future profitability in view of the rapid climate changes that are already impacting the industry, as well as the global market responses that are changing the demands made on growers and exporters. Medium- to long-term strategic planning is vital for this industry with a production base of orchards with an expected economic lifetime of 20-30 years, considerable investment in infrastructure and markets, and a critical provider of employment. In addition, fruit production is a source of greenhouse gas emissions and there are many opportunities to reduce these emissions in cost-effective ways, thus helping to reduce long-term risks. The aim of this project is to develop a climate change response strategy for the deciduous fruit industry (pome and stone) of South Africa. This strategy is science-based and targeted at the next 20 years, but considering both immediate future (2030s) and intermediate future (2050s) projections of climate change. It was co-developed with diverse industry stakeholders to ensure relevance and clear prioritisation, and developed per fruit type across the main production regions. Furthermore, it focuses on climate change adaptation and building resilience, but also incorporates climate change mitigation actions that are responsive to the global and national pledges to rapidly reduce the emissions of greenhouse gases and remove carbon from the atmosphere.

# PROJECT NAME: TECHNIQUES TO IMPROVE THE NON-DEGRADABLE PROTEIN FRACTIONS IN LOCALLY PRODUCED PLANT PROTEIN SOURCES

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| PROJECT NUMBER: | AP/NP/S/TB103 |
| AUTHOR/SCIENTIST: | PROFESSOR TERTIUS BRAND/OLGA DREYER (MSc AGRIC) - Tertius.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 APRIL 2021 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

Protein sources high in rumen undegradable protein (RUP) is expensive. High producing ruminants requires a sufficient amount of RUP in order to sustain their high metabolic demands. This results in a tendency to oversupply in total protein, resulting in lost expenses, and insufficient protein utilisation, subsequently ending in nitrogen wastage also presenting an environmental issue. Therefore plant protein sources such as locally produced lupins and canola oilcake could be utilised as substitutes, by applying either chemical treatment (formaldehyde) or heat treatment (extrusion) or both in order to increase their RUP fraction. These local plant protein sources are more within means and could result in effective utilisation of protein by supplying the correct ratio of RDP: RUP desired in order to increase growth performance of animals.

# PROJECT NAME: A COMPARISON OF CALVES BORN TO HOLSTEIN COWS SIRED BY BONSMARA, LIMOUSINE AND NGUNI BULLS ON A PASTURE BASED SYSTEM WITH SUPPLEMENTAL FEEDING


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| PROJECT NUMBER: | AP/BR/D/TS98 |
| AUTHOR/SCIENTIST: | THABO SEFIKE - Thabo.Sefike@westerncape.gov.za |
| PROJECT START/END DATE: | 01 JUNE 2019 - 31 AUGUST 2020 |
| PROJECT STATUS: | COMPLETED |


## AIM AND INDUSTRY RELEVANCE

The aim of the project is to compare the performance, carcass conformation and carcass classification of crossbred Holstein dairy calves sired by three beef breeds for an assessment of the beef production potential. The study will identify the suitability of various beef breeds for crossing to Holstein cows to produce calves that can be finished on a grass fattening system or a more intensive kraal system. Dairy enterprises have milk as their primary source of income. Heifers produced are kept for replacement and bulls are sold off after a few days for veal and beef production. In some parts of the world, 20 to 50% of beef production is derived from dairy herds (mostly Holstein), through culled heifers and cows as well as bull calves reared for slaughter. Beef is a protein rich food source in the human diet and represents a large portion of food consumed in the world. One strategy is to introduce beef sires into the dairy breeding programme through artificial insemination. The lowest producing cows are identified and inseminated with semen from a beef breed. In this way, surplus purebred heifers and bulls with low market value are replaced by potentially high income beef x dairy crossbred counterparts that could be either kept for beef production or sold to emerging beef growers. The intension with the use of beef breed semen is to add to the beef characteristics of the excess calves that are born on a dairy farm. Introducing beef genetics can allow for a secondary income stream from meat production. The growth rate of crossbred steers is higher than that of purebred genetic breeds. Improvements in beef performance traits can be attributed to hybrid vigour (also known as heterosis) and the combined genetic strengths of the parental breeds in the offspring. In this way, surplus purebred heifers and bulls with low market value (i.e. inferior beef conformation score, lower carcass weight and generally lower carcass classification) are replaced by potentially higher income beef x dairy crossbred progeny that could be either kept for beef production or sold to emerging beef outgrowers.

# PROJECT NAME: INVESTIGATING TEMPERATURE GRADIENTS IN ELECTRONIC INCUBATORS WITH MODERN VENTILATION SYSTEMS, AS WELL AS OSTRICH EGGSHELL TEMPERATURES

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| PROJECT NUMBER: | AP/BR/O/ZB83 |
| AUTHOR/SCIENTIST: | DR ZANELL BRAND - Zanell.Brand@westerncape.gov.za |
| PROJECT START/END DATE: | 01 AUGUST 2018 - 31 MARCH 2023 |
| PROJECT STATUS: | COMPLETED |

## AIM AND INDUSTRY RELEVANCE

The incubation conditions during the artificially incubation of eggs are off the most important factors for both the success of hatching and embryonic development. More and more hatcheries are starting to use advanced automated setters and hatchers. The incubators currently in use are not specifically designed to hatch large ostrich eggs. Problems may arise if incubators do not have sufficient heating, cooling and air exchange for the lager ostrich eggs set. Hatchability of turkey eggs decreased when an incubator was adapted from a standard chicken design without proper adjustments made for the change in total egg weight in the machine. The fluctuations in temperature within incubators were only investigated for force-draught wooden incubators with a capacity for 200 ostrich eggs. Electronic incubators in present use contain up to 1000 ostrich eggs and results from previous research may not be transferable to the practical situation. The aim of this study was to investigate temperature gradients in electronic incubators with modern ventilation systems, as well as subsequent ostrich eggshell temperatures. Outcomes from this study potentially could contribute to a better hatchability and chick quality, increase chick production and consequently benefit the ostrich industry as a whole. Objectives include incubation temperature stays a critical factor in incubation for the production of viable chicks. During early incubation, there are limited heat production by the embryo, but heat production increase as the embryo mature. At the later stage of incubation, eggshell temperature (EST) becomes critical and the incubation environment needs to be adjusted to improve hatchability and improve chick quality. Commercial farmers and small-scale farmers will benefit from results obtained during this research through reduced embryonic mortality in ostriches. Together with establishing good hatchery practices, it is foreseen that a marked improvement may be achieved in hatchability success contributing to increased income.

## CONTACT INFORMATION:


POSTAL ADDRESS:

Western Cape Department
of Agriculture
Private Bag X1
ELSENBURG
7607

PHYSICAL ADDRESS:

Muldersvlei road
Elsenburg
Stellenbosch

+2721 808 5111

www.elsenburg.com

DOA.Info@westerncape.gov.za


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