The cellar building at Elsenburg dates back to 1904 and approximately 80% of winemakers in the industry received their training here. Over the years most of the available funds were allocated to keeping up with the latest technology of the time concerning machinery and equipment, which meant little maintenance was done...

Read all about the extreme makeover of the Elsenburg Cellar on page 4.
The year 2013 is into its sixth month already. It seems that December has never been, and we are all rushing towards the end of 2013, with many challenges demanding our attention. However, I would still like to wish you a wonderful and prosperous 2013 and to invite you to think “better together” to tackle the challenges in the agricultural sector, ie the minimum wage implementation, market access, agricultural production and above all, the competitiveness of the sector.

For the Department the last quarter of the financial year 2012/13 is almost over, and we are preparing (have been preparing from August 2012) for the new budget (2013/14) and are also starting to prepare for the audit process and annual report. Suddenly the year seems very short and it is likely to be intense.

It is therefore fitting to confirm specific actions and plans for the next year and beyond (see our Vision, Mission and Strategic Goals on page 2).

I would like to invite you to reflect on the lofty goals we have set, and to engage each other on how to contribute towards the realisation of these goals in an effort to ensure that the agricultural sector remains competitive and viable for all the role players.

On page 3 you will also find the Department’s Public Service Charter. We invite you to share any comments you have on this with us. We want to deliver the best possible service to you and the commitment we make in the Service Charter underlines this. You can email us at info@elsenburg.com with your comments by no later than 30 June 2013.

We have revamped the look and feel of AgriProbe in accordance with the new corporate identity of the Western Cape government and we trust that you will enjoy the new version as much as we have enjoyed putting it together for you.

Happy reading!

Joyene Isaacs, Head of Department

Minister promotes AGRICULTURAL EXPORTS abroad

Wouter Kriel – wouter.kriel@westerncape.gov.za

Gerrit van Rensburg, Western Cape Minister of Agriculture and Rural Development, recently returned from a week’s visit to Finland, Sweden and Germany, aimed at bolstering agricultural trade relations between the Western Cape province and these trading partners.

Minister van Rensburg said the recent agricultural strikes in the province led to his office receiving calls from concerned international trade partners. “I have had several meetings with major importers and senior government officials in Finland, Sweden and Germany. I assured them that Western Cape farmers adhere to all South African labour legislation, and also exceed the minimum standards prescribed by various international ethics codes.”

Minister van Rensburg said apple, pear and deciduous fruit exports alone amount to R700 million per year to these three countries, and it is therefore important to maintain good trade relations. “We are also discussing the possibility of increasing our export portfolio where possible.”

Minister van Rensburg met with Magnus Kindbom, State Secretary to the Minister of Rural Affairs in Sweden as well as senior representatives of the Swedish Systembogalet, the Swedish state wine import monopoly. “The Systembogalet raised concerns regarding the negative international press coverage the farm strikes received. I could assure them we are working very hard to improve on the social challenges we face, and also reaffirmed our commitment to local and international ethical codes such as Fairtrade.”

Minister van Rensburg was accompanied by Willem Paulse, the Western Cape Farm Worker of the Year for 2012. Part of his prize included an overseas trip. The minister also met with Western Cape Empowerment farmers at Fruit Logistica in Berlin, Germany. They are visiting Europe as part of the Western Cape Department of Agriculture’s Market Access Programme. This programme assists new farmers with finding local as well as international markets for their produce.

Western Cape empowerment farmers met with Minister van Rensburg at Fruit Logistica. Left to right: Anthony Janse; farmer Charles Pietersen; farmer Wimpie Paulse; Western Cape Farm Worker of the Year 2012; Johan Coetzee, Western Cape Ministry of Agriculture; Lewinia Adams, farmer; Gerrit van Rensburg; Jan Skippers, farmer.
It might seem difficult at this stage to envisage a united sector, but this is exactly what we need to strive for and also work on very hard.

The MISSION to realise the vision:

Unlocking the full potential of agriculture to enhance the economic, ecological and social wealth of all the people of the Western Cape through:

- Encouraging sound stakeholder engagements
- Promoting the production of affordable, nutritious, safe and accessible food, fibre and agricultural products
- Ensuring sustainable management of natural resources
- Executing cutting edge and relevant research and technology development
- Developing, retaining and attracting skills and human capital
- Providing a competent and professional extension support service
- Enhancing market access for the entire agricultural sector
- Contributing towards alleviation of poverty and hunger
- Ensuring transparent and effective governance

This mission creates opportunities and challenges to all of us in the agricultural sector, and the questions should be: “What can I contribute?” “What can I do with others to strengthen achievements?” and “How do I get involved?”

And then most important are the 5 STRATEGIC GOALS that all of us can contribute to, starting today:

- Agricultural Production: Develop and implement a strategy that will support 10% agricultural growth over the next 10 years.
- Market Access: Support the agricultural sector to at least maintain its export position for the next five years by growing its value added from R14 014 billion in 2009.
- Agricultural Research: Collaborate with farmers and industries to execute research and to develop cutting edge technologies whereby agricultural production can increase by 10% over 10 years.
- Rural Development: To create an enabling environment for business in rural areas and develop selected rural nodes to facilitate their socio-economic growth towards a sustainable future.
- Extension Revitalisation: Ensure that at least 60% of all agricultural land reform projects in the province succeed over the next term of office.

Let us take hands, share our expertise, tackle our challenges and show the world that “better together” is the underpinning game changer for sustainable production in our sector.

Joyene Isaacs, Head of Department
Customer Service Charter
Western Cape Department of Agriculture

An open opportunity society for all

This charter reflects the belief of the Western Cape Department of Agriculture and its implementation partners in Batho Pele: A better life for all South Africans by putting people in agriculture first. It is our commitment to our customers that we will do our utmost to help you and provide you with the quality of service you deserve.

VISION: We are striving towards being a united, responsive and prosperous agricultural sector in balance with nature.

You have the right to:
- Be treated with courtesy and respect and in a dignified manner at all times.
- Be consulted about your service needs and the level and quality of service expectations.
- Full information upon request in an open and transparent manner.
- Access to prompt and efficient service in accordance with the service delivery standards.
- An apology for and redress should any service lapses occur.
- An assurance of value for money in all services provided.

We expect you to:
- Be civil, courteous and respect the dignity of our employee(s) who render the service to you.
- Be honest in your dealings with us.
- Submit full and accurate information accompanied by recently certified copies of documentation needed or requested.
- Make yourself available as well as be willing to undergo empowerment programmes agreed upon.
- Enforce on active application and implementation of plans, initiatives and advice received from the Department.

Our Commitment:
- We will respond to all your emails within 48 hours.
- We will answer telephone calls within five rings.
- When you write to us we will acknowledge receipt of your letter within 3 working days.
- We will send a reply within 10 working days. If we cannot give a reply within ten working days, we will explain why and tell you when you can expect a reply.
- When you send an application or request, we will provide a fair and objective assessment based on the information submitted.
- We will give you informed, useful and constructive feedback.
- All complaints and correspondence pertaining to agricultural matters made to the Minister of Agriculture and Rural Development by citizens or potential clients, will be responded to in an efficient manner within 3 weeks after receipt thereof.

ACCESSIBILITY: Our buildings are accessible for people with disabilities.
For your nearest agricultural service point, contact the number below or visit our website.

Our Service Delivery Standards
Farmer Support and Development Services:
- Extension and advisory services will be provided to all farmers within 15 days of reception of a request or in accordance with a pre-determined service level agreement.
- Support to smallholder and commercial farmers through sustainable development within agri-food innovation initiatives will be facilitated, coordinated and provided within 30 days of receipt of the request.
- Applications relating to the implementation of the Integrated Food Security Strategy (IFSS) will be considered for funding in accordance with the consulted and predetermined service plan.

Engineering, Landcare and Land Use Services:
- Recommendations regarding land use to prevent the fragmentation of agricultural land in accordance with applicable legislation will be provided to the relevant authority within 45 days after receipt of the request.
- Sustainable natural resource management solutions and methodologies through the provision of agricultural engineering, landcare and land use services to 80% of clients and partners, will be provided within 30 days of offering a service.

Research and Technology Development Services:
- Cutting edge research to increase agricultural production as well as technology to address challenges of sustainability and climate change, will be provided to all farmers and stakeholders on a continuous demand driven basis.
- Appropriate, new and adapted technology and scientific information in the form of carefully prepared information packages, popular and scientific publications, e-mines “waks and talks” and information days, will be provided to the agricultural and agribusiness sector on an on-going basis.

Veterinary Services:
- Regulatory services in accordance with the relevant and applicable legislation to prevent and control animal diseases. Facilitate export markets access and ensure the safety of meat and meat products will be provided to communities as well as the agricultural and agri-business sector on a priority basis.

Main Services to Client
Goverance:
Provide and adhere to good corporate governance principles and practices, including effective communication with clients, other Departmental Services and African countries, within the context of the South African IFSS Principles and Internal Governmental Relations requirements.

Regulatory Function:
- Monitor and minimise animal health risks as well as ensure food safety by means of food safety and to facilitate the export of internationally commended products.
- Promote the conservation and sustainable use of the environment, especially agricultural natural resources (land and water) and to prevent the fragmentation and erosion of agricultural lands.

Knowledge Transfer
- Train prospective and current agriculturists, farmers and farm workers in the agricultural sector.
- Provide a comprehensive and cost-effective farmer support service (including extension) to a broad spectrum of clients, with emphasis on the emerging farming sector and areas of potentially high development.

Financial Support for Agriculture
- Provide financial support for farmers at all levels of production, including CAPS, Landcare, land use, production subsidies and AMSA training for agricultural training and education as well as disaster relief funds as allocated from time to time.

Report any instances of fraudulent or corrupt activities by contacting the National Anti-Corruption Hotline: 0800 701 701 or 021 483 0971.

Your voice counts. We want to hear from you. You can tell us how we are doing and performing, or report poor service or misconduct by requesting to see a supervisor. Or you can contact our Communication unit.

Head Office: Tel: 021 308 8511 | Fax: +27 21 308 5000
Private Bag X1, Elseneberg 7969 | Midstream Road, Elseneberg

Office hours: 08:00 - 15:30 (Monday) www.elsteneberg.co.za | www.westerncape.gov.za

Executive Authority declaration:
G. van Rensburg
Date: 2013/01/01
The cellar building at Elsenburg dates back to 1904 and approximately 80% of winemakers in the industry received their training here. Over the years most of the available funds were allocated to keeping up with the latest technology of the time, concerning machinery and equipment, which meant little maintenance was done.
While Elsenburg continued to offer the best practical training in the industry, the building started to show its age. An extreme makeover was due. This was already evident 10 years ago, but funds for maintenance were never enough to make a significant impact.

In 2011 the icon of the wine industry was awarded the funding that it deserved by the Western Cape Department of Transport and Public Works, and renovations to the amount of R7 million started. Mr Gerrit van Rensburg, MEC of Agriculture and Rural Development, also highlighted that “the Cellar on Elsenburg is central, and absolutely essential, to our wine making and cellar technology study programmes. There is a very important element of practical experience that is needed in the study to become a wine maker, and we would not have been able to supply the wine industry with promising new talent without this infrastructure.”

It was indeed an extreme makeover, literally from top to bottom. The roof, ceiling, walls and floors were revamped. New roofing, a new drainage system, epoxy flooring, etc. Nothing was overlooked, not even the laboratory, storerooms, electricity and cold rooms. Truly amazing. Included in the revamp were eight new stainless steel combi-tanks as well as four concrete eggs, correctly known as Nomblot vessels. The renovations were completed just in time for the 2012 harvest.

Minister van Rensburg was very impressed with the added value that the revamp brought, saying, “The renovations have resulted in us regaining our Environmentally Friendly Wine Making Accreditation. (Integrated Production of Wine [IPW] accreditation from Wine and Spirits Board of South Africa). This is very important, especially in the context of the Provincial Government’s commitment towards a green economy.”

This also afforded the vineyard the opportunity to be accredited with BWI (Biodiversity and Wine Initiative) recognition. This is only possible when both cellar and vineyard have IPW accreditation and the farm has a significant area of land dedicated to conservation of the natural biodiversity. Added to this, the class of 2012 won nine medals at the Young Wine Show – one gold, four silver, four bronze as well as a trophy for best in the Cinsaut class.

The cellar is now fully updated and geared to give the best winemaking training as well as to make award-winning wine, as indicated. A function was held to showcase the cellar revamp to all stakeholders and industry role-players as well as to say thank you to all who were involved in this wonderful project.

Minister van Rensburg, who delivered the keynote address at the function, concluded, “This building, together with the talented and hardworking staff of the College, is a direct investment in agriculture. We are creating job opportunities. We are also training the workers to grab these opportunities and fly with them.”
Elsenburg Graduation 2012

Maritjie Cornelissen - maritjiec@elsenburg.com

December 2012 marked a proud day at the Elsenburg Agricultural Training Institute. The Structured Agricultural Education and Training Institute (SAET) graduation ceremony was attended by Gerrit van Rensburg, Western Cape Minister of Agriculture and Rural Development. SAET falls under the mandate of the Western Cape Department of Agriculture.

This year saw 74 students successfully complete the B. Agriculture Degree; 29 students completed the Higher Certificate; 14 students completed Equine Studies; four students completed the Diploma in Agriculture; and seven students completed the Diploma in Cellar Technology. The 2012 graduation had a different spin to it, with two students, Riandri Visser and Mardre Fullard, sharing the following trophies for Dux students: The Co-op Wine Cellars SA Floating Trophy and Certificate for the Dux student in Cellar Technology and the Farmers Weekly Medal for the Dux student in the B.Agric programme.

Mardre Fullard described her experience as follows: “The ceremony was an experience of a lifetime in a very relaxed environment. My time at Elsenburg cannot really be put into words, but in short, it was the time of my life. I learned so much and could express myself in different ways. The lecturers and even my fellow students were very supportive of me. Some days were tougher than others, but it prepared me for the work environment and in the process I could better myself and grow as a human being.”

Another 79 students completed Further Education Learnerships on NQF levels one to four.

The graduation of the Learnership students was the culmination of 40 weeks and 38 modules of theoretical and practical training which started in January 2012 and ended in November of the same year. These 79 Learnership students, from 102 active learners from diverse backgrounds and all five regions of the Western Cape, graduated and received certificates endorsed by AgriSETA.

Minister van Rensburg congratulated the students on the successful completion of their studies and wished them well in their future careers. He said agriculture is rapidly changing, as new technology makes higher yields with fewer inputs possible. He said climate change and an increasing world population will be only two of the very important challenges they will have to grapple with in their lifetimes. “People need to eat; and your challenge will be to see to it that there is enough safe and healthy food available.”

Several awards were handed out during the 2012 Graduation Ceremony and Phumla Petros from the decentralised centre in George was recognised as the best Learnership candidate overall. Other awards at the ceremony were:

- UAP Award for best Learnership student in Viticulture
  Thando Grootboom
- UAP Award for best Learnership student in Pomology
  Lorenzo Geduld
- UAP Award for best Learnership student in vegetables
  Andile Nwelende
- UAP Award for best Learnership student in Farming
  Phumla Petros
- UAP Award for Dux student in Learnership
  Phumla Petros
- Novare Bursary Award (worth R30 000)
  Kayla Koul

Eight students were articulated from Further Education and Training learnership programme to the Higher Education and Training Programme. They commenced their studies in the two-year Higher Certificate and three-year B.Agric programmes respectively, in January 2013.
Die ‘fight’ vir Groen uitnemendheid

Anton Nel – antonn@elsenburg.com

In 2012 is daar besluit om lidmaatskap by BWI (Biodiversiteit & Wyn Inisiatief) te bekom. ’n Insnyrwingsvorm is aangeva en deurgelees. Eén van BWI se vereistes is dat ’n stuk grond, verkieslik groter as 4ha, vir bewaringsdoeleindes beskikbaar gestel word. Grond wat aan die Kromme Rhee pad grens het dadelik in die gedagte opgekom.

Ondersoek is ingestel by die GIS-afdeling en daar is vasgestel dat die grond is 6.1ha groot, groter as die vereiste 4ha van BWI. ’n Brief is aan mnr. Paulse, Hoofdirekteur, Gestrukturrede Landbou Onderwys en Opleiding, gerig om vas te stel of die grond aan iemand behoort en of die grond vir bewaring gebruik kan word. Mnr. Paulse het bevestig, na beraadslaging met bestuur, dat die grond vir bewaring gebruik kan word om as deel van die aansoek vir BWI-lidmaatskap te dien.

Intussen is daar ’n oudit by die kelder gedoen waarna hulle IPW (Integrated Production of Wine)-registrasie verkry het. Daar is aanvaar dat indien die kelder geregistreer is, dan moet die wingerde ook geregistreer wees. Op die IPW-webportaal wys egter dat die enigste staatsplaas wat by IPW geregistreer is, die Departement se plaas op Oudtshoorn is. Die IPW-kantoor is gebel om seker te maak die webbladsy nie verkeerd geïnterpreteer is nie. IPW bevestig egter dat die enigste plaas Oudtshoorn is. Wat nou? Suid Afrikaanse Wyn Inligting & Statistiek (SAWIS) is gekontak om seker te maak Elsenburg en Kromme Rhee is by hulle geregistreer. Gelukkig kon SAWIS bevestig dat die enigste plaas Oudtshoorn is. Wat nou? Suid Afrikaanse Wyn en Spiritusraad geproe en ontleed word. Hierdie saak was blykbaar die deurslaggewende faktor.

Die uiteinde van die saak was dat Elsenburg op 14 Desember 2012 lidmaatskap verkry het van BWI. Dit beteken ook dat die BWI-seël gebruik mag word. Hierdie seël kan op Elsenburg se gebottelde wyne aangebring word wat deur ons uitnemende studente gemaak word.

Indien ’n wynkelder wel aan die IPW-beginsels voldoen, dit in besit is van ’n IPW-sertifikaat asook op ’n gereelde grondslag (gewoonlik elke derde jaar) geoudit word. Dit beteken dat die kelder asook die wingerde op ’n omgewingsvriendelike manier gebruik word en dat besoedeling tot die minimum beperk word. Dit gaan dus oor die beginsels van volhoubare landbou.
Tydens die nasionale Landcare konferensie wat in Mahikeng gehou is, het die LandCare program van die Wes-Kaap Departement van Landbou weer eens goed presteer en met 2 van die 4 goue toekennings asook ‘n brons toekenning weggestap.

Die eerste goue toekenning was vir die projek wat bewaringsboerdery bevorder onder die opkomende boere van Suurbraak naby Swellendam. Die boere kry reeds die voordeel van verhoogde opbrengste asook ‘n toename in grondvrugbaarheid. Die boere het ook ‘n Bewaringsbestuursplan vir hul grond aanvaar wat ingesluit is by hul boerdery besigheidsplan. Hierdeur word die krities bedreigde renosterveld plantegroei op hul plase beskerm en vir hulle beteken ‘n gesonde ekosystelsel ook ‘n gesonde boerdery.

Die tweede goue toekenning is gewen vir die Genadendal Gemeenskapsprojek. Weens ‘n agteruitgang van die waterinfrastruktuur te Genadendal het die boerdery bedrywighede agteruitgelaat met ‘n gepaardgaande afname in grondvrugbaarheid en ‘n eens florerende boerderygemeenskap het feitlik tot stilstand gekom en baie mense het na die omliggende dorpe en stede verskuif. ’n Innoverende projek is begin in samewerking met die gemeenskap en die Wes-Kaap Departement van Landbou waardeur die waterinfrastruktuur opgegradeer is, die gedegredeerde gronde is weer herstel, voedselsekuriteit vir die gemeenskap en die omliggende area is herstel, werkgeleenthede is geskep en die lewensomstandighede van die gemeenskap is verhoog.

Die brons toekenning wat ontvang is in die kategorie LandCare Leier is gewen deur Dirk van Papendorp. Dirk is ‘n kommersiële boer van die Suurbraak area wat ‘n besonderse passie het vir gemeenskapsontwikkeling. Sy mentorskap van ses opkomende boere van die Suurbraak Graan Koöperatief het hulle gehelp om die bewaringsbeginsels onder die knie te kry deur opleiding en verskaffing van advies. Hy het ook van sy eie implemente aan hulle beskikbaar gestel en hulle gehelp om ‘n mark vir hul produktes te skep.

Ons wens die betrokke gemeenskappe, die mentor asook die toegewyde personeel van LandCare in die Wes-Kaap geluk met die uitstekende prestasie. Mag dit ander aanspoor om dieselfde hoogtes te bereik.

Joyene Isaacs, Hoof van die Departement en Polie Theunissen, Voorstter van Genadendal Boerevereniging en Genadendal Transformasie Komitee
Traditionally the agricultural sector has been regarded as the domain of males, with women occupying a minor role. Agriculture is increasingly becoming inclusive and recognises that all resources need to be used to strive towards more effective farming systems. Agricultural projects need to recognise the valuable contribution women can make and need to include women in managerial and operational planning.

Gender issues play an important and increasing role in the success of development projects. In any development project, many disparities arise due to gender differences and such disparities have significant effects on the efficiency and welfare outcomes of a project or policy intervention. The structural relationship of inequality between men and women manifests through their different roles and responsibilities and through the different values attached to their work. Such structural inequalities may also be present in various political structures and household relationships, and are solidified or reinforced by customs, law and policies.

“Gender division of labour” refers to work being done by women and men that is divided according to sex and is valued differently. In some communities, men’s work will often be recognised via payment, status or political power, while women’s work goes unnoticed and unpaid as it is seen as “natural” (as part of their domestic duties as wives and mothers). Such issues arising from tradition and culture may keep women from reaching their full potential in the agricultural sector.

Further obstacles for women to reach their full potential in agriculture are access to land, education and finance. Women in Africa are often only able to gain access to land through marriage. The lack of access to land disempowers women both by impoverishing them and by excluding them from the decision making process. Women are impoverished because poor access to land leads to poor access to financial services; money lenders often require land title certificates for use as collateral for a loan.

The smallholder farming that women are thus often confined to can lead to lack of access to credit, low investment in infrastructure and poor market access. Such financial disempowerment in turn leads to exclusion from decision making both at the local level and at the policy level. Smallholder farmers are often excluded from the agricultural policy process. Equal access to education is also of key importance for equal opportunities. Boys and girls get involved in different aspects of agricultural work through different socialisation processes. Boys learn the necessary skills from their fathers and girls have to assist with domestic work and the caring for younger siblings.

At the policy level the recognition of women’s contribution to agriculture is still inadequate. This poor recognition stems from a combination of institutionalised values, cultural behaviour, poor governance, poorly targeted interventions and corruption. Women are exploited when it is to the benefit of household accumulation. At the national level their contribution to the economy will remain unrecognised as long as they work as non-wage labourers. That is why it is so important for governments to intervene in the agricultural sector to ensure that women participate fully in the decision making process.

In order for women farmers to grow and become successful, solutions for their empowerment need to be found. Four possible interventions are identified that could be implemented.

Firstly, the role of female farmers should become visible and they should receive recognition for their work. The Female Entrepreneur of the Year Competition introduced in 1999 by the former National Department of Agriculture, which aims to empower women in agriculture by recognising their contributions and increasing their visibility, is an ideal platform for the Western Cape government to give recognition to female farmers. The competition also serves as an opportunity for women to motivate and inspire other female farmers.

Secondly, education and job training programmes that are specifically targeted at women should be put in place. More government support and investment should be targeted at rural educational programmes.

Thirdly, at policy level the policy environment should be more gender sensitive and greater participation by women encouraged. This may involve improving avenues through which women can have access to budgetary resources and credit. Such an intervention could build on existing agricultural financial aid schemes such as the Comprehensive Agricultural Support Programme grant, Mafisa scheme, the AgriBEE fund, loans from Landbank, IDC funds, DBSA and many more. Improved access to such resources for women may also assist in improving actual budgetary allocations towards smallholder female farmers and vulnerable rural communities.

Finally, continuous support must be given to women in agriculture through research and development and monitoring and evaluation. Research needs to be done on creating new markets, extending existing markets, the impact of policies and programmes at household level, the impact of climate change and the impact of HIV/AIDS. On the basis of such research and with the backing of monitoring and evaluation that includes input from women in agriculture and improves programme outcomes, technical assistance should be offered to producers. Governments must also engage with private companies to encourage greater capital investment in projects. In the context of the South African government’s focus on equality for all, gender equality in agriculture and in other sectors is becoming increasingly important. From the above narrative it is clear that there is still a lot that needs to be done to achieve gender equality in the agricultural sector. The Western Cape government is continuously striving to include women in various levels of decision making and is looking for ways to increase the number of women in agriculture to create a better future for all.
Since 1999 a number of female farmers in the agricultural, forestry and fisheries sectors have been awarded for their successes in the industry.

The Female Farmer (now Entrepreneur) of the Year Competition was initiated by the National Department of Agriculture, Forestry and Fisheries (DAFF). The aim is to encourage the increased participation of women in the agricultural sector by highlighting and acknowledging the efforts and contributions of women in matters of food security at community level and large-scale agricultural production, including value-chain activities. The competition also includes forestry and fisheries since these portfolios form part of the National Department of Agriculture, Forestry and Fisheries (DAFF).

Over the years, the competition has become an empowerment platform that recognises the entrepreneurial skills of women in the sector. It is also an opportunity for women to motivate and inspire other women of all ages across career borders. In a world where women deserve and receive more recognition for their contribution to community development and upliftment, this competition serves as an instrument that should be supported by all.

The annual competition starts with an application, adjudication and awards process at provincial level, facilitated by the Western Cape Department of Agriculture. The provincial winners are escalated with a full information support pack, including DVDs, to the National Female Entrepreneur of the Year adjudication and final award event, which is facilitated by the National DAFF and is normally hosted in August – Women’s Month.

For female entrepreneurs to be eligible to enter the competition, they must own the enterprise and be able to substantiate it. In the case of partnerships women should comprise 80%. In the case of a trust, 80% of the trustees must be women and active.

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In the Western Cape specifically, 102 women were chosen as provincial winners and runners-up over the past 12 years. They have received a substantial amount in prize money, which has empowered them to build their businesses even further.

However, hard work, determination and dedication are what realised these women’s dreams and today they are standing their ground as solidly as their male counterparts. Sonja Ferreira from Oudtshoorn in the Klein Karoo used her winnings to expand her business even further by starting a farm stall, selling goat’s cheese to locals and tourists alike.

Wadea Jappie of Philippi was able to extend her family business by securing vegetable and herb contracts with Woolworths and a number of other retailers. What started with selling a few dozen eggs from her house ended up as a profitable business, which also landed Wadea the Emerging Farmer of the Year for the Western Cape trophy of the Agricultural Writers Association in 2009.

Against setbacks like Rift Valley Fever, flash floods and jackals, Allie Gordon of Kranskraal in Leeu-Gamka has a flock of 370 sheep and a steady market. The Karoo is certainly not for sissies and Allie’s determination and innovative ways of making the best of her circumstances won her the Provincial Female Entrepreneur for Smallholders award in 2012. She expanded her income by also selling wood, home-made jams from fruit she grows on her farm and sheep skins.

Jacky Goliath from Simondium in the Western Cape scooped the coveted National Female Entrepreneur of the Year award in the Commercial category this year. Jacky was awarded for the excellent way in which she runs the De Fynne Nursery, which focuses on the growing and selling of mostly indigenous plants. She started in 2001 with 1 000 plants and has since expanded the business to a total production of 600 000 plants. Since her triumph, Jacky has enjoyed a wide range of media attention, was interviewed on Kwêla on Kyknet and has featured in a number of publications.

These women clearly show that agriculture is not about making a living, but a way of living.

The success of the winners has also opened more doors for them in terms of business opportunities as the Western Cape Department of Agriculture uses sponsored exhibition space to give some of the winners an opportunity to sell their produce to the public as well.

**Competition categories:**
- Best Subsistence Producer
- Top Entrepreneur in the Sectors:
  - Smallholder
- Top Entrepreneur Processing in the Sectors
- Top Entrepreneur in the Sectors:
  - Commercial
- Top Entrepreneur in the Sectors:
  - Export Markets

For more information regarding the competition contact Gizelle van Wyk on 021 808 5022 or gizellewv@elsenburg.com.
Agricultural land use (in various scales and formats) is one of the most requested datasets from the Western Cape Department of Agriculture (WCDoA) GIS unit. Baseline commodity data and associated areas is required by decision makers at all levels and across many disciplines. At present we have little choice but to use data mainly derived from the National Land Cover (NLC) dataset, which was captured from Landsat satellite imagery by a consortium led by the CSIR, between 2000 and 2003 (NLC2000). The data was initially designed for broad scale use – i.e. around 1:250,000. It does not identify actual land use (i.e. the actual commodity), but provides generalised categories of land cover – e.g. temporary cultivation, permanent cultivation, at a coarse scale. Most stakeholders nowadays require considerably more detail than this, for a wide variety of applications. Fine-scale data at farm or field scale is only available for a few areas where intensive surveys have taken place.

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Examples of queries/tasks that need to be addressed by land use and associated data are:

- Defining the actual, available hectares of agricultural land, and land lost to agriculture through mining, urbanisation and conservation.
- Rural development and land reform planning and analysis.
- Food security planning.
- Mapping the “footprint” of agriculture in terms of infrastructure, commodities and projects.
- Providing commodity statistics and/or maps to government and other stakeholders on, for example, areas under wheat, areas where persimmons are grown, total hectares under table grapes, etc.
- Providing regional production statistics to our own officials and economists – which can be aggregated and reported at any scale from farm, to municipality, to province.
- Departmental participation in and contribution to municipal and provincial spatial planning frameworks (SDFs).
- Providing data in support of the Department’s Land Use Management officials in decisions regarding zoning/rezoning applications, urban edge changes, developments, etc – it is critical to know what commodities and implied land values are affected.
- Disaster management – quick, quantifiable assessment of damage following floods, fires, and droughts. Having “inventory”-level land use data facilitates calculation of the hectares and types of enterprises affected and associated economic impacts. Quantification of areas and commodities potentially at risk surrounding nuclear power developments.
- Identification of all irrigated land for planning purposes.
- Identification of land use per catchment for catchment management agencies, planning and hydrological modelling.
- Monitoring the trends in terms of land use changes and the associated losses of agricultural land.
- Support of conservation planning and Landcare initiatives. Supporting the Department’s mandated activities in natural and agricultural resource assessment and inventories.
- Having field scale land use mapping that facilitates the “masking” of specific, similar land uses for remote sensing analysis and research, for example yield or biomass assessment using NDVI.

There are likely to be a number of further transversal applications not listed here.

In order to address these issues, the Department has taken the step of appointing an experienced consulting firm to conduct a field-scale aerial survey in order to simultaneously address a range of associated and urgent needs.

The project is to address the needs of a wide range of Departmental stakeholders, so it becomes more of an agricultural inventory than a simple land use exercise. It is based on an “objective” survey, meaning that the surveyors generally do not contact farmers, but do most of the work by aerial survey using light aircraft and helicopters, with some remote sensing data used in the planning stages. The project will include aspects such as:

- A summer and a winter mission to map all agricultural commodities at field scale.
- A refinement of the existing farm spatial database.
- Comparison with existing statistics on agriculture in the province as provided by Statistics SA.
- An estimation of the hectares of current agricultural land and land lost to agriculture through mining, urbanisation and conservation.
- Define all irrigated land through air survey supported by remote sensing time-series analysis over five years archived NDVI data.
- Mapping of agricultural and agro-processing infrastructure such as:
  - Pack houses
  - Cool chain facilities
  - Abattoirs
  - Dairies
  - Chicken batteries
  - Tunnels
  - Dip tanks
  - Feedlots
  - Agritourism facilities
  - Map the status quo of land reform

Internally the data will furnish baseline data to a number of the Department’s own information systems, (eg the Agricultural Information Management System, (AIMS) while the project will also address the needs of a wide range of stakeholders, not only in agriculture, but across other departments as well. The survey will provide a benchmark against which future changes (eg due to climate change, economics, land reform and urbanisation) can be measured, and should ideally be re-visited and updated every five years.

The project will also play a critical role in a forthcoming national project to define high potential and unique agricultural land, in order to protect it from development in accordance with new land use planning laws.
Rabies is one of the primary diseases which the Animal Health sub-directorate of Veterinary Services within the Western Cape Department of Agriculture targets in terms of disease control. Figure 1 shows the progression of the rabies vaccination effort logged by Western Cape Veterinary Services officials over the past three years. Included in the maps are the outbreaks the province has experienced in animals over that time period and the species in which those outbreaks occurred. The rabies subtype that predominates in the Western Cape is found mainly in the bat-eared fox population. It is very important to note, however, that this does not mean that bat-eared foxes are carriers of the virus in the Western Cape; if they get infected they will almost certainly die. The bat-eared fox acts rather as the maintenance host for the rabies virus variant that occurs in the Western Cape, and should the virus spill over to another host like the domestic dog, the infection will generally not spread further.

**Outbreaks and vaccination during 2012**

In 2012 the Western Cape Veterinary Services experienced the first case of rabies in a domestic cat since 2010; in that case a domestic cat in Mossel Bay was found positive to the virus. Other than that, the trend of rabies outbreaks has remained very constant over the three years, with the majority of cases occurring in bat-eared foxes in the Malmesbury State Vet region. There were, however, two cases of Cape fox associated rabies in 2012 which had not been evident over the past few years, and the case in the striped polecat in Beaufort West also shows some spillover from the bat-eared fox host into this species in the Western Cape.

The number of rabies outbreaks experienced in the Western Cape has decreased. There were 10 cases in 2010, eight cases in 2011 and seven cases in 2012. The number of outbreak response vaccinations concur with this trend, as in 2012 the State only performed 176 vaccinations in response to outbreaks, compared with 1651 in this category in 2010. The number of routine rabies vaccination events logged by technicians reached its highest year on year total in 2012 with 3 999 events logged, totalling 50 512 vaccinations (average per event was 13 vaccinations), compared with 76 668 routine vaccinations performed in 2 948 events in 2010 (average per event was 26 vaccinations). It can be seen that technicians are either spatially more accurate when logging their data or there is an increase in smaller numbers of vaccination in more areas. Whichever is true, it’s a good trend in terms of coverage and accuracy of data, although it is still important to continue with the vaccination campaigns with large quantities vaccinated in few areas to cover the more densely populated areas thoroughly. No major changes have occurred in the areas covered by rabies vaccination in the Western Cape. Subjectively there is an impression that the avian influenza events of 2011/2012 may have influenced the Southern Cape rabies vaccination effort. This area must be focused on as soon as is logistically possible in order to decrease the susceptible population of animals in this area. The continued dedication of the Malmesbury State officials is, in my opinion, having a significant impact on the number of cases of spill-over rabies from the bat-eared fox population in the Swartland. Based on the outbreaks in wildlife in that area, the pressure for spill over is at its peak in this part of the province. “Prevention is better than cure” is especially true for human cases of rabies and it would not be an exaggeration to say that the effort by the officials in this area have saved human lives.

**Figure 1:** Three maps showing the rabies vaccination effort and the rabies disease events within the Western Cape Province over the past 3 years. The vaccinations (blue circles) are dog and cat vaccinations logged only by Animal Health Technicians but do include some data from welfare organisations. The red dots indicate the disease outbreaks with labels indicating in which species these outbreaks occurred in.

Deur die jare het Pap hom verder bekwaam totdat hy in die pos van Beheertegnikus in die Departement te Elsenburg aangestel is, die pos wat hy beklee het tydens sy aftrede einde Februarie.

Gedurende sy hele loopbaan was hy betrokke by wateraangeleenthede. Sy tyd by Waterwese het hy hoofsaaklik spandeer aan die ondersoekte na en beplanning van talle besproeiingsrade se waterskemas, veral in die Breëriviervallei.

By die Departement van Landbou het hy meer gekonsentreer op besproeiing en plantwaterbehoeftes. Die resultaat was dat hy ’n kenner op die gebied is en feitlik enige gewas in enige streek se waterbehoeftes uit die kop ken.

Een uitstaande kenmerk van Pap is sy integriteit. ’n Saak is of reg of verkeerd by hom, geen middeweg nie. Hierdie kenmerk het hom dikwels die gramskap van kollegas op die hals gehaal wanneer hy verseg het om projekte te ondersteun indien daar twyfel was oor die waterregte, hoeveelheid en kwaliteit van die water beskikbaar en die verwagte bedryfskoste van die ontwikkeling.

Pap gaan beslis gemis word en sy kollegas sal moet sokkies optrek om sy skoene vol te staan. Veral sy grappies, droë humor in en kwinkslae gaan gemis word. Soos hy onlangs opgemerk het: “Soos in enige huwelik verskil ek en die vrou partykeer, die res van die tyd verstaan ons mekaar glad nie!”

Ons wen hom alles van die beste toe met die nuwe status van pensioenaris. Die aftrede gaan hom en Sonja die geleentheid gee om dinge te doen waarvoor hulle voorheen nie kans gehad het nie.

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Kikoejoe-raaigras as WINTERWEIDING ...bestuur versigtig!!

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Raagras wat gedurende die herfs in kikoejoe as winter- en lenteweiding oorgesaai word, is die belangrikste besproeide weiding vir melkproduksie in die Suid-Kaap. Navorsing op Outeniqua Navorsingsplaas toon dat verskillende raagrasspesies en -tipes in 'n voervloeiprogram met kikoejoe as basis ingeskakel kan word. Raaggraspesies word egter nie slegs in kikoejoe as winter- en lenteweiding oorgesaai nie, maar word ook gebruik om die seisoenale kwaliteit, en dus die melkproduksiepotensiaal, van kikoejoeweiding gedurende die somer en herfs te verhoog.

Alhoewel die raagraseskompententie gedurende die winter en lente hoofsaaklik die weikapasiteit en kwaliteit van die oorgesaai kikoejoe-raaigrasweiding bepaal, is daar belangrike bestuursfaktore wat die landboer in ag moet neem. Die belangrikste is dat daar verwag kan word dat die produktsetempo van raagras gedurende die diekoue wintermaande (Junie tot Augustus) tussen 30 en 40 kg droëmateriaal (DM)/ha dag varieer en heelwat laer sal wees as die produktsetempo van 60 en 80 kg DM/ha dag in die lente. Die optium seisoenale produktsetempo’s kan slegs egter behaal word waar raagrass as ‘n volwasse plant op die drie-blaarstadium bewei word. Weidingstekorte sal dus gedurende die winter ontstaan en indien onvolwasse plante bewei word kan verwar word dat die produktsetempo gedurende die winter selfs laer kan wees.

Die weifrekwensie van raagras behoort gedurende die winter elke 30 tot 40 dae en lente 24 tot 28 dae te wees. Vinniger weifrekwensies sal veroorsaak dat die DM-inhoud van die raagrasspe, wat uit ‘n voedingsoogpunt reeds laag is en onder goeie bestuurstoestande tussen 12% en 14% varieer, selfs laer as 10% gedurende beweiding kan wees. Uit ‘n plantkundige oogpunt sal die volhoubaarheid van die stand en produksiepotensiaal verlaag, maar belangriker nog is dat weiding inname beperk word deur die vog in die weiding. Jersey koeie moet daagliks ongeveer 10 kg DM vanaf die weiding inneem. By ‘n DM-inhoud van 10% moet die dier dus 100 kg groen weidingsmateriaal inname. Beperkte rumenkapasiteit veroorsaak dat die dier nie genoeg kan vreet nie en melkproduksie word negatief beinvloed.

Landboers wat vinnige weifrekwensies in die winter handhaaf neig ook om hoë vlakke van stikstof (N) toe te dien in ‘n poging om die verlaagde groeitempo te verhoog. Buiten dat dit nie die groeitempo sal verhoog nie, en dus onekonomies is, word die stikstofstatus van die grond en nitriet-inhoud van die raagrassplant en later ook die van die jong kikoejoeplante in die laat lente en somer, verhoog. Dit veroorsaak dat die plant onsmaklik is en beperk die vrywillige inname daarvan deur die weidende dier. Stikstof behoort toegedien te word volgens die koolstofgroei punt van die drie-blaarstadium. By ‘n C-inhoud van laer as 2% word stikstof toedienings van 40-50 kg N/ha na elke beweiding (gebaseer op volwasse plant) vereis. Indien die C-inhoud hoër is as 3% kan die N toedienings na 30 tot 35 kg N/ha verlaag word.

Goed om te weet:
1. Wei raagrass as die plant volwasse (3-blaarstadium) is en wei gedurende die winter elke 30 tot 40 dae of sodra oorskaduing van die raagrasgroei punte plaasvind.
2. Wei die plant tot ‘n na-beweiding diskmeterhoogte van tussen 12 en 15 (6 cm en 7.5 cm).
3. Dien stikstof volgens die koolstof (C) inhoud van die grond.

Jong raagrassalinge wat in kikoejoe as winterweiding ingesaai is.

Raagrass word as winterweiding met ’n planter in kikoejoe ingesaai.
SABIA is born – an association for biogas

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Biogas in South Africa received a boost recently with the launch of the Southern African Biogas Industry Association (SABIA). This is the first organisation dedicated solely to the development of the fledgling biogas industry in South Africa.

Although biogas is widely utilised in many parts of the world and has undergone tremendous development in recent times, biogas in South Africa has lagged behind. While rising energy costs and environmental concerns have sparked an interest in biogas, and although this interest has been sustained over a number of years, it has unfortunately not translated into actual working plants producing biogas. Some of the reasons for this slow uptake are, among others, few existing plants to serve as examples, little experience in designing and financing plants, lack of biogas specific standards, lack of reliable, unbiased information, etc.

Stakeholders in the biogas industry felt that a dedicated biogas association could address many of the stumbling blocks that the industry faces. The Southern African Biogas Industry Association (SABIA) was therefore launched at its inaugural meeting in December 2012. Both the private and the public sectors were well represented. SABIA envisions three main focus areas. Firstly SABIA aims to act as biogas champion with government with regards to policy, standards and regulations. A second aim is to provide education and training to both potential users and practitioners to disseminate correct, unbiased information and to help set benchmarks for the industry. The third aim is to market the many benefits of biogas effectively to increase acceptance of biogas systems as viable investments.

There is a lot of energy and enthusiasm in this new association and dedicated teams have already started work on standards, on guidelines and on a biogas handbook. SABIA is in talks with ESKOM regarding rebates and has also taken part in the recent Africa Energy Indaba. Although much hard work remains, the formation of SABIA promises to accelerate the development of a vibrant and viable biogas industry in South Africa. Visit the SABIA website, www.biogasassociation.co.za, which supplies more information and up to date news.
Mr Willem Paulse from the farm Rietfontein in the Witzenberg region was announced as the 2012 Western Cape Farm Worker of the Year during a formal gala dinner hosted at the Cape Town International Convention Centre (CTICC) in November 2012. Willem was born on the farm Kromfontein in the Koue Bokkeveld. His parents were employed at Kromfontein, where his father also retired after 45 years of service. In 1985 Willem joined the De Keur Group as an administrative clerk, and in 1992 he was promoted to accountant. In 2007 he joined Rieftontein Estate as Financial Manager. According to Willem he attended various career orientated short courses during his career in order to stay relevant and up to date about his subject matter. Willem dedicated his award to his father, who inspired him always to do his best.

Willem is very involved in his community, serves on various committees, and is currently the chairperson of Hortgro’s Fruit Workers Development Trust. Apart from a R20 000 cash prize, an overseas study tour and a R20 000 study bursary from Stellenbosch University, Willem also becomes a member of Minister Gerrit van Rensburg’s Prestige Farm Worker Forum. This forum consists of all the previous overall winners of the competition and meets regularly with Minister Van Rensburg to raise issues of importance and other matters related to farm workers. They also attend various events and serve as motivational speakers.

The annual Western Cape Farm Worker of the Year Competition, funded and organised by the Sub-programme: Farm Worker Development is hosted to recognise farm workers for the significant and valuable role that they play towards the sustainability and growth of the agricultural sector in the Western Cape. The competition, the only one of its kind in South Africa, was initiated in 2002 in the Hex River Valley and started with only 36 participants.

Over the years the competition has grown tremendously and that is reflected in the fact that during the 2012/13 financial year the competition included 15 regions across the province with 887 farm workers participating in nine different categories. The competition is highly regarded by farm workers and producers alike and winners not only receive increased status on the farms and in the regions, but also receive opportunities to further develop their skills and potential through training courses and visits abroad to expand their exposure.

During 2012 Shoprite partnered with the Department and contributed a R750 000 sponsorship to the competition. The Department is also grateful that Shoprite has confirmed its continued support for the competition during 2013. Through its financial commitment, Shoprite acknowledges the role that farm workers play in sustaining food security in South Africa.

The gala award ceremony where all the provincial winners were announced was attended by farm workers, producers, farmers’ associations, industry stakeholders and experts, sponsors, political leaders and senior government officials. The Premier of the Western Cape, Helen Zille, thanked farm workers for their dedication and hard work during her keynote address at the event.

This competition not only provides farm workers with something to strive towards, but it instills a sense of achievement and pride. Numerous farm workers attribute the development and successes in both their careers and personal lives to their participation in the competition.
The Food and Agriculture Organisation of the United Nations commemorates World Food Day (WFD) on 16 October, the day on which the organisation was founded. World Food Day was proclaimed in 1979 by the conference of the FAO. In 1980, the General Assembly endorsed the observance of the day in consideration of the fact that “Food is a requisite for human survival and wellbeing”.

In light of the importance of food security in the nation’s development and the overall goal of improved welfare of the population, government has placed a high priority on establishing an explicit food security legislation, ie Integrated Food Security and Nutrition Programme (IFSNP), which outlines a coherent ultimate goal to raise the nutritional levels of the population, particularly the more vulnerable members of society at household and individual level.

In addition, ACT 108 of 1996 asserts food security as a fundamental human right and further states that the State must take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right.

Therefore, the importance of attaining household food security in the Western Cape is evident via the establishment of a dedicated work group for food security, organised within the Provincial Strategic Objective 8.

The Branch Agricultural Development and Support Services, especially the Programme: Farmer Support and Development, is at the coalface of delivering a range of services of which World Food Day is a strategic event on the calendar of the Department. The theme for the 2012 World Food Day was “Agricultural Cooperatives - Key to Feeding the World” which is extremely relevant within the context of our socio-economic profile of households and given our constitutional imperative.

The 2012 World Food Day event was commemorated on 10 October 2012 at Bella Vista in Ceres. As part of the World Food Day deliverable, the Department supported 63 households with household food production packs, ie garden tools, family irrigation systems, compost, seeds and seedlings, as an enabler to produce their own food. These households were selected from the municipal indigent register.

The Minister for Agriculture and Rural Development, Gerrit van Rensburg, delivered the keynote address at the event, which was attended by over 700 people. An old-age home, pre-schools and the Association for Persons with Disabilities were identified by the planning team to benefit from the food mountain, which was handed over by the Minister and the Mayor of the local municipality.

Since 2007, the Department of Agriculture has observed World Food Day with the delivery of specific interventions targeted at households and communal projects and to date has supported approximately 300 households.

The World Food Day event in Ceres also received generous contributions from the World Food Bank, SAB and the staff of the Department of Agriculture.

It must be noted that food insecurity is a complex intervention that requires multiple stakeholder collaboration and commitment across spheres of government to ensure positive sustainable results. ☞
Agricultural Science Fiction: A reality in our lifetimes? (Part 2)
Dr Dirk Troskie

Artificial insemination technology for ostriches: A way forward
M. Bonato & S.W.P Cloete

A preliminary study of molecular divergence of the Elsenburg Merino flock based on RAPD markers
P. Naidoo, S. W. P. Cloete & A. Fossey
Agricultural Science fiction: A reality in our lifetimes? (Part 2)

Dr Dirk Troskie – dirkt@elsenburg.com
Director: Business Planning and Strategy; Western Cape Department of Agriculture

Although farming has traditionally filled a very special place in the minds of all South Africans (irrespective of race or gender) it is important to acknowledge that this position is changing as our society develops. In the previous part of this two-paper series a brief overview of the origins of our agricultural technology was provided and the nature of the important trends in these countries was investigated. It was reasoned that South Africa’s agricultural technology is imported from developed countries whose agricultural sectors are shedding labour. Indeed, as a significant part of the labour in these countries is provided by illegal immigrants and their citizens are generally reluctant to face the conditions implied in agricultural wage labour, their technologies tend to be labour-replacing. In this paper some key characteristics of the next generation of agricultural technology will be investigated. After all, this technology will find its way to South Africa; irrespective of whether it supports or contests the public and social objectives of our society.

The link between the nature of farming and labour intensity...

The Economist (2009) argues that the conditions under which automation takes place on a farm are significantly different from those on the factory floor. First, the surface of a factory floor is firm and smooth with the possibility of installing guides to direct repetitive actions. On a farm the surface of one field will inevitably be uneven and may range from rocky on the one side to muddy on the other. Second, while it is expected of a robot in a factory to work with standardised components, an on-farm automate has to deal with biological products. This implies that no two trees look the same, and while fruit is carried at different places on a branch, its shape and consistency also varies widely and it can be hidden by leaves. Furthermore, branches move in the wind and fork arbitrarily.

...is about to be broken.

These are some of the reasons why the biggest gains in agricultural labour-replacing technologies historically tended to be limited to those crops which could be destroyed during harvesting. Perennial crops (e.g fruit, grapes, etc), vegetables and certain animals always implied labour-intensive cultivation and harvesting practices; despite the pressures building up as described in Part 1 of this paper. This labour intensity in horticulture and irrigation farming is also one of the reasons why the authors of the National Development Plan were confident enough to put a target of 1 million new jobs at the door of the Agricultural Sector (npC, 2011). However, the Economist (2009) made the case that improvements in vision and other sensing systems, increases in the power of computing, miniaturisation and advances in propulsion systems have made robots cleverer, safer and more dextrous.

New technologies must be technically efficient...

Yet even if an action is feasible, it will only be widely accepted once adoption makes economic sense. This reality forces us to take a brief look at the nature of technological development (see Figure I). The life-span of a technology usually follows an S-curve, with a lot of effort (time, money, resources) initially being invested in the new technology and very little gain in the desired features (higher capacity, lower cost, etc). Indeed, during this phase it is not uncommon for scientists to do something just for the heck of it or to prove that it can be done. This is usually followed by a second phase during which each additional unit of input results in a bigger gain than the previous unit and rapid progress takes place. In the third phase progress is still rapid, but at a declining rate. During the final phase a particular piece of technology has reached maturity and progress tends to be slow, with tinkering around the margins being the order of the day.

It is inevitable that a new technology, following its own S-curve, will come along at some stage. In the initial stages the features of this replacement technology will often be less attractive than those of the new technology. For instance, according to the UK Locomotive Act of 1865, automobiles were allowed a maximum speed of 6 km/h and a person with a red flag had to walk 55 m ahead of the vehicle. At that stage these features were evidently much less efficient than any horse-drawn carriage, but just imagine what our economy would look like today if it was still totally dependent on animal traction? The key here was that automobiles did not imitate animals, but used a fundamentally different way of motion (wheels and the internal combustion engine). Similarly, flight with machines heavier than air was doomed until inventors stopped imitating birds and the Wright Brothers understood the principles of the movement of air and control mechanisms. In the same way, letters were replaced by the telegraph and eventually by electronic media. As no business today can be competitive if it shuns electronic communication, no farm in the Swartland can be viable if wheat is still harvested with a sickle. Automation and robotics will change the face of horticulture and animal production in the same way.

...and economically viable.

Indeed, The Economist (2009) reports that hand harvesting of raisins in California cost $494 per acre compared with the cost of $282 per acre if the continuous tray method is used. The difference could even widen if trellising systems are adapted to favour this new technology. South Africans have become used to mechanical grape harvesters and rotary pruners; both rather crude ways of replacing labour. During 2011, Vision Robotics received a grant (Grant no 2011-33610-30821) from the USDA to develop a robotic pruner for wine grapes. The key to this system is the use of lasers to develop a three-dimensional image of the grapevine. A mechanical arm employs this image to identify the most appropriate place and angle to cut individual shoots. The United States Department of Agriculture has foreseen that “the robotic vineyard pruner should prune with higher quality and lower cost than manual labor” (USDA, 2011).

Existing agribots are proving their mettle...

In some instances disruptive change is even closer than we think. According to Katrin Fisher, Secretary of the Bavarian Young Farmers Association, about 50% of the milking machines currently being installed in Germany are so-called “milking robots”. An image of the cow’s udder is scanned and
stored in the unit’s computer and the cow carries an electronic chip in its ear or a dongle around the neck. When the cow enters the unit, its details are recorded and the washing takes place with a robot arm. A laser helps a separate arm to place the clusters on the teats and each cup can be removed separately when the flow of milk from that particular quarter stops. This prevents over-milking and, as the unit also tests the cow’s temperature and does a somatic cell count of the milk from each quarter, the cows tend to be much healthier than those milked with ordinary machines. One robot can milk about 80 cows and, as they have free access to the unit 24 hours per day, they have on average close to three milkings per day. Ms Fisher indicates the milking robot on their farm triggers the alarm for human assistance only once in about every six weeks. She also mentions that, in addition to the increased production, lower disease pressure, reliability and labour saving benefits associated with the robot, the wives (who usually do the milking chores in Germany) of young farmers are particularly active in “motivating” their husbands to adopt this new technology (Troskie, 2012).

...and smaller may be smarter.

We are currently used to the idea that mechanical technology in commercial agriculture is increasingly dominated by bigger machines. These machines are usually extremely expensive and add the characteristic of “lumpiness” to mechanisation. In other words, although you only need one operator, you need a farm of at least some basic proportions for a modern no-till wheat planter to be a rational acquisition. As a new limit needs to be approached, the purchase of a second planter will only make sense once this limit is reached, resulting in the step-wise nature of mechanisation and economies of scale. The only way to mitigate this problem (especially in the case of small scale farmers) is to form machine circles or mechanisation hubs.

Robotics may add a new dimension to this trend. The principle behind so-called “Antbots” or “Ag Ants” is that it may be better to have a large number of small, inexpensive and dispensable robots performing a particular task than one cumbersome, heavy and fuel-guzzling machine (Peterson, 2004). Just imagine a mass of ant-like robots swarming through a wheat field and selectively eradicator a weed or aphid infestation. Ag Ants may not only favour the smaller farmer, but may operate under conditions unfavourable for big human operated machines (eg muddy or sandy conditions), be more efficient and may have cost advantages.

Increased efficiency...

Some experimental robots have the capacity to assess the morphological characteristics of a plant, compare it with the information in its on-board database and decide whether it is a plant or weed. If it is a weed, the robot can cut the weed and apply herbicide to the cut. In addition to preventing the drift of sprays, the targeted application of chemicals is much more cost efficient than current blanket application methods. Almost more interesting is that the use of solar power will increase the independency and scope of application of these robots (Lucas, 2006).

The same principles are being applied at Wageningen University. One of the projects of their Systems and Control group is to develop an autonomous weeding robot. In their case a purely mechanical process is being developed with the argument that it will enhance organic farming (Bakker, 2012).

...and the capacity to multi task will disrupt current labour practices.

These developments support the argument by The Economist (2009) that agricultural robots could be developed to multi-task. As a harvesting robot moves through an orchard, it could also detect the early stages of a disease outbreak and selectively apply a pesticide stopping the outbreak before any damage is done and with the minimum damage to the environment. The complexity and knowledge demand of this type of multi-tasking is way beyond what could reasonably be expected from a seasonal worker.

Even high-skilled activities may not escape the disruption.

Even agricultural activities such as wine making, traditionally seen as more art than science, are not exempt from disruption. The making of wine is usually associated with images of dark and musty cellars in which a venerable sage walk between the vats and identifies the true worth of any wine through swirls of wine in glass, determining its “nose” and tasting its “palate”. It is claimed that a true sommelier can determine the origin, vintage, and even the slope and aspect of the vineyard in which the grapes were produced. However, the superior knowledge of leading lights has been questioned in recent times (not the least through inter-faction conflicts among experts) with the result that the need for a less biased approach has been promoted. An electronic nose, a type of mass spectrometer, with the ability to analyse the compounds in vaporised wine, has recently been developed (Gray, 2009). Properly calibrated, this artificial nose can tell exactly which variety of grape, region and vineyard from which the wine was made. It can even go as far as to indicate the specific barrel in which the wine matured and the origin of the wood (forest) from which the barrel was made.

Watch this space.

One of the indicators that a new technology is starting to progress rapidly is when people involved in the design of the technological artefact are sufficiently confident that they are willing to challenge their peers. Such a challenge is the Annual Field Robot Event originally started by Wageningen University with the belief that autonomous agricultural robots will soon carry out a range of tasks such as weeding, spraying and disease monitoring. After a sojourn in other countries, the 10th annual event was again hosted by Wageningen University, from 28 to 30 June 2012. As the idea is that the robots must operate autonomously, humans are not allowed to follow the robot with any sort of controller or to communicate with it. The competition usually consists of a number of tasks to be completed by the robots. For instance, one of the tasks to be completed during the 10th Event was to test the cooperation between robots. One robot had to find a marked rose in the field and the other had to print a barcode on it. During the 2012 Field Robot Event 20 teams from nine countries (Germany (seven teams), The Netherlands (two), Iran (two) and Turkey (one) vied for the winner’s rostrum (Field Robot, 2012).

The fact that applied robotics is a serious science is underscored by the fact that this subject field even has its own scientific journal. The aim of the Journal of Field Robotics is to promote scholarly publications in dealing with robotics in unstructured and dynamic environments. It follows that some of the areas of application would include agriculture, forestry, construction, the environment, intelligent highways and military use.
In conclusion

In this two-paper series it was argued that South African agricultural technology is being imported from developed countries who are increasingly promoting labour-saving devices. In both Europe and North America rapid advances are being made to replace activities traditionally considered to be the prerogative of skilled people, with robots. Once automation moves beyond imitating human action, real and rapid progress will be made and farmers failing to adopt these technologies will not survive. After all, with more than 50% of South African households living on less than R1 500 per month (StatsSA, 2012), cheap food is an imperative for our social sustainability.

Agribots will become more cost effective, efficient, and able to cope with a wider range of tasks, do not get tired and never demand better conditions of employment. Perhaps we should ask ourselves if we are focusing our attention on the right issues (for instance, labour brokers) and rather develop a collective focus on innovative ways to enhance labour absorption in the Western Cape Agricultural Sector.

Figure 1: The nature of technology development.

References


Gray, R. 2009. Electronic nose can pinpoint where wine was made. The Telegraph, 28 June 2009.


Take home message

The development of animal and human-friendly methods to collect semen from males and artificially inseminate female ostriches has generated a new interest in developing assisted reproductive technologies to assist development in the fragile industry. Research pertaining to the determination of the optimum semen collection frequency, semen handling and storage, insemination dose and frequency are currently underway at the Oudtshoorn Research Farm. This paper summarises our advances in developing a viable protocol for artificial insemination in this species, and provides directions for further research.

Introduction

Assisted reproductive technologies like artificial insemination (AI), as well as semen holding and cryopreservation are needed to preserve and disseminate livestock germplasm. Commercial ostrich farming is still constrained by low fertility, high levels of embryo and chick mortality, as well as an inadequate genetic improvement (Cloete et al. 1998; Malecki et al. 2008; Cloete & Malecki, 2011). The development of an AI program in this species could potentially overcome these limitations. Specific traits could be selected and genetic improvement would accrue if high quality fertile ejaculates can be collected from males and inseminated in a stress free manner into receptive females using AI. Recently, new animal and user-friendly methods have been developed for ostriches, allowing routine semen collection in male ostriches and artificial insemination of females (Rybnik et al. 2007; Malecki et al. 2008). Given this recent development, the artificial insemination technology can now move to the next phase, which is to design protocols for the optimum collection frequency of semen, for semen storage and for the dosage and frequency of AI in females. Against this background, our present research project undertakes to address the following questions: 1) how frequently semen can be collected from ostriches; 2) what should ejaculates be diluted with and at what temperature should sperm be stored; 3) what dose of sperm should be inseminated for optimal fertility; 4) how frequently should females be inseminated to maintain maximum fertility?

Materials and Methods

Study population and ejaculate characteristics

At present, seven males (aged 2-7 years) are trained to mount a dummy female and ejaculate into an artificial cloaca (Rybnik et al. 2007). On average, ostrich ejaculates have a volume of 1.3mL, with a concentration of 4 billion spermatozoa and a percentage of 87% live spermatozoa (Bonato et al, unpublished).

Results and Discussion

Semen characteristics and frequency of collections

Seasonality of breeding

Reproductive performance of male ostriches can exert a considerable influence on the success of a breeding program. Season can potentially influence the quality and quantity of semen collected for AI and hence fertility. The collection of ejaculates and the assessment of ejaculate characteristics over a period of 12 months revealed that the largest volumes were found in autumn and winter (April-September), while higher numbers of spermatozoa were found during the spring and summer months (October-April), with a peak in spring (October-November; Figure 1). The libido of trained males was also maximised in spring and lower in mid-summer (Bonato et al. in preparation).

\[ \text{Figure 1: Seasonal variation of semen volume and number of spermatozoa output in seven male ostriches.} \]

These results indicate that it is possible to collect semen from ostriches all year around and that collections conducted in spring will yield higher numbers of spermatozoa when libido of males is at its best.

Frequency of semen collection

The success of an artificial insemination programme relies largely on the ability to collect semen, as well as on the availability of large numbers of spermatozoa for AI purposes. The collection of semen at different frequencies (once every two days – 48h interval, daily – 24h interval, and twice a day – 6h interval) over a period of 10 days showed an increase of semen volume and number of spermatozoa collected with an increase of collection frequency (Figure 2; Bonato et al. 2011), while the male’s libido remained unaffected.
These results suggest that semen can be collected from ostrich males relatively frequently without a depletion of sperm reserves and without altering the libido of males.

Development of semen diluents

Undiluted, ostrich semen coagulates and deteriorates rapidly at room temperature (Ciereszko et al. 2010; Malecki et al. 2008). Preliminary studies on the dilution of ostrich sperm in poultry semen diluents resulted in a limited maintenance of sperm motility and viability over time (Ya-jie et al. 2001; Malecki et al. 2008; Ciereszko et al. 2010; Bonato et al. 2010), emphasising the need to develop a suitable specie-specific diluent for storage of ostrich sperm. A key to developing a diluent promoting sperm viability and motility involves determining the optimal pH and temperature for both short and long term storage. Changes in viability and motility over a biologically relevant pH range were assessed at temperatures of 20°C (room temperature) and 40°C had a higher motility, with a peak at pH8 (Figure 3). The effect of temperature and pH on the motility and viability involves determining the optimal pH and temperature for both short and long term storage. Changes in motility and viability over a biologically relevant pH range were thus assessed at temperatures of 20°C (room temperature) and 40°C (average avian body temperature). Sperm incubated at 40°C had a higher motility, with a peak at pH8 (Figure 3). The viability of sperm (as expressed by the percentage of live normal spermatozoa) was unaffected by temperature but decreased with an increase of pH (Figure 3; Bonato et al. 2012).

These results indicate that body temperature and slightly alkaline conditions seem to stimulate ostrich sperm motility, but an acidic to neutral pH range is required for the ostrich-specific diluents to ensure better sperm survival during in vitro storage.

**Routine insemination of females**

Development of a population of females laying eggs without the presence of male.

It is generally accepted that most female ostriches do not produce eggs in the absence of males. However, identification of females producing eggs without male presence is needed to develop an AI program. The egg production of 20 docile females, single-penned and without prior experience with males was compared with those of paired females maintained in breeding camps, over two breeding seasons (May to December). Single panned females were found to produce significantly fewer eggs per month, compared with paired females (3.90 eggs vs 5.69 eggs per month), but both groups showed a similar pattern of laying with a peak production occurring in August (Brand et al. in preparation; Figure 4).

**Artificial insemination: preliminary results**

Female ostriches are able to store sperm in the oviduct and fertilise subsequent eggs for up to two weeks after the last copulation (Malecki et al. 2004). However, the fertility of female ostriches after AI has not yet been investigated. The amount of sperm inseminated is crucial to optimise fertility: too much sperm reduces efficiency by increasing collection frequency from males and reducing the number of females that can be inseminated with a single ejaculate, while too little sperm can have detrimental effects on fertility rates and increases the frequency with which females need to be inseminated. We thus monitored fertility of 10 females inseminated with 3 billion spermatozoa on five consecutive days, using the voluntary crouching behaviour (Figure 5; Malecki et al., 2008). Semen was collected from two to four males (aged three to five years) using a dummy female, pooled and diluted 1:2 with EK diluent. Fertilisation status of eggs was estimated by the appearance of the germinal disc after the egg was broken out. The number of sperm trapped in the perivitelline membrane (spermOPVL) above the germinal disc region was also counted under fluorescence to determine the rate of sperm loss and the number of days that passed before the last egg containing sperm was laid.

These results demonstrate that the presence of a male is not necessary to induce laying, although paired females produced more eggs. The reason for the latter phenomenon should be determined to optimise egg production in females maintained without males.

**Figure 2:** The effect of the frequency of collection on total volume of semen and total number of spermatozoa produced by seven male ostriches during a 10-day test. (Bonato et al. 2011)

**Figure 3:** The effect of temperature and pH on the motility and viability of four male ostriches.

**Figure 4:** Average egg production in single vs paired-bred females across two breeding seasons.

Females laid fertilised eggs for up to nine days but sperm were detected in the perivitelline membrane of the eggs for up to 18 days. The change of spermOPVL detected followed a logarithmic decline (y = -0.05x + 1.41, R² = 0.523, P = 0.001 after transformation to natural logarithms; Bonato et al, unpublished, Figure 5).

**Figure 5:** The effect of temperature and pH on sperm motility and viability over time (Ya-jie et al. 2001; Malecki et al. 2008; Ciereszko et al. 2010; Bonato et al. 2010). Semen was collected from two consecutive days, using the voluntary crouching behaviour (Figure 5; Malecki et al, 2008). Semen was collected from two to four males (aged three to five years) using a dummy female, pooled and diluted 1:2 with EK diluent. Fertilisation status of eggs was estimated by the appearance of the germinal disc after the egg was broken out. The number of sperm trapped in the perivitelline membrane (spermOPVL) above the germinal disc region was also counted under fluorescence to determine the rate of sperm loss and the number of days that passed before the last egg containing sperm was laid.

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Figure 5: Changes in spermatozoa number detected in the perivitelline membrane of the eggs following five consecutive inseminations of three billion spermatozoa in 10 female ostriches.

Conclusions

References


It is clear that substantial progress has been made in the development of a viable protocol for artificial insemination in ostriches. However, much emphasis still needs to be placed on the development of a suitable diluent for both short term and long term storage (cryopreservation), before insemination dose and frequency can be adequately evaluated. In particular, a good biochemical understanding of the spermatozoa and seminal plasma is necessary to establish an appropriate storage environment to promote sperm motility, viability and longevity. Hence, questions pertaining to dilution rate, osmotic pressure, pH incubation and storage time as well as temperature (for short term storage purposes) together with cooling, freezing, thawing and warming rates (for cryopreservation purposes) need to be investigated further before a viable protocol for artificial insemination in this species could be implemented.

Acknowledgements

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A preliminary study of molecular divergence of the Elsenburg merino flock based on RAPD markers

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Take home message

The study shows that the H and L lines of South African Merino sheep divergently selected for and against their ability to rear multiple offspring are different at a molecular level. Ten RAPD markers were used to study divergence. Phenotypic data on the lifetime reproduction of ewes born in 1999 and 2000 indicated that reproduction in the high line ewes was markedly higher than that of low line contemporaries (P < 0.01). The preliminary RAPD assay, conducted on 15 ewes from each line, used eight primers and produced 87% polymorphic loci. The mean coefficient of genetic differentiation between lines (GST) was estimated to be 0.25.

Introduction

Over several years, marked fluctuations were observed in the wool: meat price ratio, with the relative monetary value of wool generally declining and meat becoming more expensive. These trends have resulted in the selection strategy of South African Merinos being adapted accordingly (Olivier, 1999). The genetic improvement of reproduction, expressed as total weight of lamb weaned per lambing opportunity, is thus seen as one of the cornerstones of increased productivity.

This situation prompted a divergent selection experiment for and against the ability of ewes to rear multiple offspring. The composite trait is affected by the expression of several genetically influenced traits. Variation in the component traits contributes to the phenotypic variation in the composite trait. Lamb survival, and in particular the survival of multiples, was improved in the High (H) line. The selection strategy based primarily on the maternal phenotype has proven successful in the establishment of the two phenotypically distinct Merino lines (Cloete et al., 2004).

Furthermore, results from this selection experiment have shown a marked, divergent response in total weight of lamb weaned per parity amounting to +1.8% per annum in the H line and -1.3% per annum in the low (L) line (Cloete et al., 2004). These distinct differences between lines possibly suggest that one or more putative loci with a marked effect on overall reproduction may perhaps be present. Random Amplified Polymorphic DNA (RAPD) markers could be used to estimate the molecular genetic divergence between the H and L lines in an initial attempt to estimate the genetic distance between lines. The minimal infrastructure and equipment required for RAPD studies makes this technique useful as a preliminary method for screening for DNA based diversity on limited funds.

The objective of this study is to show phenotypic data that establishes the divergence between the two lines, as well as the first investigation of DNA based diversity using RAPD markers to find evidence that the H and L lines are significantly divergent at a molecular level.

Materials and Methods

Experimental animals were obtained from two lines of Merino sheep divergently selected from the same base population since 1986. Details of the procedure for the selection of replacements can be found in the literature (Cloete et al., 2004). In short, ewe and ram progeny of ewes rearing more than one lamb per joining (ie reared twins at least once) were preferred as replacements in the H line. Replacements in the L line were preferably descended from ewes rearing fewer than one lamb per joining (ie barren, or lost all lambs born at least at one lambing opportunity). Replacements were preferably descended from ewes with more than one reproduction record, particularly in rams. The general management and husbandry of the flocks as well as the experimental sites were also described by Cloete et al. (2004). To elucidate the phenotypic divergence between the lines, records of the two most recent ewe groups present for three lambing opportunities (regarded as lifetime reproduction for this study) were analysed. Thus only 68 ewes, born in 1999 and 2000, and present in the flock at lambing at four years of age were considered. Number of lambs born, number of lambs weaned as well as total weight of lamb weaned were expressed per ewe joined.

Preliminary RAPD assays were conducted on 15 randomly chosen ewes per line from the H and L lines. Eight individuals born during 1999 and seven individuals born in the period from 1996-1998 were used. Total genomic DNA was extracted from whole blood samples collected by jugular venipuncture, and isolated using the Gentra Puregene DNA Purification Kit (Aidcock Ingram). DNA concentrations were determined by comparison with the molecular weight marker III (Roche) on 0.8% agarose gels after electrophoresis. Five RAPD primers based on the study by Cushwa et al. (1996) were selected for usage (Table 1). Five randomly selected RAPD primers were also tested (Table 1). Primers were synthesised at the University of Cape Town and diluted in 10mM Tris (pH 8.0) to 20 mM working stock solutions. All RAPD reactions used Taq DNA Polymerase in Buffer A (Promega) and PCR Nucleotide Mix (Promega). The RAPD assays followed the protocols of Cushwa et al. (1996), but altered the reaction volume to 25 µl. Amplification was effected on the Geneamp PCR System 2700. RAPD assays were screened on 1.5% agarose gels at 150 V for three hours, using 1 X TBE buffer and ethidium bromide UV fluorescent stain. Bands were scored by visual analysis. Two RAPD primers were discarded: primer B08 selected from Cushwa et al. (1996) showed no polymorphism, while primer J09 of the randomly selected primers failed to amplify. All primers were tested for repeatability of amplification patterns under constant reaction conditions.

<table>
<thead>
<tr>
<th>Primer Name</th>
<th>Sequence 5’-3’</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>B08</td>
<td>GTC CAC AGC G</td>
<td>Cushwa et al. (1996)</td>
</tr>
<tr>
<td>B20</td>
<td>GGA CCC TTA C</td>
<td>Cushwa et al. (1996)</td>
</tr>
<tr>
<td>C08</td>
<td>TGG ACC GGT G</td>
<td>Cushwa et al. (1996)</td>
</tr>
<tr>
<td>C19</td>
<td>GTT GCC AGC C</td>
<td>Cushwa et al. (1996)</td>
</tr>
<tr>
<td>D20</td>
<td>ACC CGE TCA A</td>
<td>Cushwa et al. (1996)</td>
</tr>
<tr>
<td>F03</td>
<td>CCT GAT CAC C</td>
<td>-</td>
</tr>
<tr>
<td>X07</td>
<td>GAG CGA GGC T</td>
<td>-</td>
</tr>
<tr>
<td>J09</td>
<td>TGA GCC TCA C</td>
<td>-</td>
</tr>
<tr>
<td>P16</td>
<td>CCA AGC TGC C</td>
<td>-</td>
</tr>
<tr>
<td>K03</td>
<td>CCA GCT TAG G</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1: RAPD markers tested for polymorphic alleles in the preliminary genome scan

Average reproduction records were subjected to analysis of variance, involving the effects of line (H or L) and birth year (1999 or 2000). Least squares procedures were used, to account for uneven subclasses. In the absence of significant selection line X birth year interactions, only line effect means were subsequently computed and tabulated. The analysis package POPGENE (Yeh et al., 1999) was used for the analysis of the RAPD assay data.
Results and Discussion

Reproduction of the H line ewes was markedly higher than that of L line contemporaries (P < 0.01; Table 2). Average weight of lamb weaned per joining in the H line was thus more than double that in the L line. This clearly supports marked divergence between the two lines (Cloete et al. 2004), presumably resulting from divergent genetic selection since 1986. Means for total weight of lamb weaned accorded with earlier figures of 25.1 kg in the H line and 16.1 kg in the L line for the period from 1997 to 2002 (Cloete et al. 2003).

The eight RAPD primers used for the analysis produced 51 polymorphic loci in the H line and 48 in the L line. The percentage of polymorphic loci was 69% and 65% for respective lines. The total percentage of all polymorphic loci for both lines was 86%. The means of the observed number of alleles and the effective number of alleles were 1.69 and 1.36 for the H line, and 1.65 and 1.34 for the L line. Cushwa et al. (1996) correspondingly reported a total percentage of 97% polymorphic loci; when using 131 primers in RAPD assays using the Agresearch international mapping flock Kantanen et al. (1995) generated only 47 polymorphic loci in the H line and 48 in the L line. The eight RAPD primers used for the analysis produced 51 polymorphic loci in the H line and 48 in the L line. The percentage of polymorphic loci was 69% and 65% for respective lines. The total percentage of all polymorphic loci for both lines was 86%. The means of the observed number of alleles and the effective number of alleles were 1.69 and 1.36 for the H line, and 1.65 and 1.34 for the L line. Cushwa et al. (1996) correspondingly reported a total percentage of 97% polymorphic loci; when using 131 primers in RAPD assays using the Agresearch international mapping flock Kantanen et al. (1995) generated only 47 polymorphic loci in the H line and 48 in the L line.

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Table 2: Average (± SE) reproduction of 1999 and 2000 born ewes in the H (n = 40) and L lines (n = 18) over three lambing seasons

<table>
<thead>
<tr>
<th>Trait</th>
<th>Line</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs born per ewe joined</td>
<td>H line 1.18 ± 0.06</td>
<td>L Line 0.70 ± 0.09</td>
</tr>
<tr>
<td>Weight of lamb weaned per ewe joined (kg)</td>
<td>H line 23.3 ± 1.3</td>
<td>L Line 10.6 ± 1.9</td>
</tr>
</tbody>
</table>

** Denote significant line differences (P < 0.01)

Table 3: Chi-squared comparisons of gene frequencies between lines at polymorphic loci, as derived from the RAPD assays

<table>
<thead>
<tr>
<th>Primer</th>
<th>Allele</th>
<th>Line</th>
</tr>
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<tbody>
<tr>
<td>B08</td>
<td>**</td>
<td>H line</td>
</tr>
<tr>
<td>B20</td>
<td>ns</td>
<td>H line</td>
</tr>
<tr>
<td>C08</td>
<td>ns</td>
<td>H line</td>
</tr>
<tr>
<td>C19</td>
<td>ns</td>
<td>H line</td>
</tr>
<tr>
<td>D20</td>
<td>**</td>
<td>H line</td>
</tr>
<tr>
<td>F03</td>
<td>ns</td>
<td>H line</td>
</tr>
<tr>
<td>X07</td>
<td>ns</td>
<td>H line</td>
</tr>
<tr>
<td>K03</td>
<td>**</td>
<td>H line</td>
</tr>
</tbody>
</table>

- Denotes the absence of a locus
- Denotes non-significance (P > 0.05)
* Denotes significant line differences in gene frequencies at polymorphic loci (P < 0.05)
** Denotes significant line differences in gene frequencies at polymorphic loci (P < 0.01)

Conclusions

This preliminary study was unsuccessful in providing conclusive evidence of the segregation of loci that could possibly be associated with the marked reproduction differences between lines. It was the first attempt to derive genetic distances between the lines. A more accurate determination of molecular genetic differentiation between the H and L lines could be derived using SNP chip technology, as well as the possible detection of the effect of selection on reproduction traits at the molecular level.

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