grass roots

Newsletter of the Grassland Society of Southern Africa

Incorporating the Bulletin of the Grassland Society of Southern Africa
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Bush encroachment in Namibia: farmers embrace complexity

Forage sorghum and millets

A new plan for the Journal

Bankruptbush: understanding and managing a noxious weed

Advancing rangeland ecology and pasture management in Africa

Editorial

Dear Readers

Welcome back to the New Year, and what an interesting year it looks like it's going to be, to put it mildly. In the last few months, the health of the world's economy plunged to lows last seen decades ago. Oil crashed from well over $120 a barrel to $35 a barrel within a couple of months, and the economy of the world's richest and most powerful nation, we suddenly find, was appallingly badly mismanaged by the same capitalists who created its wealth (according to *Newsweek*, a common taunt on Wall Street was "If you're so smart, why aren't you rich?"; to which we might respond, "if you're so rich, why aren't you smart?").

How that will affect each of us remains to be seen. It's a general election year in South Africa, which usually means changing policies as new ministers take the place of the old ones we're just beginning to get accustomed to. Coupled to times of economic uncertainty, we'll each just have to either weather the storm or embrace the new opportunities, depending on our approach to life.

We have an interesting issue for you this month, with lots of opportunities for young scientists and students.

Embrace, explore, and enjoy!

Alan Short

The Grassland Society of Southern Africa is dedicated to the advancement of the science and practice of range ecology and pasture management.

We welcome any contributions to the Grassroots*, in the form of news, informative articles, reports, short research notes, scientific papers and letters to the Editor. Email shorta@arc.agric.za or admin@grassland.org.za or fax +27 (0)86 622 75 76*

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Farmers in Namibia discussing "leaking" landscapes: how do we restore degraded rangelands? (P. 14) Photo: Ibo Zimmerman

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News

News from NISC

NISC, the publisher of the *African Journal of Range and Forage Science*, has worked very hard in the last year to ensure that the journal is more widely recognized. The Journal has now finally been accepted on the Thomson's list of the journals with the most global impact (normally referred to as ISI-rated).

The Journal is hosted on IngentaConnect and African Journals Online, meaning that all articles can be searched using Google. In addition, the articles are submitted to all major bibliographic databases, listed on the back cover of each issue. Send any additional names of bibliographic databases to NISC for inclusion.

Language editing service

We are aware that the journal gets some submissions based on good science but where poor language and stylistic proficiency prejudice consideration for publication. NISC will offer an affordable local editorial service from 2009. Authors may submit, via the editor-in-chief, such unreviewed manuscripts directly to NISC for editorial and stylistic revision. We will quote once we have seen the work and evaluated the size of the task, but typically we would charge authors between R25 and R65 per manuscript page.

Open access

From the first issue of 2009 we will offer authors the choice of making their article available "Open Access". Procedures are described below and in more detail on our website (www.nisc.co.za).

There is a local and international move in scholarly publishing to give authors the choice of retaining copyright ownership of their published work so that they may make the article available through "open access" channels. In keeping with other commercial publishers we need to charge a once-off open access fee to cover the production costs and to maintain the high editorial standards associated with an international peer-reviewed scholarly journal. Once published, authors may disseminate such open access articles in whatever way they wish. Furthermore, on Ingenta (www.ingentaconnect.com) the specific article will be clearly identified as available for free download. Open access journals are perceived to have lower standards than subscription journals. Therefore, to protect the credibility of the journal, authors will only need to commit to "open access" once their article has been through the journal's standard production processes.

Costs

There will be **no page charges** for GSSA members subscribing to the Journal, for 2009.

News

Prof. Peter Scogings steps down as Scientific Editor

Prof. Peter Scogings has served for five years as the Scientific Editor of the *African Journal of Range and Forage Science*. During that time, he made great efforts to grow the Journal, both in terms of the number and quality of published articles and in terms of the international status of the Journal.

His efforts were finally rewarded last year when the *African Journal of Range and Forage Science* was accepted onto the Thomson's list of Journals (formerly ISI-rated). It will be two years before the Journal's rating is published.

Pete is succeeded by Dr. Susanne Vetter of Rhodes University. Susi has thrown herself with enthusiasm into her new role, and we look forward to many more years of growth of the Society's most important product—the *African Journal of Range and Forage Science*.

Pete's personal accomplishment was marrying Brigid Letty in January. Congratulations to both of them and best wishes from the GSSA!

Photo: Luthando Dziba

Namaqualand initiative develops restoration guide

The Namaqualand Restoration Initiative (NRI) has developed a step-by-step restoration guide for restoring land in the Namaqualand region. These guidelines include restoration packs containing seeds of some of the dominant perennial species in the area, and are designed to increase the success rate of the restoration process.

The initiative, which is funded by the Critical Ecosystem Partnership Fund as well as the De Beers Namaqualand Mine, has been working in Namaqualand for the past four years testing various methods in order to come up with the best solution for restoring the land as closely as possible to its natural state.

At the recent Interfaces conference in Oudtshoorn, staff on the initiative reported back on the methodologies they had used to work out the best restoration method, and what their major achievements had been.

Raldo Kruger, a field researcher working

(Continued on page 8)

News from the African Journal of Range and Forage Science

Exciting times are ahead for the African Journal of Range and Forage Science as plans for improving the journal coincide with an ISI rating

Susi Vetter
Scientific Editor, African Journal of Range and Forage Science

At the last GSSA Council strategic planning meeting in March 2008 it was acknowledged that the African Journal of Range and Forage Science (AJRFS) had reached a state of crisis, with low and declining submission rates and a decline in the standard of submitted manuscripts. Peter Scogings, who served as Scientific Editor from 2003 until 2008, reported that fewer and fewer GSSA members appeared to choose the journal to publish their research. In response to this, a strategic meeting for the Journal was held prior to the July 2008 Congress to plan the way forward to improving the situation. The main – and closely interlinked – issues identified for action were raising the profile of the journal, improving submission rates and reviewing the aims and scope of the journal. Plans for improving the editorial structures and procedures were also discussed.

Profile of the journal and ISI rating

Under the editorship of Peter Scogings, and together with the Journal's publishers NISC, an application was made to have the African Journal of Range and Forage Science listed on the Thomson Reuters ISI Web of Science database. Once listed on ISI, citation data are used to calculate a journal's impact factor. Essentially, the impact factor takes into account how many articles are published annually in a journal and how often these articles are cited by other authors. Researchers wanting to attract funding, promotion or NRF rating are acutely aware of the impact factors of the journals they publish in, and not being ISI rated thus makes a journal an unattractive option for publishing their research. At the same time, Thomson Reuters use the current impact of a journal to decide whether it is worthy of inclusion in their database. Despite being rated as one of the higher impact journals in a recent review of South African science journals, the African Journal of Range and Forage Science was stuck in the vicious circle of "no ISI rating – people reluctant to publish in the journal – not enough research in the journal to attract citations – hence no ISI rating" and at the time of the strategic planning meeting, the efforts to gain an ISI rating had remained unsuccessful. To our great delight, however, we were informed less than a month later that the Journal had been selected for inclusion in the ISI database from 2008, and authors of papers in the Journal have already reported an increase in the awareness of the work they have published there.

The challenge now is to work towards a respectable impact factor, which will be calculated by 2010. To achieve this, the journal needs to attract a large enough number of good submissions to be able to publish high-quality papers of interest to a wider readership. The

latter is crucial as a good impact factor relies on the work being cited by other researchers. Without a reasonable impact factor it will remain difficult to attract manuscripts from leading rangeland and pasture scientists in South Africa, elsewhere in Africa and beyond.

Aims and scope of the Journal

At both strategic meetings there was intense discussion about where the Journal should be headed and what it should be publishing. There appeared to be two main, conflicting and to some extent mutually exclusive ways forward. The one is to strive towards becoming more international in the scope and impact of the journal, whereas the other is to be a forum (in the absence of another journal filling that role) where locally relevant research can be published that would not make it into high-profile international journals. Much discussion was devoted to whether it would be possible to meet both aims in one journal. This is not as straightforward as it sounds. If AJRFS publishes mainly work of strictly local interest (be that in South Africa or another country), this would negatively affect its impact factor and hence the attractiveness of the journal to international and high-profile authors. If on the other hand we are too strict about accepting well-designed local empirical studies, where else would these data become available to other researchers? Clearly there is scope for a range of research, but local studies have to meet the criterion of being applicable to systems beyond the immediate study area. It was suggested that papers reporting on studies of more local relevance should be kept short and to investigate the possibility of archiving electronic appendices and data sets which interested readers could access.

One question that has come up more than once is: if we want to be an international journal, why not drop the "African" in its title? It was agreed that we should rather work on developing a unique niche than to become another general rangeland journal. The African Journal of Range and Forage Science the only journal focusing on rangeland and pasture research in Africa, which is conducted, published and read by local and overseas scholars. African pastoral, commercial farming and wildlife systems are of international interest and research in Africa should be informing rangeland science in places like the USA and Australia, as it has already started to do in recent years. As a case in point, the disequilibrium debate of the 1990s and early 2000s was based largely on research done in Africa and had a major worldwide impact.

The GSSA's vision and mission were revised during the strategic planning meeting in March, and it was decided at the July meeting that the Journal's aims and scope should be aligned with the Society's vision and mission. The resulting new aims and scope of the journal (see Box) succeed in reflecting both the Society's vision and mission as well outlining the scope of an internationally relevant journal reporting quality research done in, and relevant to, the African continent.

Low submission rates

At the time of the strategic planning meeting in July 2008, the rate at which manuscripts were submitted to the Journal was at an all-time low. This seemed to have a number of reasons. Active researchers with a good publication track record appeared to favour other journals over AJRFS, because of the reasons already discussed. Of equal or even greater concern was the impression that much research that is conducted, while of interest to other researchers

and practitioners in the field, is just not being published. With many researchers working in non-academic environments, the pressure (or encouragement) to publish research in the peer-reviewed literature is often not strong enough to motivate scientists to make the extra effort. Two main thrusts are planned to address these problems. The first is to encourage established researchers to publish more of their research in the AJRFS, including work by their students and research and discussion papers around topical issues. The second is to support a broader group of researchers to publish their research in AJRFS via a mentorship programme. This will be designed and piloted in 2009 and funding sought to support its wider implementation from 2010. While the exact model still needs to be developed, in essence the plan is to team up researchers who are seeking support in turning their research into manuscripts with experienced researchers in the field, and to cover the costs of such collaborations.

The good news is that as with the ISI rating, things have looked up since the meeting in July. The rate of submissions picked up dramatically in the second half of the year and we have managed to fill the current and upcoming issues of the journal with some good papers. Thanks go to the editorial team for a sterling effort to process the wave of manuscripts that were received.

What next?

The GSSA has committed itself to achieving the objectives of the strategic plan – to improve the number and quality of submission, to attract submissions from both established and less experienced authors, to improve the journal's national and international profile, to achieve a good impact factor and to improve the editorial process. To this end, provision has been made to pay an honorarium to the scientific editor who is tasked not only with the day-to-day running of the journal but also with revamping the editorial process, soliciting papers and guest issues from suitable researchers and setting up the mentorship programme. But it takes more than a good editorial team to make a good journal and I would like to end with a call to all GSSA members to support the journal – by choosing the AJRFS to publish their research, and by spreading the word to other authors to do the same.

Feedback, comments and questions are welcome – please write to journal@grassland.org.za.

Aims and Scope

The African Journal of Range and Forage Science is the leading rangeland and pastoral journal in Africa. The Journal is dedicated to publishing quality original material that advances rangeland ecology and pasture management in Africa. Contributions reporting on research not done in Africa, which is applicable in Africa, are welcome. The Journal promotes both science and its application and authors are encouraged to explicitly identify the practical implications of their work. Peer-reviewed research papers and research notes deal primarily with all aspects of rangeland and pasture ecology and management. Articles highlighting transdisciplinary linkages among biophysical and social sciences that support management, policy and societal values are particularly encouraged. The Journal includes relevant book reviews and invited perspectives that contribute to the development of range and forage science in Africa. Letters to the editor that debate issues raised in the Journal are acceptable. The African Journal of Range and Forage Science is the official journal of the Grassland Society of Southern Africa.

The ergot fungus, *Claviceps*, on grasses: a special request for specimens

Dr Elna van der Linde of the Agricultural Research Council Plant Protection Research Institute (ARC—PPRI) has appealed to all farmers, botanists, technicians and other workers to submit any specimens of fungus-infected grasses to the address given below.

Because of the vastness of the country, as well as the fact that the fungal survival structures are only visible on grasses and sedges from February to May of each year, it is almost impossible for one person to cover all areas in search of them.

'Ergot' refers to the infection of ovaries in the florets of cereals and grasses (*Poaceae*), sedges (*Cyperaceae*) and rushes (*Juncaceae*) by 47 described and various undescribed fungal species of the ascomycete genus *Claviceps* (*Clavicipitaceae*, *Hypocreales*).

A total of 509 species in the *Poaceae*, 17 in the *Cyperaceae* and 4 in the *Juncaceae* have been reported as hosts, although the actual number of hosts is considerably higher. The disease destroys between 5 and 10% of the seed in infected heads, but its main importance is the sclerotia (survival structures) which are poisonous to humans and animals due to various tetracyclic ergoline toxins - collectively referred to as ergot alkaloids - contained in them.

Consumption of ergot-infected fodder leads to ergotism, a toxicosis characterised by psychotic delusions, nervous spasms, convulsions, gangrene, abortion, infertility and reduction in milk production. Ergot poisoning continues to be of economic importance as an animal disease, although outbreaks are rare.

Research on *C. cyperi,* a fungus hosted by sedges, elucidated the morphology, taxonomy and phylogeny of the pathogen, the alkaloid profile, physiology and mode of infection, and some aspects pertaining to the epidemiology and ecology of the disease.

In recent years, much emphasis has been placed on the application of molecular methods (including DNA studies) for verifying identities and detecting genetic variability in *Claviceps* species.

Anyone encountering specimens of grasses or sedges infected with fungi that may belong to this genus, is requested to collect some seed heads, dry the samples in a plant press or even in a telephone directory, and post them in clearly marked paper envelopes (not plastic) to the address below.

Dark, elongate sclerotia of *Claviceps digitariae* on florets of *Digitaria* (Smuts finger)

Important:

Please include all collection information, i.e: Locality of collection (farm, district, nearest town, etc.), date of collection, name of collector, name of host plant (scientific or common name, if known).

Dr Elna van der Linde
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Movers and Shakers

Axel Rothauge:
After 12 years of teaching Rangeland and Animal Science at the Neudamm Agricultural College near Windhoek, Namibia, the last two of which also as Principal, I decided to work as a consultant for the largest co-operative in Namibia, Agra. The intention is to Namibianize the donor-driven development of Namibia's communal ("emerging commercial") agricultural sector and take up the slack left by the implosion of Government's agricultural extension effort to established commercial farmers. Our country has such vast potential; it would be criminal not to unlock it!

Dr Roger Uys
I have recently been appointed as the Ezemvelo KwaZulu-Natal Wildlife, Regional Ecologist South Coast. This involves providing ecological advice to the terrestrial area covering the municipalities along the coast from South of iSimangaliso Wetland Park (St Lucia) to the Eastern Cape boundary. In addition to advising the management of the Province's Nature Reserves I deal with all manner of nature conservation issues outside of protected area managent from commenting on development issues, to advising landowners on fire and wildlife management, and facilitating research in our protected areas. I can be contacted at uysr@kznwildlife.com.

Peter Wragg
I'm no shaker, but I guess I have moved … I am starting a PhD in the Ecology, Evolution and Behavior Graduate Program at the University of Minnesota in the USA. I will investigate grassland ecology, management and conservation, probably both in my native habitat (KZN mesic grassland) and in U.S. tallgrass prairie where some similar management and conservation issues are being confronted. My advisor is David Tilman, and I will collaborate with others in SA (particularly at the University of KZN) and the USA. Email: wragg@ukzn.ac.za.

Coral Birss
I started with CapeNature at the beginning of February 2009 as Regional Ecologist for the Overberg-Hassequa and Langeberg-Karoo regions, after 5 years with Gauteng Conservation as Regional Ecologist for Southern Gauteng. Not quite so much "the same – different venue", especially since the landscape and the scale of everything has really grown and of course, this is FYNBOS and the fires are spatially spectacular to say the least; and of course, there's a sea view! I feel than I have joined a formidable group of scientists, specialists and conservators and am looking forward to getting entrenched in Fynbos ecology with a hint of Coastal and Marine ecology and touch of Karoo ecology.

Namaqualand restoration guide

(Continued from page 3)
on the NRI, said "one of the main aims is developing restoration methods for degraded areas and post-mine landscapes on the Namaqualand Coastal Belt." This is an area about 400km wide, and more than half of it is affected by mining.

For more info contact Peter Carrick at peter.carrick@uct.ac.za

Letters

Thank you for a most interesting news letter in September where three very interesting articles appeared, for a person who finds heavy scientific detail hard to digest and also to keep them interested in a way these articles did.

Roelof Bezuidenhout touches on an important communication necessity in getting the message to people involved in doing the practical side of agriculture. The purpose of the scientific research is to get better results to assist these practical people to optimise production and profit while conserving the environment. Often this technical data is wrapped in "camouflage" for the people working in the practical situation on farms and the message is lost to these people for whom the scientific research has been conducted.

Some years ago there used to be a publication called the Farmers' Forum that was delivered all around KZN and well accepted by the farming community. My suggestion to their editor was that instead of just featuring "advertorial articles", often written in favour of a service, system or product, we approach scientists to write popular articles which would in turn be edited by other scientists so as to pass on the real findings. Many scientists approached were willing to do so. However, after a meeting to discuss this was organised, at the Royal Show Grounds together with scientists and their managers, management said NO and an opportunity to get important facts in a suitable format to the end user was curtailed.

The article about forage sorghums and millets was very informative and we need more of this data to become available for all forage and pasture species.

Congratulations to Richard Fynn on his article regarding "Savory Insights". This was the best assessments of Savory's grazing system that makes sense. Many farmers are proving that the Savory system works. If you compare this grazing system in veld management to the New Zealand ryegrass grazing systems, there are similarities. If it works for the beef farmers and the New Zealanders on intensive pastures then there must be something that is being done right.

Regards

Richard Findlay
Sustainable Soils
and Forage Systems
Pietermaritzburg

New Members

- Akona Zweni: ARC—Livestock Business Division
- Andrew Rossaak: Emross Consulting
- Aslam Pandor: Albarakah Bonsmaras
- Basanda Nondlazi: ARC—Livestock Business Division
- Phillip Nengwenani: DoA—Grootfontein ADI
- Marion Holmes: Karoo Pred-A-Tours

Bursaries and Jobs

Postgraduate Training Fellowships for Women Scientists from Sub-Saharan Africa

Contact Details

Ms. Leena Mungapen
TWOWS Secretariat ,
c/o TWAS, ICTP Campus, Strada Costiera 11, 34014 Trieste,
Italy
Tel: +39 040 2240321
Fax: +39 040 2240689
Email:info@twows.org

MSc, PhD and Post-doctoral bursaries available in the Research Centre for Plant Growth and Development, University of KwaZulu-Natal

Applications can be made to Professor J. Van Staden Please submit applications via e-mail to rcpgd@ukzn.ac.za. For more information see the GSSA website.

MSc rangeland Resources Management

University of Namibia

See the University of Namibia website (www.unam.na) or contact E. Nowaseb (+264-(0)61-2063363/3895 or P. Petrus (+264-(0)61-2064109 for further information.

Internship at the Heinrich Boell Foundation

Cape Town (Deadline 27 February and 30 June 2009)

Offers 3-6 months internships for graduates of political or social science, gender/feminists studies, migration studies, sustainable development, environmental science who are working on their own research projects.

Contact details: Keren Ben-Zeev
Programme Manager: Transparency and Participation
Heinrich Boell Foundation
Regional office, South Africa
1st floor, Avalon building
123 Hope Street, Gardens
Cape Town 8001

Postgraduate opportunities 2009— Maloti Drakensberg Transfrontier Park

The South African portion of the Maloti-Drakensberg Transfrontier Park is offering a number of postgraduate opportunities at PhD and MSc level which will address medium to long-term changes in vegetation, fire, and large mammal populations. The programme is to be conducted under the auspices of the South African Environmental Observer Network (SAEON), in collaboration with other institutions.

The following research issues have been prioritised.

1. Landscape-level fire behaviour

Key question: What are the main controls over landscape-level spatial and temporal patterns of fire in the Drakensberg and has the spatial pattern changed over time? The study is based on long-term records and empirical investigation of landscape behaviour of fire (GIS ability essential).

2. 'Bush encroachment' of Drakensberg and surrounding grassland in relation to environmental factors

Key question: How vulnerable is grassland to bush encroachment, what are the main agents responsible, and what abiotic or biotic conditions promote such transformation? Analysis of changes apparent on aerial and lateral photographs will comprise a main component of this study.

3. Near preclusion of fire: woody ingress into grassland

Key question: What is the long-term impact of a dramatically altered fire regime on transformation of grassland to woody vegetation? This study is based on continuation of previous work on the effects of long-term fire preclusion on vegetation dynamics in several sites.

4. Grassland vegetation dynamics in response to multiple drivers

Key question: What relative influence do climate, soils, radiation, fire and land use have on the stability and resilience of botanical composition and diversity of grassland? A foundation for this study is continuation of long-term burning and grazing trials and fence line comparisons of land use.

5. Mammals in response to multiple drivers

Key question: What are the population trends of the more common mammal species in relation to various factors? This study is based on continuation of previous monitoring of large mammal populations across the Maloti-Drakensberg conservation areas.

Potential candidates should submit a brief CV and motivation (Word or pdf) to Tim O'Connor at:
timoconnor@xsinet.co.za

Upcoming events

From www.grassland.org.za

Veld Management and Grass Identification Courses
Date: 2 March 2009, 3 March 2009
Venue: Krantzkloof Nature Reserve, Durban
Date: 4 March 2009, 5 March 2009
Venue: Bishopstowe Farmers' Hall, Pietermaritzburg
Date: 14 March 2009
Venue: Pretoria Botanical Gardens
Date: 21 March 2009
Venue: Towoomba Research Station, Bela Bela
Tel: 083 367 5693
Contact: Frits van Oudtshoorn
Email: fritsvo@lantic.net

7th Annual Savanna Science Networking Meeting
Date: 19—24 April 2009
Deadline for submissions: 28 February 2009
Venue: Skukuza, Kruger National Park
Contact: Jackey Deacon
Tel: 082 4471 570
Email: dot@mpu.co.za

First International Workshop on Summer Dormancy in Grasses: Coping with increasing aridity and heat under climate change
Date: 6 – 8 April 2009
Venue: Ardmore Oklahoma USA
Website: http://www.nobleorg?ForageImprovement/Summer dormancy/index.html

African Issues Symposium
Date: 3 March—1 April 2009
Venue: Kansas State University
Tel: Telephone
Website: www.k-state.edu/africanstudies/2009symposium
Email: dchart@ksu.edu

South African Society for Animal Science (SASAS) 43rd Congress
Date: 28 – 30 July 2009
Venue: Alpine Heath, Northern Drakensberg, KZN
Tel: 033 3559 262
Contact: Trevor Dugmore
Website: www.sasas.co.za
Email: Trevor.Dugmore@dae.kzntl.gov.za

Developing Animal Agriculture Interest Group (DAAIG) Symposium
Date: 28 September - 2 October 2009
Venue: Gauteng (Venue to be confirmed)
Tel: 083 478 1940
Contact: Heleen Els
Email: Heleen.Els@up.ac.za

African Crop Science Society Conference
Date: 28 September – 10 October 2009
Venue: Cape Town
Email: JeannieB@arc.agric.za

Council News

The Council met on 22 January for their first meeting of 2009.

All of the arrangements for Congress 44 2009 are well on track. The theme for the Congress – *Meeting rangeland, pasture and wildlife challenges* – provides ample opportunity for all members to contribute. A number of interesting and relevant symposia and workshops have been suggested and members are requested to send their inputs to the Organizing Committee. Delegates can also look forward to interesting pre- and post- Congress tours. Members are also reminded that no accommodation is provided this year, so please make the necessary arrangements. Remember to visit the website for updates and future information.

Copies of the GSSA Expertise Database questionnaires will be available during Congress for those members who have not yet completed theirs.

We would like to thank everybody who submitted manuscripts to African Journal of Range and Forage Science at the end of last year. The next issue promises to be a very interesting one dealing with a variety of topics.

Council has been attempting to raise a number of major concerns about the SACNASP (South African Council for Natural Scientific Professions) legislation, with little success. As a result of changes in the SACNASP committee, Council had to postpone the meeting with them regarding professional registration. Members will be informed about any further developments.

Everybody working at tertiary institutions is reminded to nominate possible candidates for the GSSA student awards.

Prof. Peter Scogings has stepped down as Scientific Editor of the African Journal of Range and Forage Science after five years. He has been replaced by Dr Susi Vetter, of Rhodes University (see page 3).

Council would like to wish everybody a very prosperous new year!

There are no page charges for GSSA members publishing in the African Journal of Range and Forage Science in 2009

Bush encroachment in the Auas-Oanob Conservancy, Namibia:

Mixing local expert knowledge and science to unravel salient factors through the Ecosystem Management Understanding (EMU) Process

Hugh Pringle[1], Ibo Zimmermann[2], Kuniberth Shamathe[2] and members of the Auas-Oanob Conservancy

[1]Bush Heritage Australia and [2]Polytechnic of Namibia

Email: hpringle@bushheritage.org.au

A small group of community-based Ecosystem Management Understanding ("EMU") ecologists from Western Australia travelled to Namibia in 2003 and ran a field-based workshop in land management with the Auas-Oanob Conservancy near Windhoek, with local support from the Polytechnic of Namibia. EMU is a landscape literacy programme in which local landholders are helped to use their experience and local knowledge to characterise their properties (in this case farms) as ecological systems within larger systems and so improve landscape productivity and the quality of the land as habitat to livestock and wildlife. EMU is a capacity building programme based on partnership learning that relies heavily on the participatory methods developed by Ken Tinley in southern Africa some decades ago.

In January 2008, the Auas-Oanob Conservancy held a review of its progress within the Ecosystem Management Understanding (EMU) Process (Tinley and Pringle 2002) at Farm Lichtenstein Sud, some 50km south of the Namibian capital Windhoek. The day started with a presentation of the EMU overlays of Farm Lichtenstein Sud by the owners, Friedel and Irmgard Rusch, in which the location of bush encroachment and its landscape (drainage pattern) context quickly became the major focus of discussion.

Hugh Pringle presented a model that describes how bush encroachment in critical, fertile bottomlands throughout catchments is related to landscape incision and declining soil moisture balances (Pringle and Tinley 2003; Pringle *et al*. 2006), which has its foundations in Ken Tinley's earlier work across

southern Africa (Tinley 1982), including many years in Namibia as one of its first Government ecologists.

It was generally accepted that, based on local recollections of landscape change, parts of landscapes and parts of catchments that were once seasonally inundated but are now incised and "leaking" (Ludwig *et al*. 2004; Pringle and Tinley 2003) no longer suppress bush, particularly *Acacia karroo* in lowlands, but also swarthaak (*Acacia mellifera*) and rooihaak (*A. reficiens*) more widely. This geomorphic issue (Pringle and Tinley 2003) is not given recognition as a driving process in critical parts of landscapes for both livestock and wildlife in arid and semi-arid southern Africa (e.g. Illius and O'Connor 2000), Namibia being no exception (de Klerk 2004).

The idea of soil desiccation was then also grasped by some farmers as a key factor in bush encroachment on pediments and lower hill slopes, up slope of most biologically productive, seasonally inundated areas. The desiccation they explained, results from degraded soil surface conditions for infiltration and therefore increased run off. The idea is that a landscape that harvests (through slowing and then infiltration) less water than before, dries out more quickly and clearly further favours bush over palatable perennial pasture grass species (Tinley 2001; 1982). The basal area of grasses increases infiltration, but is only one of several surface types that support this critical local process (Tongway *et al.* 2003; Walker 1974).

While the normal explanation of bush-grass competition was acknowledged by all, the idea that this competitive balance was driven by soil degradation as well as selective grazing pressure was illuminating. The farmers, without any formal exposure to Landscape Function Analysis (Tongway and Hindley 1995), saw that overgrazing, even without obvious signs of soil erosion, simply left the soil less likely to absorb rain.

There was general agreement that grazing management had to become more ecologically

Photo: Ibo Zimmermann

Workshop participants inspect one of the gully filters

based to minimise soil erosion and bush encroachment. It was when we started to discuss what "ecological grazing management" meant practically, that the issue of fire was raised. One farmer suggested that fire was always part of the natural system before commercial farming, a proposition that immediately attracted vigorous debate. Eventually, it was agreed that the absence of fire was probably another key factor in bush encroachment and related to lack of fuel.

The question was then raised, if a burnt area is destocked, what stops the wildlife from concentrating there and redirecting early succession processes undesirably? There were strong arguments for not doing any burning at all, but all of the Conservancy members agreed that some novel thinking was needed to incorporate fire at the best time to kill young bush plants when observed.

The discussion had shifted considerably from the prevailing, strictly localised perspective of palatable grasses versus bush species under heavy and continuous grazing pressure, to broader landscape management of key factors, soil moisture harvesting and fire, as well as total grazing pressure. No silver bullet solution was identified, but as a group of farmers and scientists, we had started thinking about what kinds of things might shift the balance back towards grasses against bush species that simplify, rather than enhance the landscape. We adjourned for lunch, which was characterised by numerous intense discussions about these factors and the future management of the Conservancy's landscapes.

In the afternoon we visited the site of a restoration project that was identified by the hosts, Friedel and Irmgard Rusch as a priority pilot study after the EMU Process in 2003. The restoration plan was drawn up by Hugh Pringle in consultation with the Rusch's and implemented with the help of students of the Polytechnic of Namibia. A gully system had been treated with filters made from branches of Acacia mellifera growing in dense stands nearby (Shamathe *et al.* 2008), thereby converting a problem into a solution. There had been insufficient rain to determine the effectiveness of the filters to flip the system from one of losing resources to one of capturing them, but enough to see that grass growth under filters was better than that in the open.

The farmers' discussions continued on the site as our Polytechnic of Namibia bakkie departed. We will have to get back there to learn what the farmers came up with! It was great to stir the pot and then listen and learn from good farmers who want to make changes, EMU style!

The challenge is now to investigate this collective knowledge, test contradictory ideas and therefore improve Ecosystem Management Understanding, and to refine decision support tools (Joubert *et al.* 2008a; b). This will lead to better land management, healthier landscapes and businesses and therefore be a national contribution.

Acknowledgements

Bertus Kruger (previously with the Desert Research Foundation of Namibia), Frank Wittneben (previously local Agriculture department advisor) and Dr Greg Stuart-Hill (WWF) supported this initiative. The project is owned by the Conservancy.

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Graphical presentation of research results: How to place accurate LSD bars in graphs

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Introduction

Statistical methods are generally accepted as a valid tool for decision making in scientific research. Numerous statistical methods are available for differing kind of inference; these methods have their strengths, weaknesses and basic assumptions. Some commonly used methods include the F-test, the T-test, Chi-square test and the summary statistics measures of central tendencies viz., mean, median, mode and measures of dispersion such as variance, standard deviation, standard error, coefficient of variation etc.

In presentation of research results either in a tabular or graphical form, the mean is presented with either standard deviation or standard error. Furthermore, the magnitude of difference between the treatments means need to be shown with the use of mean separation tools that are appropriate to the experimental design. Presentation of experimental data with mean separation in table format is easily achieved, while many researchers still struggle to show accurate mean separation in graphical form.

The commonly used mean separation tools give their results either in numerical value e.g. Fisher least significant difference (LSD) or in alphabetical form e.g. the Duncan multiple range test. The alphabetical results can easily be indicated on graphs by inserting borderless text boxes at the appropriate data point and typing in the right letters. While the numerical methods are best shown with bars that are accurately measured, to visually indicate differences among plotted bars or data points in line graphs.

Some authors have erroneously used the Standard error (SE) method found in graphical software as Microsoft Excel to depict mean separation. This often creates confusion as SE is more of a measure of dispersion among individual values that are averaged to derive the mean than a mean separation tool. The bars in this case are either sunk into the graph in equal halves or shown as half of the SE value on individual bar or data point in a line graph. This ultimately will not indicate the minimum difference that could exist between individual treatment mean for them to be regarded as significantly

different from one another.

Thus, devising a clear and accurate way to show graphical mean separation is vital to proper communication of research result. The aim of this write up is to graphically show few steps that could be taken to insert accurate LSD bars or other numerical mean separation values in a graph using MS Excel software. This will address the most commonly used mean separation methods and software.

Steps to get it done.

Two version of Microsoft Excel are commonly used by researchers, Excel 97-2003 and the Excel 2007. The steps vary a little between the two versions, therefore they are presented separately in this article.

MS Excel 97-2003

Step 1

Plot your graph. Note that The graph can also be a time line graph where ABCDE constitute the treatment and data are collected at different intervals.

Step 2

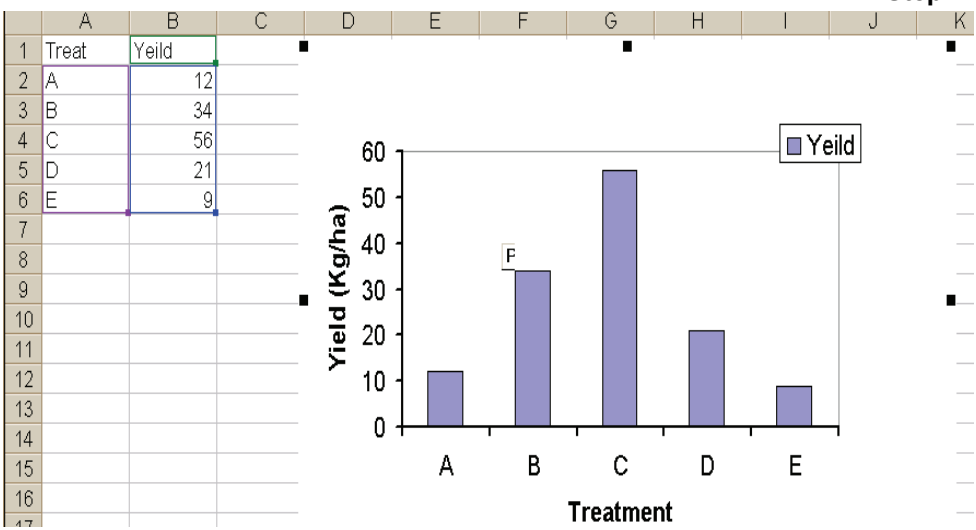
Revert back to your data and create a column, fit the column with values that correspond to the location on the Y-axis where you want the bars to be.

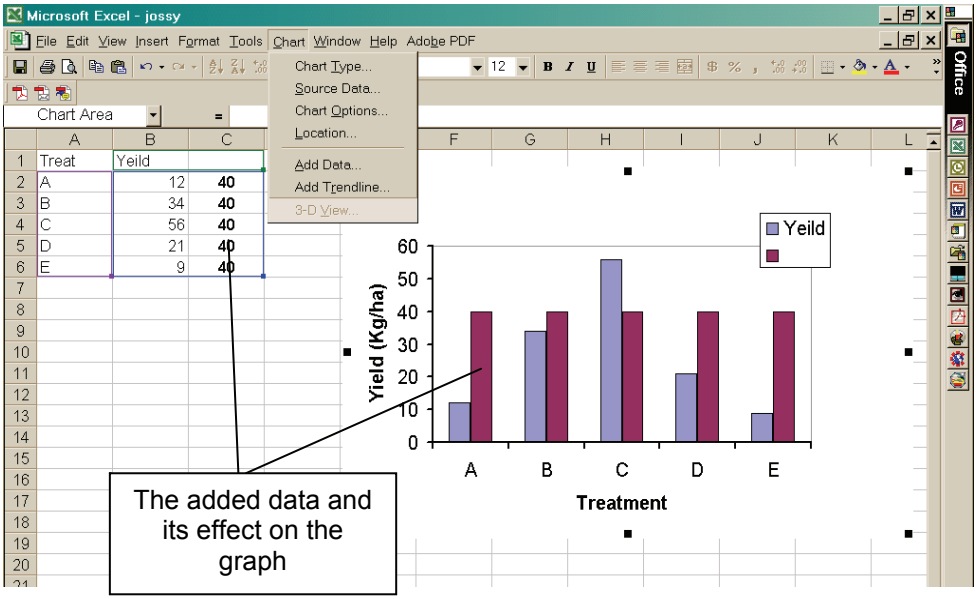
Then click on chart and select add data to include the values in the new location. A quick way is to highlight your graph and drag the blue boundary on your data to include the new data.

Step 3

Convert the added bar into a line graph by clicking on the newly added bar; the bars will be highlighted. Then right click the bars. A dialogue box will open on which you will select *chart type*, which will open another dialogue box where you will

Step 1





Step 2

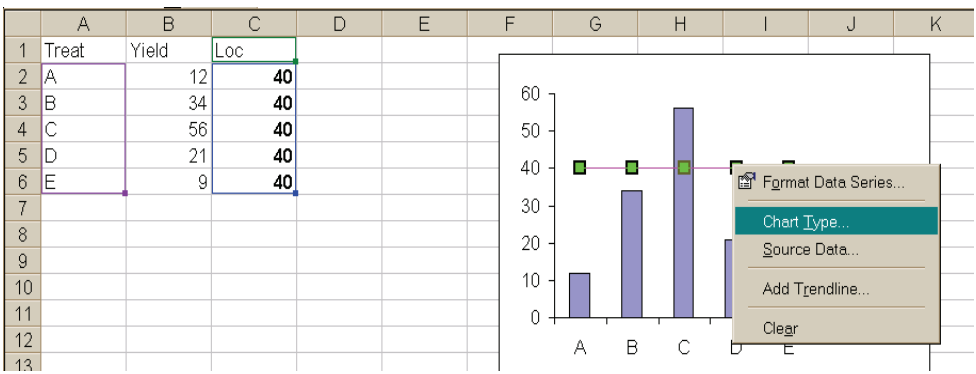
select *line graph*.

Step 4

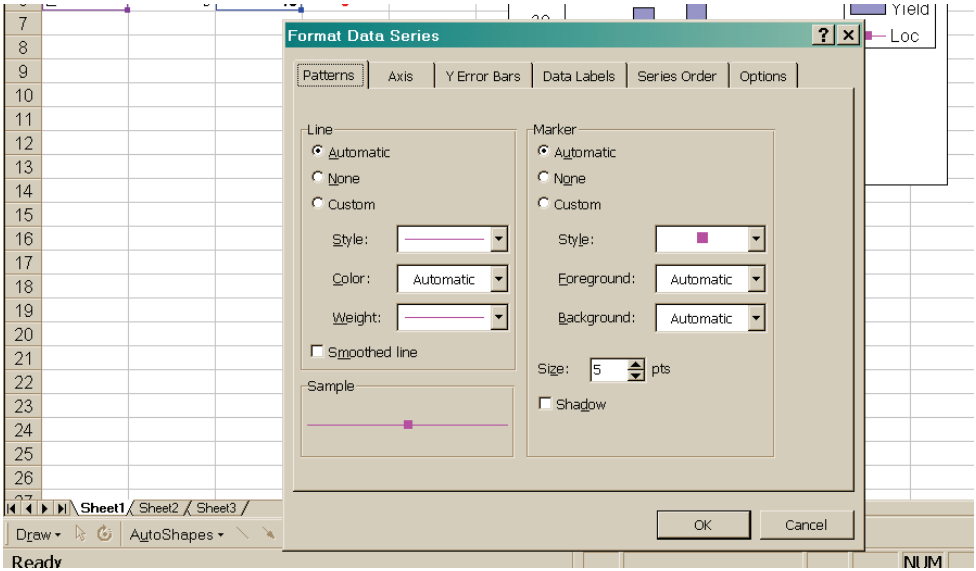
Add another column to the data area. This is where you type in your LSD value. The value you entered into this column should be your LSD value divided by 2, as the bar you will insert will have the top and bottom cut off i.e. double sided. It will double the value if you enter the actual LSD value. Then right click on the new line graph, a dialogue box will show up, on it highlight format data series.

Step 5

On the *format data series* dialogue box, open *y-error bar* and select the *custom* tab. Click on the icon with



Step 3

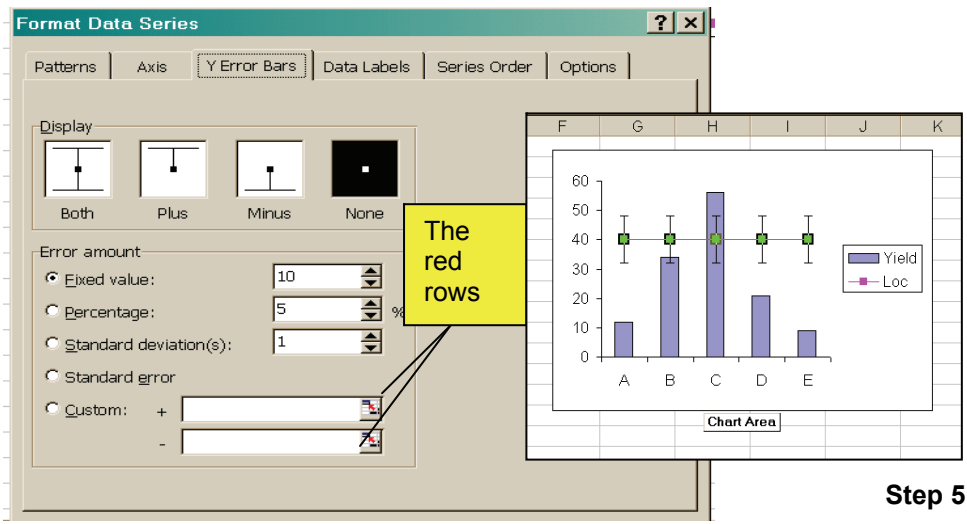


Step 4

the red arrow on the row with the positive sign and it will display. Then highlight the added LSD data and click the red arrow again. Repeat the same for the row with the negative sign. On the display buttons select *both* and click *ok.*

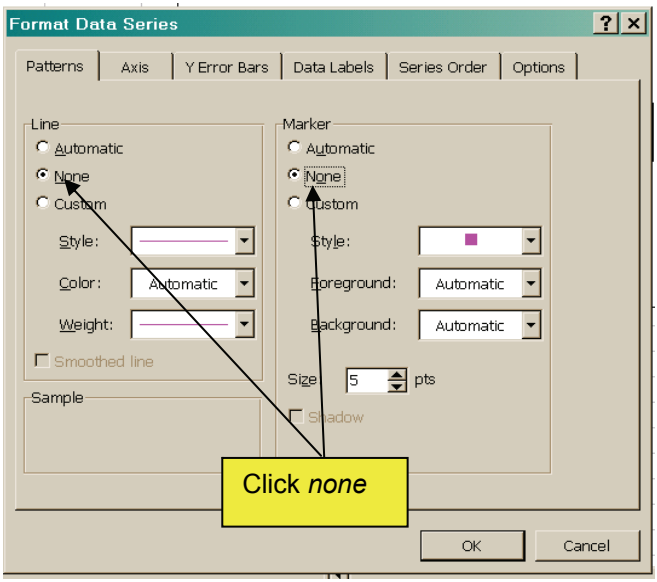
Step 6

Right click to open the *format data series* again and open *patterns* then click *none* under line and marker dialogue boxes



Step 5

Step 6



Step 7

From the original data area, delete the data from where you don't want LSD bars to appear.

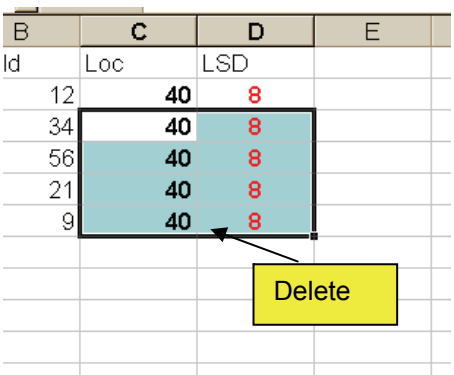
MS Excel 2007

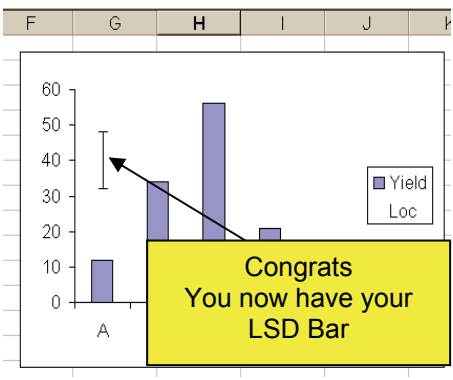
Step 1.

Plot your graph

Step 2

Revert back to your data





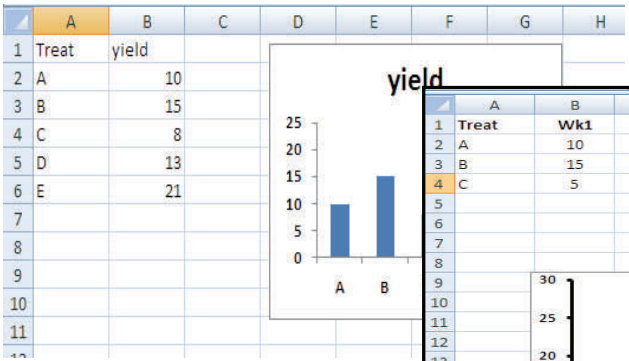
Step 7

and create a column. Fit the column with values that correspond to the location on the Y-axis where you want the bars to be.

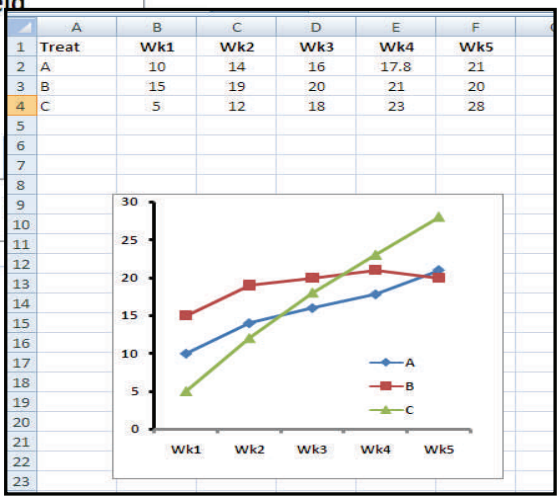
Then click on *chart* and select *add data* to include the values in the new location. A quick way is to highlight your graph and drag the blue boundary on your data to include the new data.

Step 3

Convert the added bar into a line graph by clicking on the newly added bar; the bars will be highlighted.



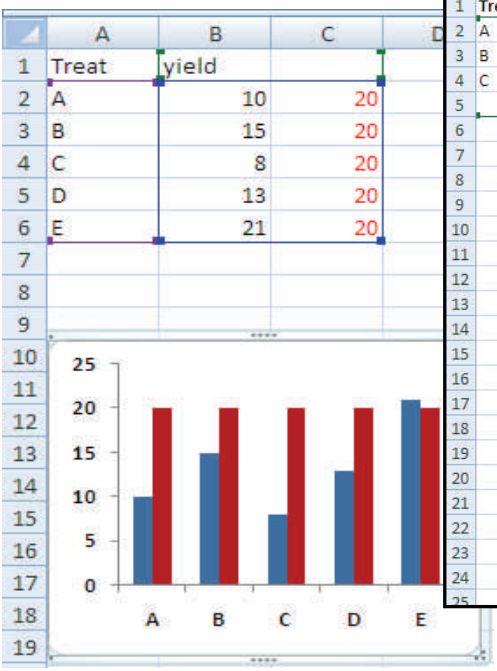
Step 1

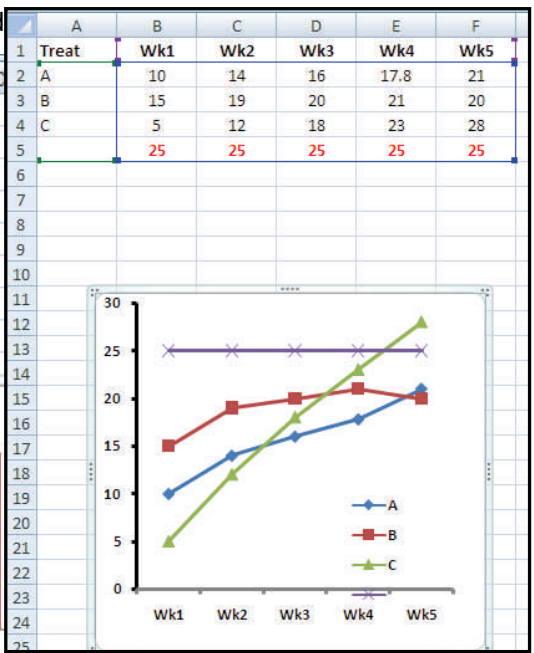


Then right click the bars. A dialogue box will open on which you will select *chart type*, which will open another dialogue box where you will select *line graph*.

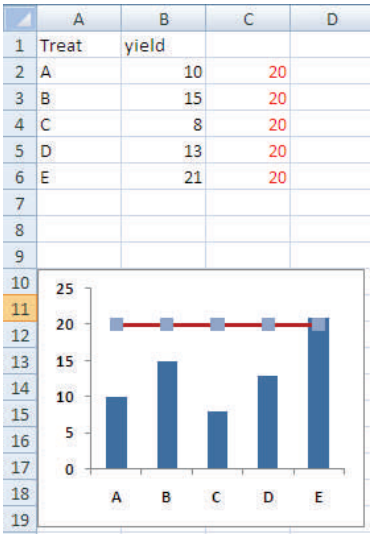
Step 4

Add another column to the data area. This is where you type in your LSD value. The value you entered into this column should be your LSD value divided by 2, as the bar you will insert will have the top and bot-





Step 2



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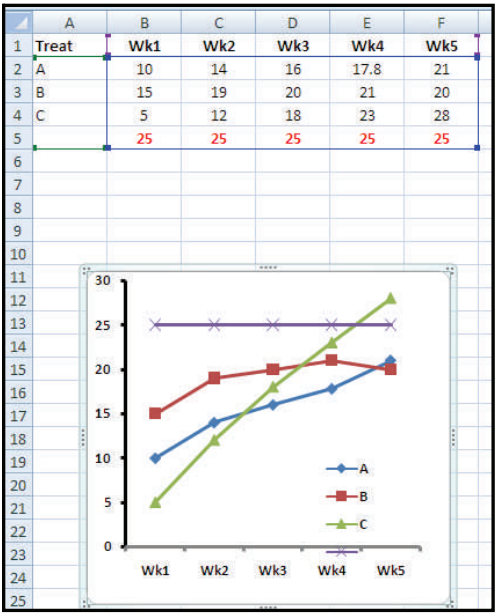
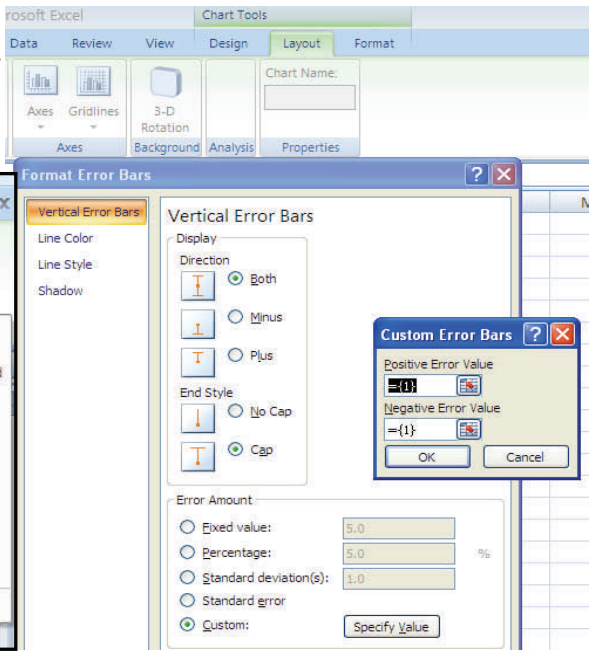


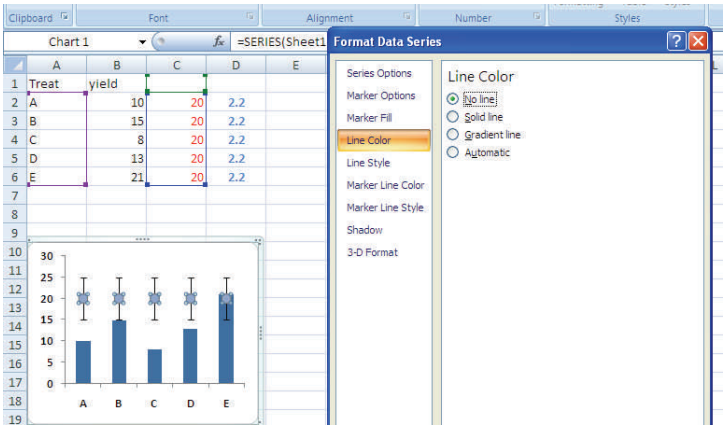
tom cut off i.e. double sided. It will double the value if you enter the actual LSD value

Click your chart, then click *layout* on the quick access tool bar, then go to a box region labelled *analysis* and the *open error bar* dialogue box

Click *open more error bar* option, select *both* at the upper part, *custom* at the lower part and specify value box. A custom error bar dialogue box will appear. Click on the

Step 4





your preferred colour.

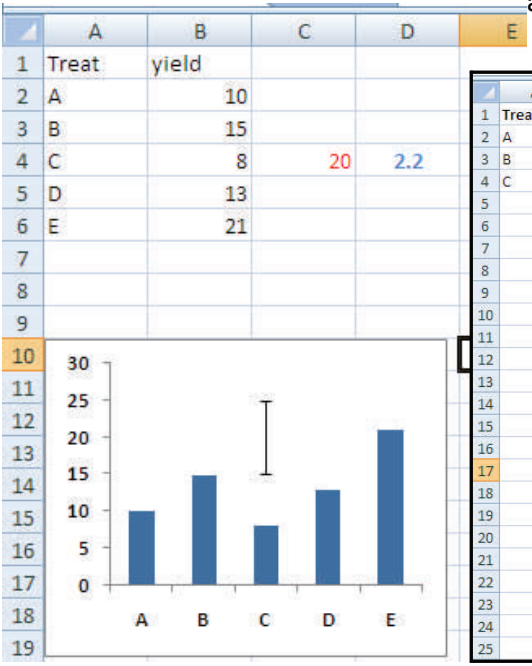
Step 5

Right click the link lines to your new LSD bars, select format data series, and a dialogue box will open. On the left side, select *line colour* and choose *no line*. Then under *marker fill*, select *no fill* and under *marker option*, select *none.* Close the dialogue box.

Go back to your data area. You may now delete points where you don't want bars to appear and leave only one where you want data to appear. In case of a line graph where more than one LSD bar is needed you may not need to delete anyone.

red arrow on the positive error value box and revert to highlight the halved LSD values you entered under step 4 above. Once the values are shown in the red arrow box, click the red arrow again. Repeat the step for the negative error value and click *OK*.

Once the value is fixed, click on *line colour* and select *solid line*. Open the dialogue box and select



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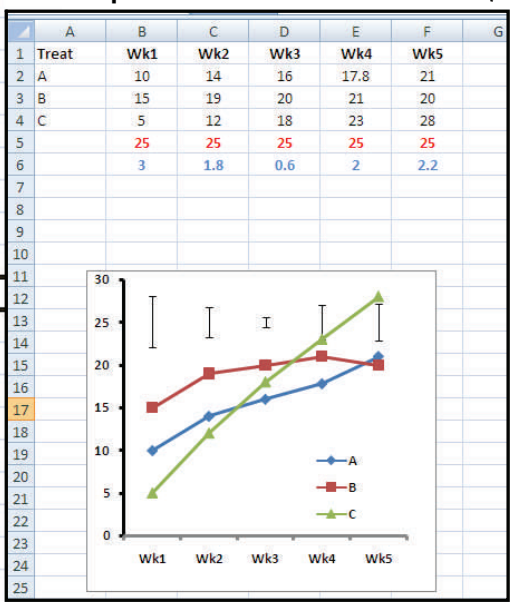

Assessment of plant species richness within and outside *Androstachys johnsonii* and *Colophospermum mopane* woodlands of Makuya Nature Reserve, Limpopo Province

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Introduction

Androstachys johnsonii (Lebombo ironwood) and *Colophospermum mopane* (mopani) are indigenous tree species found dominant in the poorly drained soil and rocky outcrops of the north-eastern part of the Limpopo Province of South Africa (Schmidt *et al.* 2002). Under the canopies of *A. johnsonii* and *C. mopane*, there are generally few shrubs and grasses growing, but species richness (defined as number of different species in a given area) of shrubs and grasses increases as one moves away from both *A. johnsonii* and *C. mopane* dominated stands (Chudnoff 1984).

According to Scholes and Walker (1993) and Scholes and Archer (1997), mature trees use deep soil water, and grasses use surface soil water. It is commonly believed that trees have a suppressive effect on grass production, whilst grasses have little direct competitive effect on mature trees. Both *A. johnsonii* and *C. mopane* secrete secondary or allelopathic compounds that suppress the establishment and hence growth and development of other species under their canopies (Munonde 1992, Rambau 1995, Molotja 2001, Lukhele and van Ryssen 2003). These allelochemicals are also known to play an important role in determining species distribution and abundance within plant communities (Einhellig 2002). Molotja (2005) investigated the effects of soils collected under *C. mopane* and *A. johnsonii* on the growth of *Zea mays* (maize), and reported that *Zea mays* grown on soils collected under *C. mopane* were healthier and greener than the ones grown on soils collected under *A. johnsonii*. Molotja (2005) concluded that there are toxic chemicals under *A. johnsonii* causing the death and establishment failure of other plants.

This paper focuses on the assessment and comparison of species richness within and outside both *A. johnsonii* and *C. mopane* woodlands on sandy and loamy soils. We

hypothesized that species richness would be higher on open habitats than within *A. johnsonii* and *C. mopane* stands, on both soil types. Besides casting shade, *A. johnsonii* and *C. mopane* are known to release secondary compounds that suppress the establishment of other plant species under them and as such limit plant diversity.

Method

The study was conducted at Makuya Nature Reserve, north-eastern part of the Limpopo Province, South Africa. It lies between 30° 50´E, 31° 05´E and 22° 25´S, 22° 35´S, along the Luvuvhu and Mutale Rivers. The soil type of the study site varies from loamy-sand to clayey in the undulating granitic landscape of the northern Kruger National Park. Annual summer rainfall varies between 250 to 500 mm per year, with a mean rainfall of 300 mm. The vegetation was described as Mopane Bushveld by Low and Rebelo (1996) and presently classified as Makuleke Sandy Bushveld by Mucina and Rutherford (2006). It is characterized by a fairly dense growth of *C. mopane* and mixtures of *Combretum apiculatum*, associated with *Acacia nigrescens, Adansonia digitata, Commiphora* spp*, Terminalia pruniodes* and *Androstachys johnsonii* while the ground layer includes *Panicum* spp, *Fimbrostylus hispidula* and *Indigofera* spp. The sandy-loam soil, low rainfall, high temperatures and lack of frost influence the distribution of

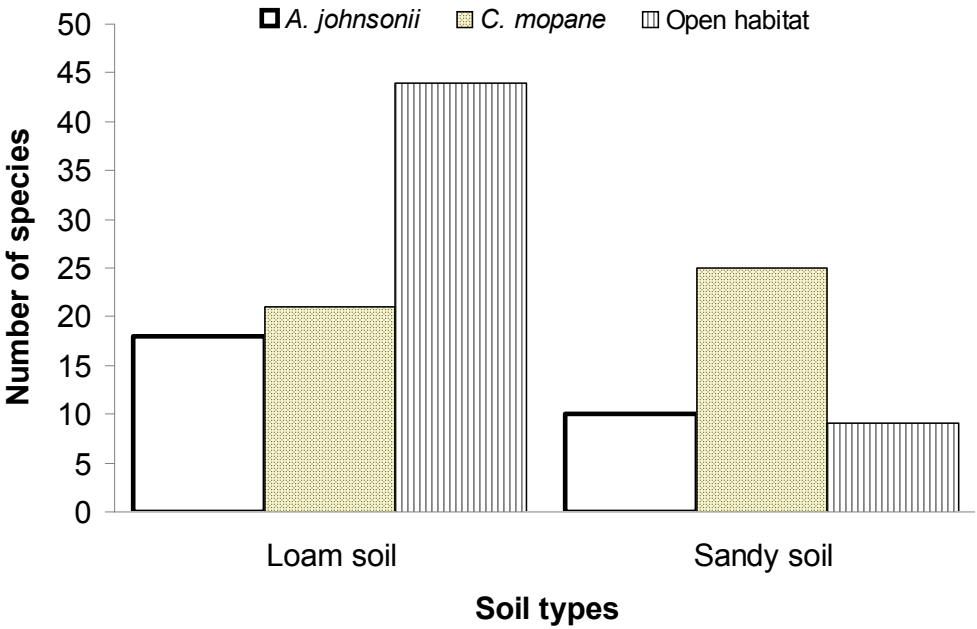

Figure 1. Comparison of species richness within and outside *A. johnsonii* and *C. mopane* woodlands on sandy and loamy soils.

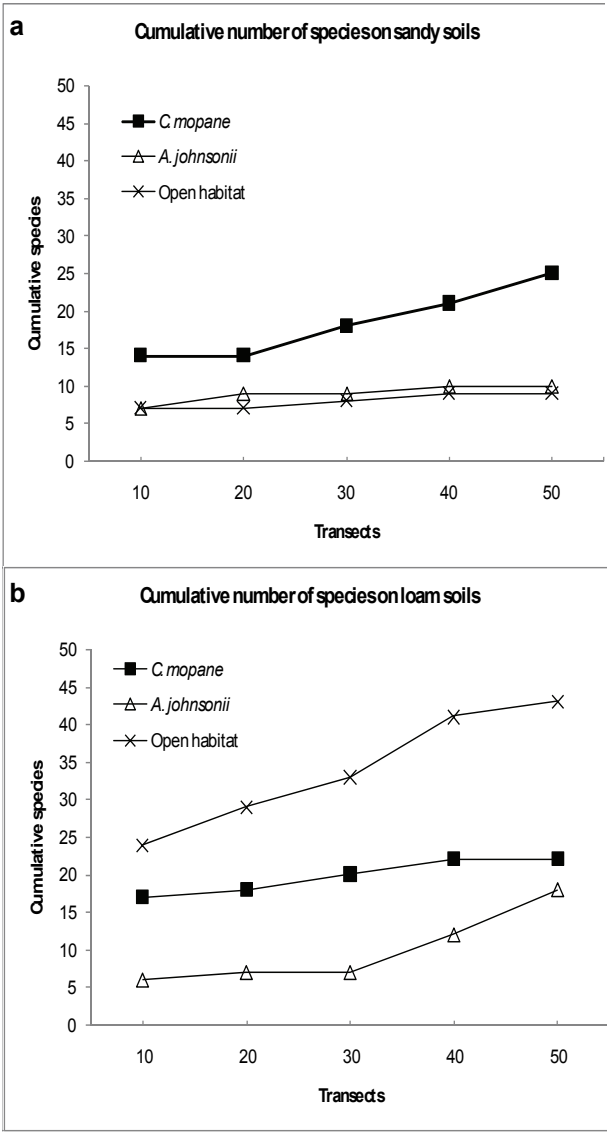

Figure 2. Cumulative number of species encountered within and outside *A. johnsonii* and *C. mopane* woodlands on (a) sandy and (b) loam soils.

this vegetation type (Rathogwa *et al.* 1999).

The belt transects and quadrat methods (Smith 1974) were laid out to sample within and outside *A. johnsonii* and *C. mopane* stands. Open habitats sites were recognised as areas without canopy effect on any large tree. Four plots, each of 20 m × 10 m in size, with 50 quadrats each of 2 m × 2 m, were placed within *A. johnsonii* and *C. mopane* stands on both loamy and sandy soils, with another pair of plots in the open on loamy and sandy soils. Species quantification included counting of individuals of all species present per 4 m^2 quadrat on each of the six plots. Differences in number of species and abundance within and outside both *A. johnsonii* and *C. mopane* stands were established. No statistical tests were performed as the study was pseudoreplicated.

Results

On loamy soils, species richness was highest on open habitats, low within *C. mopane* stands and lowest within *A. johnsonii* stands. On sandy soils, there was high species richness within *C. mopane* stands, and low on both *A. johnsonii* and open habitats (Figure 1). Cumulative number of species encountered on sandy soils was high within *C. mopane* stands (r^2= 0.94, y= 2.9x +

9.7), low on open habitats (r^2= 0.9, y= 0.6x + 6.2), and lower within *A. johnsonii* stands (r^2= 0.82, y= 0.7x + 6.9) (Figure 2a). Cumulative number of species encountered on loam soils was highest on open habitats (r^2= 0.98, y= 5x + 19), low within *C. mopane* stands (r^2= 0.94, y= 1.4x + 15.6), and lower within *A. johnsonii* stands (r^2= 0.82, y= 2.9x + 1.3) (Figure 2b).

Discussion and Conclusion

The results of this study suggest that *A. johnsonii* woodlands at Makuya Nature Reserve sustain few species within their woodlands and could probably cause an enormous decline in both species richness. Low species richness under *A. johnsonii* might be a strong indication that there are indeed toxic substances released by this species, and that such substances are remarkably suppressive to the wellbeing of the understory vegetation. *C. mopane* can interact positively with other species since it demonstrates that by high species richness found within its woodlands on sandy soils. Although *C. mopane* is believed to release secondary compounds, its effect seems to be less intense than that found under *A. johnsonii* stands. It was also thought *C. mopane* may act as a refuge for plant species that cannot tolerate direct exposure to high light intensities and allelochemicals. Several plant species tended to grow and establish themselves successfully well within *C. mopane* stands. On open habitats, low species richness is probably caused by exposure of plant species to direct sunlight which is surely scorching on sandy soil. Sandy soil is known for its high infiltration and low water holding capacity, hence less moisture and fewer nutrients are available to support variety of plant life. Accordingly, such soil type would generally support less number of species.

High species density on open habitats on loam soil may have been the result of no canopy effect, soil type and space availability to support shade intolerant species. The canopy cover effect, on loam soil may have a considerably high effect on species richness, within *A. johnsonii* and *C. mopane* stands. This probably might be as a result of intense competition between understory species for moisture and nutrients, resulting in only few species surviving under canopy environments. This results also show that different canopy habitats have different effects on the vegetation through canopy-induced factors such as competition, shading and allelopathic effects. Loam soil holds more water and is known of being rich in nutrients content. It should therefore be unsurprising to observe open habitats supporting highest species abundance and density than under canopy environments.

The cumulative number of species shows that there is a potential of finding more new species within *C. mopane* woodlands on sandy soils than within *A. johnsonii* and open habitats, whilst the same cannot be said for species on loam soil. Open habitat had the highest cumulative number of species becoming a preferred habitat for new species on loam soils, then C. mopane woodlands and *A. johnsonii* woodlands.

Overall this study shows that shading by both *A. johnsonii* and *C.*

mopane and probably other woodland species is a factor that needs to be borne in minds when overstorey-understorey interactions are looked at. Expansion of *A. johnsonii* woodland stands in Makuya Nature Reserve could probably cause an enormous decline in species richness, whereas *C. mopane* woodlands and open habitats may increase species richness on this area. Thorough understanding of this interaction has to be considered when looking at plants interaction and allelochemicals in conservation areas.

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The effect of planting method and seeding rate on the dry matter production of forage sorghum hybrids and hybrid millets.

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Introduction

Forage sorghum hybrids (*Sorghum bicolor* (L.) Moench x *Sorghum sudanense*) (Viaene and Abawi 1998) and hybrid millets (*Pennisetum glaucum*) (Navi and Tonapi 2004) are well adapted to the Southern Cape region of South Africa (Gerber et al. 2006). These annual summer crops have the ability to produce large quantities of forage, are palatable, of high quality and therefore a popular crop for milk production (Croplan Genetics 2004; Icrisat 2006).

The aim of this study was to determine the effect of planting methods and seeding rates on the dry matter (DM) production of forage sorghum hybrids and hybrid millet cultivars.

Materials and methods

This study was carried out on the Outeniqua Experimental Farm near George (Altitude 201 m, 33º 58' 38" S and 22º 25' 16" E, rainfall 728 mm per year) in the Western Cape of South Africa. The study was executed under sprinkler irrigation on an Estcourt soil type (Soil Classification Working Group 1991). Irrigation scheduling was done according to tensiometer readings, commencing at -25 Kpa and terminated at -10 Kpa (Botha 2002). Fertilizer was applied to raise the soil potassium (K) level to 80 mg/kg, phosphorous (P) to 35 mg/kg and pH (KCl) level to 5.5. Nitrogen (N) and K was given before planting at a rate of 50kg LAN/ha and 150kg KCl/ha respectively. Establishment commenced on the 20th of November 2006. The cultivars chosen for the study were the highest producing cultivars as evaluated by Gerber *et al*. (2006). Three forage sorghum hybrids and one hybrid millet type were selected for evaluation. These were planted at two seeding rates and two planting methods. The different forage sorghum hybrids and hybrid millet type, cultivars, seeding rate at the two planting methods are shown in Table 1.

The two planting methods were as follows:

Table 1 Different forage sorghum hybrids and hybrid millet types, cultivars, planting methods (reduced tillage planting and conventional planting) and seeding rate used in the trial at Outeniqua Experimental Farm.

Type	Cultivar	Reduced tillage Seeding rate (kg ha^{-1})		Conventional Seeding rate (kg ha^{-1})	
Conventional: Early	Greengrazer	20	10	25	12.5
Conventional: Late	Jumbo	20	10	25	12.5
BMR	Revolution BMR	20	10	25	12.5
Sweet	Hunnigreen	20	10	25	12.5
Pennisetum*	Hy Pearl Millet	10	5	12.5	6

BMR = Brown midrib
*Hybrid millet

Method 1

Conventional planting. Plots were sprayed with glyphosate at an application rate of 3 L/ha. After a waiting period of seven days, the plots were tilled with a harrow disc, followed by a konskilde. Seed was broadcasted and the plots were then rolled with a land roller.

Method 2

Reduced tillage planting. Plots were sprayed with glyphosate at a rate of 3 L/ha, followed by a waiting period of seven days. Seed was then planted using an Aitchison planter. After planting the plots were rolled with a land roller.

Harvesting

When 60% of the varieties reached a height of 1000mm, the plots were cut down with an Agria 5400 cutter bar mower to a height of 100mm. The forage sorghum hybrids and hybrid millets were sorted from weeds and other grasses on the plots. The total plot forage mass (kg fresh material) was determined. A fresh sample of approximately 300 grams was taken from each plot and weighed. It was then placed in an oven for 72 hours at 60ºC and weighed again to determine DM production (kg DM/ha), growth rate (kg DM/ha/day) and DM content (%). After each cutting, plots were fertilized at a rate of 200kg LAN/ha, 90kg KCl/ha and irrigated.

Weeds were not controlled. The forage sorghum hybrids and hybrid millets had to compete with self-sown tef (*Eragrostis tef*), goosegrass (*Eleusine indica*), purslane (*Portulaca oleracea*), nutgrass (*Cyperus rotundus*) and black night shade (*Solanum nigrum*).

The experimental design was a randomized block design with 3 blocks. The treatment design was a split-plot design with 4 main plot treatments (2 planting densities and 2 planting methods) and 5 subplot treatments (cultivars). An appropriate analysis of variance was performed, the assumption of normality of the residuals tested to ensure valid and reliable results (Shapiro and Wilk 1965). A Student's LSD (least significant difference) at 5% significance level was used to compare the treatment means (Ott 1998). The STATS module of SAS version 8.2 was used to analyze the data.

Result and discussion

Table 2 indicates the dry matter production (kg DM/ha) of forage sorghum hybrids and hybrid millets cultivars over four cuttings and in total.

Hy Pearl Millet planted at the conventional planting method at the high seeding rate produced the highest amount of DM during the second and fourth cutting. The DM production of Hy Pearl Millet during the first and third cuttings was similar to the DM produced by the other highest producing cultivars nl. Jumbo and Greengrazer. This resulted in Hy Pearl Millet to produce the highest ($P<0.05$) total amount of DM (kg DM/ha). This observation is supported by the findings of Gerber *et al*. (2006) where Hy Pearl Millet also produced the highest amount of DM.

Planting method and seeding rate influenced the total DM production of Hy Pearl Millet but not that of the other cultivars. Revolution BMR and Hunnigreen had a lower total DM production regardless of planting method and seeding rate compared to Hy Pearl Millet and Greengrazer.

The total amount of DM produced was low compared to previous trials performed on forage sorghum hybrids and hybrid millets at Outeniqua Experimental Farm (Gerber et al. 2006). This could be attributed to the lack of weed control in this trial.

Table 3 shows the growth rate (kg DM/ha/day) over four cuttings and the mean growth rate (kg DM/ha/day) of forage sorghum hybrids and hybrid millet cultivars.

Hy Pearl Millet planted at the conventional planting method at the

Table 2: The dry matter production (kg DM/ha) per cutting and the total dry matter production (kg DM/ha) of forage sorghum hybrid and hybrid millet cultivars at different planting methods and at a specific high and low seeding rate

Cultivar	Planting method	Seeding rate	1st Cut	2nd Cut	3rd Cut	4th Cut	Total
Green-grazer	Conventional	High	1150^{ab}	1470^{bcd}	1530^{ab}	1123^{bcdef}	5273^{bcd}
		Low	997^{abc}	1400^{bcde}	1040^{bcdef}	1387^{bcde}	4823^{bcd}
	Reduced tillage	High	1003^{abc}	1200^{cdef}	1453^{ab}	1587^{bc}	5243^{bcd}
		Low	713^{cdef}	1157^{cdef}	1033^{bcdefg}	1553^{bc}	4457^{bcd}
Jumbo	Conventional	High	907^{abcd}	1033^{defg}	687^{efgh}	1397^{bcde}	4023^{cde}
		Low	833^{abcd}	1423^{bcde}	786^{cdefgh}	1373^{bcde}	4417^{bcd}
	Reduced tillage	High	**1160^{a}**	1010^{defg}	1277^{bcd}	1477^{bcd}	4923^{bcd}
		Low	537^{defg}	1040^{defg}	723^{defgh}	1393^{bcde}	3693^{def}
Revolution BMR	Conventional	High	790^{abcd}	653^{g}	583^{fgh}	320^{g}	2347^{fg}
		Low	537^{defg}	847^{fg}	357^{h}	650^{efg}	2390^{fg}
	Reduced tillage	High	773^{bcde}	727^{fg}	550^{fgh}	700^{defg}	2750^{efg}
		Low	395^{efg}	785^{fg}	420^{h}	990^{cdefg}	2590^{efg}
Hunni-green	Conventional	High	633^{cdefg}	957^{efg}	437^{h}	443^{fg}	2470^{efg}
		Low	377^{fg}	960^{efg}	430^{h}	453^{fg}	2137^{fg}
	Reduced tillage	High	363^{fg}	753^{fg}	347^{h}	473^{fg}	2020^{g}
		Low	323^{g}	893^{fg}	457^{gh}	467^{fg}	2140^{fg}
Hy Pearl Millet*	Conventional	High	1147^{ab}	**2300^{a}**	**1980^{a}**	**2960^{a}**	**8387^{a}**
		Low	940^{abc}	1790^{b}	1263^{bcde}	1847^{b}	5840^{b}
	Reduced tillage	High	633^{cdefg}	1570^{bc}	1337^{bc}	1883^{b}	5423^{bc}
		Low	703^{cdefg}	1630^{bc}	1030^{bcdefg}	1583^{bc}	4947^{bcd}
LSD (0.05)			**385**	**494.6**	**579.1**	**786.9**	**1623.2**

^{abcde} Means with no common superscript differ significantly (P<0.05)
LSD = Least significant difference
*Hybrid millet

Table 3 Growth rate (kg DM/ha/day), mean growth rate (kg DM/ha/day^{-1}) and main effects of planting method and cultivar of forage sorghum hybrid and hybrid millet cultivars (planted on the 20th November 2006) using different planting methods and seeding rates

Cultivar	Planting method	Seeding rate	1st Cut 03-01-2007	2nd Cut 24-01-2007	3rd Cut 23-01-2007	4th Cut 10-04-2007	Mean	Mean planting methods	Mean cultivars
Green-grazer	Conventional	High	26.17^{ab}	69.98^{bcd}	51.02^{ab}	24.37^{bcdef}	42.88^{bcd}		
		Low	22.64^{abc}	66.58^{bcde}	34.66^{bcdef}	30.09^{bcde}	38.49^{bcde}	40.69^{bc}	
	Reduced tillage	High	22.77^{abc}	56.95^{cdef}	48.49^{ab}	34.47^{bc}	40.69^{bcde}		
		Low	16.24^{cdef}	55.14^{cdef}	34.30^{bcdefg}	33.77^{bc}	34.86^{cde}	37.76^{bc}	39.23^{b}
Jumbo	Conventional	High	20.60^{abcd}	49.20^{defg}	22.85^{efgh}	30.32^{bcde}	30.74^{def}		
		Low	18.91^{abcd}	67.78^{bcde}	26.25^{cdefgh}	29.88^{bcde}	35.71^{bcde}	33.22^{c}	
	Reduced tillage	High	26.37^{a}	48.09^{defg}	42.62^{bcd}	32.10^{bcd}	37.30^{bcde}		
		Low	12.18^{defg}	49.51^{defg}	24.04^{defgh}	30.24^{bcde}	28.99^{efg}	33.14^{c}	33.18^{b}
Revolution BMR	Conventional	High	17.99^{abcd}	31.05^{g}	19.37^{fgh}	6.95^{g}	18.84^{fg}		
		Low	12.20^{defg}	40.43^{fg}	11.86^{h}	14.18^{efg}	19.67^{fg}	19.25^{d}	
	Reduced tillage	High	17.52^{bcde}	34.62^{fg}	18.26^{fgh}	15.16^{defg}	21.39^{fg}		
		Low	9.01^{efg}	37.57^{fg}	13.91^{h}	21.55^{cdefg}	20.51^{fg}	21.04^{d}	20.06^{c}
Hunni-green	Conventional	High	14.37^{cdefg}	45.60^{efg}	14.55^{h}	9.65^{fg}	21.04^{fg}		
		Low	8.68^{fg}	45.81^{efg}	11.49^{h}	9.85^{fg}	18.97^{fg}	20.01^{d}	
	Reduced tillage	High	8.19^{fg}	35.96^{fg}	14.30^{h}	10.23^{fg}	17.17^{g}		
		Low	7.32^{g}	42.66^{fg}	15.17^{gh}	10.16^{fg}	18.83^{fg}	18.00^{d}	19.00^{c}
Hy Pearl Millet*	Conventional	High	26.10^{ab}	109.48^{a}	65.98^{a}	64.40^{a}	66.49^{a}		
		Low	21.35^{abc}	85.18^{b}	42.09^{bcde}	40.15^{b}	47.19^{b}	56.84^{a}	
	Reduced tillage	High	14.49^{cdefg}	74.67^{bc}	44.51^{bc}	40.93^{b}	43.66^{bc}		
		Low	15.98^{cdefg}	77.50^{bc}	34.47^{bcdef}	34.40^{bc}	40.59^{bcde}	42.13^{b}	49.48^{a}
LSD (0.05)			**8.786**	**23.501**	**19.269**	**17.094**	**12.222**	**8.621**	**6.091**

Table 4 Dry matter content (%), mean dry matter content (%) and main effects of planting method and cultivar for forage sorghum hybrid and hybrid millet cultivars at different planting methods and seeding rates

Cultivar	Planting method	Seeding rate	1st Cut	2nd Cut	3rd Cut	4th Cut	Mean	Mean planting methods	Mean cultivars
Green-grazer	Conventional	High	15.17^{def}	14.64^{cdef}	15.87^{abcdef}	21.04^{abc}	16.68^{cde}		
		Low	15.11^{def}	14.48^{def}	13.49^{f}	20.07^{abcd}	15.79^{defg}	16.23^{cde}	
	Reduced tillage	High	16.95^{bc}	14.33^{def}	15.73^{abcdef}	19.22^{cd}	16.56^{cde}		
		Low	14.97^{ef}	15.77^{abcd}	16.88^{abc}	19.19^{cd}	16.70^{cde}	16.63^{cd}	16.43^{b}
Jumbo	Conventional	High	15.35^{def}	13.87^{f}	16.91^{abc}	19.63^{bcd}	16.44^{cdef}		
		Low	14.90^{ef}	13.70^{f}	13.81^{ef}	17.79^{d}	15.32^{fg}	15.88^{de}	
	Reduced tillage	High	15.84^{cde}	15.99^{abc}	17.35^{ab}	18.86^{cd}	16.74^{cde}		
		Low	16.63^{bcd}	15.57^{abcde}	16.29^{abcd}	19.01^{cd}	16.88^{bcd}	16.81^{bc}	16.34^{b}
Revolution BMR	Conventional	High	15.63^{cde}	14.90^{bcdef}	16.69^{abc}	19.07^{cd}	16.57^{cde}		
		Low	15.23^{def}	14.47^{def}	14.20^{def}	22.85^{a}	16.69^{cde}	16.63^{cd}	
	Reduced tillage	High	16.95^{bc}	16.20^{ab}	16.83^{abc}	19.47^{cd}	17.36^{bc}		
		Low	15.94^{bcde}	16.19^{ab}	17.11^{abc}	22.72^{ab}	17.99^{ab}	17.61^{ab}	17.08^{a}
Hunnigreen	Conventional	High	17.50^{b}	14.68^{cdef}	16.89^{abc}	19.98^{abcd}	17.26^{bc}		
		Low	15.49^{cdef}	14.39^{def}	15.35^{bcdef}	20.18^{abcd}	16.35^{cdefg}	16.81^{bc}	
	Reduced tillage	High	20.36^{a}	16.53^{a}	18.05^{a}	20.34^{abcd}	18.82^{a}		
		Low	17.05^{bc}	14.88^{bcdef}	15.71^{abcdef}	21.03^{abc}	17.17^{bc}	17.99^{a}	17.40^{a}
Hy Pearl Millet*	Conventional	High	13.91^{f}	13.83^{f}	14.74^{cdef}	18.40^{cd}	15.22^{g}		
		Low	13.64^{f}	14.26^{ef}	15.70^{abcdef}	18.62^{cd}	15.63^{efg}	15.42^{e}	
	Reduced tillage	High	15.56^{cde}	14.99^{bcdef}	16.00^{abcde}	20.70^{abcd}	16.81^{cd}		
		Low	14.83^{ef}	15.33^{abcde}	16.09^{abcde}	21.20^{abc}	16.86^{bcd}	16.84^{bc}	16.13^{b}
LSD (0.05)			**1.586**	**1.450**	**2.388**	**3.203**	**1.17**	**0.825**	**0.583**

high seeding rate had the highest growth rate during the second and fourth cuttings and was the same as the growth rate of Jumbo and Greengrazer at the first cutting or Green grazer during the third cutting. This resulted in Hy Pearl Millet to attain the highest mean growth rate. Revolution BMR and Hunnigreen had the lowest mean growth rate. If seeding rate is not taken into consideration, the growth rate of Hy Pearl millet with the conventional method is still the highest followed Hy Pearl Millet planted by reduced tillage and Greengrazer planted by conventional or reduced tillage methods. The growth rate of Hy Pearl Millet compared to the other cultivars was also the highest if planting method and seeding rate is not taken into consideration.

Table 4 indicates the dry matter content (%) over four cuttings and the mean dry matter content (%) of forage sorghum hybrids and hybrid millet cultivars.

Hunnigreen planted at the reduced tillage method at a high seeding rate had the highest ($P<0.05$) DM content. Revolution BMR planted at the reduced tillage method at the lower seeding rate was the only cultivar with a similar ($P>0.05$) DM content. Hunnigreen and Revolution BMR attained the highest mean dry matter content, if planting method and seeding rate is not taken into consideration. Revolution BMR was the only cultivar able to achieve similar mean dry matter content as Hunnigreen, when seeding rate was not taken into consideration. Cultivar had the biggest influence on DM content. The cultivars (Hunnigreen and Revolution BMR) with the lowest DM production (Table 2) and growth rate (Table 3) had the highest DM content whereas the more productive cultivars (Hy Pearl Millet, Greengrazer and Jumbo) have the lowest DM content.

Conclusion

The hybrid millet cultivar, Hy Pearl Millet, planted at the conventional planting method at the high seeding rate produced the highest amount of DM (kg DM ha-1) and the highest mean growth rate (kg DM ha day-1). If only seeding rate is taken into consideration, there is no significant difference between the high and low seeding rate concerning the DM production, growth rate and DM content of forage sorghum hybrid cultivars. Cultivar had bigger influence on growth rate than planting method or seeding rate.

The cultivars with the lowest DM production and growth rate (Hunnigreen and Revolution BMR) had the highest DM content, whereas the cultivars with the highest growth rate and total DM production (Hy Pearl Millet, Greengrazer and Jumbo) had a lower DM content.

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Grassland Society Awards

The Council of the Grassland Society of Southern Africa calls for nominations for the following Society Awards:

- Prestige Award (outstanding contribution to the science of the discipline)
- Meritorious Award (service to the discipline of Grassland Science)
- Young Scientist Award (for an outstanding young scientist)
- Honorary Membership (outstanding contribution to achieving the aims of the Society)

All nominations must be fully motivated and supported by at least three members in good standing.

Please send nominations to The Administrator via:
Post: PO Box 41, Hilton, Pietermaritzburg, 3245, South Africa
E-mail: admin@grassland.org.za
Fax: +27 (0)86 622 7576

Full descriptions of the awards and their criteria appear below. Please consider these when making your nominations.

Grassland Society of Southern Africa Prestige Award

This award is made to the scientist whose work has made a significant impact on range and forage science and/or practice.

Objective

The primary aim of this award is to encourage the scientific advancement of the discipline of range and forage science in Africa. It is aimed at all research fields that have an influence on the development of science, and applies to

research work that breaks new ground in the discipline.

Criteria

This award should only recognise outstanding contributions to the science of the discipline.

The research programme or the interpretation should be innovative.

The results and, in particular, the interpretation which is applied to them should have a substantial impact on the discipline.

Signed nominations must be submitted in writing together with a motivation to the Honorary Secretary (as per the Constitution).

Decisions regarding this award are made by secret ballot at a Council meeting, where the vote must be unanimous for the candidate to be recognised.

Grassland Society of Southern Africa Meritorious Award

This award is made to a member of the GSSA in recognition of exceptional service to the Society.

Objective

The primary aim of this award is to encourage active and meaningful participation in the running of the GSSA. It is not made in recognition of research but rather for contributions to the development of the Society.

Criteria

The recipient must have contributed significantly to the development of the Society over extended period of time.

The GSSA must have benefited from such contribution in some manner.

Decisions regarding this award are made by secret ballot at a Council meeting and require a two thirds majority.

Young Grassland Scientist Award

Objective

This award is made to encourage new researchers in the discipline.

Criteria

The award is available only to members of the Society who have been involved in scientific research in the discipline for less than five years by 31 January of the year in which the Congress is held.

The award is made to an individual only once.

The award should be made on the all-round performance of new scientists. Factors which should be taken into consideration include the quality of the research and its presentation (in the form of both Congress presentations as well as publications), as well as the potential impact the research has on the discipline of range and forage science.

At least one peer-reviewed scientific publication and one formal conference presentation (no posters, and not necessarily at the GSSA Congress) must be made by every nominee. The amount of supervision associated with such presentations of research must be taken into account.

Signed nominations must be submitted in writing together with a motivation to the Honorary Secretary (as per Constitution).

Decisions regarding this award are made by secret ballot at a Council meeting.

It is not mandatory for this award to be made at each Congress, and the award may be made to more than one person in any particular year.

Grassland Society of Southern Africa Honorary Membership

This award is made to a person whom the Society wishes to honour by reason of meritorious services rendered for the realisation of the objects of the Society or by reason of his/her eminence in science.

Bankruptbush (Slangbos) – A silent threat to grasslands?

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Introduction

Encroachment of *Stoebe vulgaris*, currently known as *Seriphium plumosum,* in both planted pastures and natural veld, is a serious problem in most of the provinces of South Africa. The provinces that are worst infected, are the North West, Free State, Eastern Cape, Mpumalanga, Gauteng and certain parts of KwaZulu-Natal.

The plants are part of the Family Asteraceae (daisy family) and there are a total of 36 species of which two are in Madagascar and 34 in South Africa. The species that occurs on the Cape flats in not the aggressive specie that is discussed here. The *Stoebe* species (previous name) are quite common and have a widespread distribution throughout South Africa. *Seriphium* is derived from seraph, a stroke or line of a letter; *plumosum* means feathery.

General names

Slangbos
Bankrupt bush
Vaalbos (to a lesser extent)
Khoi -kooigoed

Plant characteristics

The plant is a small multi-stemmed woody shrub that grows to an average height of 60cm and a width of 60cm. The light colour of the shrub reflects sun light; the woolly covering and small leaves reduce water loss and are adaptations to survive long dry summers. This is supported by its root system which may vary from $1m^2$ around the plant and can be 1.8m deep. However, this specific species of plant usually does not occur in lower rainfall areas (less than 400mm rain, personal observation).

The plants show aromatic characteristics by yielding volatile oil, which acts as a successful protective measure against animal grazing by making it unpalatable (apparently only Eland utilize it to a lesser extent) and thus providing no fodder.

The bankrupt bush is a low fertility plant that prefers lighter (sandy) soils and occurs mostly on foot slopes and mid slope terrains but is not seen on clay soils in a valley bottom (vlei area).

Origin

Seriphium plumosum is indigenous to South Africa and is not a so-called pioneer plant. The plants probably increased due to poor soil fertility status on abandoned or poorly maintained cultivated lands or poor veld management strategies. Poor veld management ensures the retention of and the survival of these bankrupt bush plants.

Heavy stocking rate (although it can be a part of poor veld management) is not directly the cause of an increase in plants.

Impact

Generally, *Themeda / Cymbopogon* veld becomes encroached by *Seriphium* and the primary grass production can be reduced up to 75% with an infestation of 10 000 or more *Seriphium* plants per hectare. The threat of this is that a profitable fodder can be turned into a degraded piece of land on which sustainable cattle farming is no longer possible.

In spite of all efforts to make farmers aware of the disadvantages of the plant there is a huge tardiness to realize how serious the problem really is.

Control

Thinning

After 2-3 years the density of the bush increases - it should be thinned 8-10cm beneath the ground surface. This is not a recommended practice.

Burning

This increases encroachment because of the drastic increase in seed.

When plants are thinned the plants with seed on should be burnt.

The only effective time for burning is in the spring or early summer.

Burning is not recommended generally because of the bad influence on the grass specie composition. Burning can however be combined with chemical control.

Thinning and burning the bush may in fact make the problem worse because the seed germinates a great deal more after these procedures. However, they do have a place in an integrated strategy made up of all control methods.

Chemical control

Hand application for single plants with suspension or granules can be used.

Air application of soil applicants in a granular form can be done in areas exceeding 200ha.

Broad application with tractor and boom is also possible.

Problems with the practical execution and effectiveness can be the following:

- Topography and accessibility of the terrain
- Selectivity of the product (soil agents have very little selectivity whereas foliar sprays are very selective)
- Time of the year (only in growing season)
- Clay content of soil (soil agents are not economically viable in soils with more than 20% clay)
- Rainfall and the distribution thereof (apply soil agents during the beginning of the rainy season

Agents

The active ingredient is Tebuthiuron. It belongs to the soil agent group and needs rain to wash it into the soil (the residual effect can be up to 5 years).

Retail names: Molopo, Limpopo, Brushoff and Climax.

The chemical is transported to the leaves where photosynthesis is inhibited; the leaves turn yellow and fall off. No carbon fixation takes place and the root reserves are depleted and the plant dies. The herbicide has no selectiveness – all woody plants will die. Grass damage is minimal with the correct dose.

The herbicide is available in granular form (GG 20 kg containers) and suspension (SC 5 l containers).

With single plant applications, the granules are applied with a small spoon at the rate of 1.5g per plant. The suspension is diluted at a ratio of 1.5 litre of agent to 8.5 litre water and injected in 2ml dosages.

Only granular agents can be used for aerial applications. The rate should be 5kg/ha using an additional 1kg/ha when the clay content is between 11 – 22%. Aerial spraying should only be used when the contaminated area is larger than 200ha.

A tractor mounted boom sprayer is an alternative, applying 2 litre of SC in 100 – 200 litre of water per hectare.

No after care is necessary for the first year because it takes the chemical up to 12 months to react under certain circumstances.

The agent is not affected by sunlight. It will not poison cattle and game. However fire will destroy any agent that has not been washed into the soil.

Costs

Costs are between R 200 and R 550 per hectare depending on the density.

Planted Pasture

Increase the soil fertility status of the pasture by applying nitrogen and the abundance of the encroacher will decrease.

Recommendation

The resting of veld is not the answer to eradicate *Seriphium plumosum* (not the normal rest that should form part of a management programme). Intensive over grazing can suppress the growth of *Seriphium plumosum* by a combined influence of and an increase in soil fertility due to urine and dung and trampling (physical damage). An integrated strategy where all the options are used should be considered to make it economic and ecological viable. For the sparse infestations a single plant application can be done by hand – SC at 1.5L of the “agent” and 8.5 L water ratio. More than 5000 plants per hectare: tractor with suspension if the terrain permits.

Treatment can start at the beginning of the growing season because the chemical is not broken down by sunlight. There is no danger of poisoning animals and game and animals do not have to be withdrawn from the camps. The only prerequisite is that there should be no danger of fires because the chemical is destroyed by fire if the rain has not yet washed it in the soil. In areas with a danger of fire it is perhaps better to wait for the first spring rain or at least to the middle of October.

It is imperative to do veld reclamation in many cases where the seed source of the natural occurring grass species in the ground, does not exist.

For more information on the control please contact Chris Richter from Terra Care 082 458 4558 or Dieter Jordaan at 018 297 5330.

Germination potential of *Seriphium plumosum* (bankrupt bush, slangbos or vaalbos)

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Introduction

Seriphium plumosum, generally known as slangbos, bankrupt bush or vaalbos (formerly known as *Stoebe vulgaris*) is indigenous to South Africa and already widely distributed in various parts of our country (Eastern Cape, Free State, Mpumalanga, North West Province and Gauteng) (Schmidt *et al*. 2002, Badenhorst 2008). This aggressive encroacher endangers valuable grassland, which is and will remain the cheapest forage for the livestock farmer. This highly unpalatable fynbos shrub is very difficult to control as almost no animal utilizes this plant. It is not wholly true that encroachment is due to only mismanagement like overgrazing (Hatting 1953), as *S. plumosum* rapidly spreads on a farm after first occurring there (Richter 1989; Wepener 2007). The encroachment could also be as a result of a lack of controlled burning and selective grazing particularly by sheep since settled livestock farming development in these problem areas (Trollope 1987). The main reasons for the enormous explosion of it, especially over the past five to ten years, remain a mystery.

Very little has been published on the physiological, phenological and ecological aspects of this plant. It is generally accepted to be mainly found on sandy, rocky soils with a low pH (Smit 1955, Krupko and Davidson 1961). Soils with a clay content of up to 24% could still be encroached if the drainage is good, which could favour the establishment of this woody species (Wepener 2007). This plant first develops on the southern slopes then spreads to

the valleys and seldom occurs in the vlei areas. It is also only limited to areas with an annual rainfall of 620 to 750 mm (Hatting 1953).

The shrub flowers mainly in the autumn/winter (April to June) and spring (Badenhorst 2008). Millions of very light seed are produced which can be widely distributed by wind (Hatting 1953, Richter 1989). Very little is known of the actual germination and the conditions contributing towards its most aggressive encroachment. This study aimed to determine the germination potential of *S. plumosum* at different sites where the grassland has already been encroached. This information is an important factor in determining control measures for this aggressive encroacher shrub.

Procedure

The research was conducted in the districts of Zastron, Thaba Nchu, Ladybrand and Clocolan with an annual rainfall that varies from 600 to 650 mm and altitude from 1 400 to 1 600 m. Temperatures vary from -11°C to 38°C, with an average of 17°C. The data were collected from a Moist Cool Highveld Grassland vegetation type described by Bredenkamp and Van Rooyen (1996) or *Cymbopogon – Themeda* veld type (A 48) as described by Acocks (1988).

The soil is a fine, sandy, loam soil which varies between Kroonstad, Estcourt and Westleigh forms (Soil Classification Working Group 1991). The percentages of clay in the A – horizon varies between 9 and 10% and pH (KCl) between 4.79 and 4.89.

In each of the four districts, a site was identified (0.5 ha) where *S. plumosum* encroachment occurred. These sites were situated against the slope of a ridge. The number of *S. plumosum* plants varied from 1 000 to 2 000 plants per hectare. In each site, the soil beneath 10 randomly selected shrubs was gathered to a depth of 50 mm. The shrubs were selected to be of more or less similar size from which 0.25 m^2 of soil was collected underneath each shrub. Some of the seeds can remain on the plants for several months before they are dropped and therefore the shrubs were hit with an object to get all possible seed on the soil before soil samples were taken. Although the selected plants flowered during spring (July/August) the seeds were not dropped at the time of soil sampling. Only the Thaba Nchu shrubs were hit. Soil samples for the seed bank test were taken at the end of August 2008.

The research was further continued in the greenhouse with respective day and night temperatures of 32°C (± 2°C) and 18°C (± 2°C). In the greenhouse, soil samples were evenly spread (50 mm deep) in plastic containers (0.5 m x 0.5 m) containing a 100 mm deep layer of Hygiotech growth medium (Canadian peat, polystyrene vermiculite and mono-ammonium phosphate). Separate containers were used for the soil of each shrub. Seedling plastic containers were randomly placed in the greenhouse and hand-watered daily.

The germination of *S. plumosum* was monitored over a period of

two months by counting all the seedlings which germinated. To facilitate the counting of *S. plumosum*, the forbs and other grasses that emerged over this period were pulled out.

Results and discussion

A very fast germination is expected from such a small *S. plumosum* seed (Snyman 2004), which was not the case in this study. The first seeds in the seed bank germinated five weeks after watering. After six weeks no further germination took place up to week twelve. Surprising was that during weeks 14 and 16 another explosion of germination took place. In the past some researchers made wrong decisions from poor germination observations (Hatting 1953), without taking into account the initial delayed germination phase of this shrub. This delay can have positive or negative implications on the encroachment process of this shrub. The negative aspect is that it allows the seed to be distributed over very long distances by wind before optimal germination can take place. The positive is that grasses, the mush faster germinator after rain, can compete stronger for water and minerals and can therefore depress *S. plumosum* seedling establishment. In these areas a drought is more the rule than the exception and therefore it could also be possible that during limiting soil water conditions over these long germination periods, *S. plumosum* seedlings can die off.

Five weeks after watering a very high numbers of seedlings occurred in the seed bank for all districts (Table 1). Over this time only Clocolan produced statistically significantly ($P < 0.01$) fewer seedlings in the seed bank than was the case in the other districts. There are many possible reasons for this lower number of seedlings found at Clocolan, including that the shrubs may have been smaller or less seed could have been produced the preceding season than in other districts. The most logical cause can be ascribed to the soil and climate differences between the various districts. The germination of the Clocolan seeds took more or less one week longer than that of the other districts. The

Table 1: Number of *Seriphium plumosum* seeds germinating (seedlings per bush and per m^2) from the soil seed bank, at different times and for different districts. Means (n = 10) within a column with identical letters are not significantly different at $P < 0.01$.

	Seedlings			
	After 5 to 6 weeks		After 14 to 16 weeks	
Districts	Per shrub	Per m^2	Per shrub	Per m^2
Thaba Nchu	147[a]	588[a]	110[a]	440[a]
Zastron	141[a]	564[a]	81[a]	324[a]
Clocolan	98[b]	392[b]	39[b]	156[b]
Ladybrand	148[a]	592[a]	85[a]	340[a]

Clocolan shrubs perhaps flowered later and therefore the longer rest period needed for the seeds for optimal germination. Clearly, *S. plumosum* encroachment is similarly dangerous regardless of the environment.

The values in Table 1 must be viewed against the background of researchers' findings that if more than 10 000 *S. plumosum* plants occur per hectare, the production potential of the grassland can be decreased by up to 70 to 80% (Richter 1989, Jordaan and Jordaan 2007). Further, these seedling numbers (Table 1) are shocking as they are expressed per m^2 and not even per hectare. The positive is that, although each shrub produced millions of seeds each season, only these few germinate at the end. It is observed that the seeds can form a yellow layer underneath a shrub after seed dropping with the potential to germinate.

The fact that no seeds germinating between weeks 6 and 14 could be that fresh *S. plumosum* seeds need a post-resting period which had to be lifted before optimal germination can take place (Snyman 2004). In the case of the first germination after five weeks of watering, the post-resting period was perhaps lifted by the cold winter period. On the other hand, the fresh seeds without completing their rest period landed on the soil in August for the first time and germinated 14 weeks later and therefore the big gap between the two germinating periods. Interesting was that for the second germination, significantly more ($P < 0.01$) seeds germinating from the Thaba Nchu soil seed bank than from the other districts. The striking of these shrubs allowed dropping of all fresh seeds from the shrubs and therefore this higher germination after lifting the rest period. The reason only few seeds germinated from the Zastron, Clocolan and Ladybrand soil seed banks could be that only a few fresh seeds accidentally dropped from the shrubs at the time soil sampling took place. Although the number of developed seedlings is less during the second germination period, it is still a reason for concern for the encroachment of this shrub, because these seeds will reach optimal germination at a later stage. It is clear that over the season there will always be seeds only waiting for environmental conditions to be suitable for germination. These results clearly show our limiting knowledge on the dynamics of this problem plant.

If an average sized *S. plumosum* plant, which has already produced seed, removed from the grassland mechanically or by fire, would result in an explosion of seed germination due to lifting the overshadowing effect on surrounding plants (Snyman 2009). Therefore, care must be taken that follow-up action accompanies *S. plumosum* control measures. Without such an action, the whole encroachment problem would only worsen. The advantage of chemical control is that the active killing agent also results in a few years of residual effect, thereby inhibiting emerging seedlings.

It is astonishing that such a very small seed as that of *S. plumosum*

can successfully germinate and establish in a dense cover of grassland in good condition. The fact that only a limited number of very young *S. plumosum* plants are normally found between grass tufts in grassland in good condition over a season is heartening as millions of viable seeds are produced by a shrub, which possibly do not immediately germinate due to competition. Allelochemic substances produced by the plant could be the reason why no young *S. plumosum* plants establish near mature shrubs (Squires and Trollope 1979). The possibility of an allopathic substance in *S. plumosum,* which contaminates the soil where it suppresses the germination of seeds is investigated at present (Snyman 2009). The longevity of these small seeds is an aspect requiring in-depth investigation and will contribute towards the application of successful control measures. Overgrazing, accompanied by a decrease in plant cover, create the ideal conditions for the viable *S. plumosum* seed to germinate in mass and rapidly encroach in the grassland. Old crop lands are especially prone to *S. plumosum* encroachment due to the lack of competition by grass species (Wepener 2007). As indicated in the literature (Smit 1955, Jordaan and Jordaan 2007, Badenhorst 2008), it is probably true that *S. plumosum* mostly flowers during autumn/winter and spring, but according to the latest observations seeds occur throughout the growing season on the shrubs, which further facilitates its distribution. Some seeds can remain on the plants for several months before they are dropped (Wepener 2007).

It was also observed that a *S. plumosum* seedling established this year will already flower in the same season.

Conclusion

Seriphium plumosum is presently viewed as one of the most significant problem plants in South Africa and without definite action with the control thereof, our precious grassland is facing a severe dilemma. Overgrazing probably leads to the appearance of the shrub, but actually only contributes towards its encroachment by decreasing the grass cover and allowing shrubs (which are not utilized) to grow and increase undisturbed. The enormous germination potential of the seed after controlling the shrub by cutting or burning has not always been realized in the past. These control measures must be managed correctly in terms of follow-up treatments which have to be applied. Therefore, underneath a shrub an infinite number of viable seed lie in waiting for favourable environmental conditions to explode in terms of germination. From this study it was clear that *S. plumosum* seeds are taking a very long time (5 weeks at least) to germinate and also need a post-resting period (more or less 3 to 4 months) to be lifted. These aspects must form part in the selection process for different controlling measures for this shrub.

The Conservation of Agricultural Resources Act legislation lists this plant as a proclaimed encroacher. Therefore the soil owner is responsi-

ble for its control where natural vegetation is being encroached. The control and eradication of *S. plumosum* is the subject of widely differing opinions. Therefore further in-depth research is required on this problem plant. Control measures do exist which can be successfully applied.

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