Session 3: Research proposal posters

Communal rangelands

Assessing the quality of available forage, and its effects on livestock productivity in the semi-arid communal rangelands in South Africa

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The livestock farming industry of southern Africa is divided into two broad categories, commercial and communal farming. In the Northern Cape Province, particularly within the Steinkopf communal area, livestock farming is characterised overall by low productivity. Within these extensive farming systems, the nutritive value, digestibility and feed intake are among the most important factors, which determine livestock performance. The required concentrations of these mineral nutrients in specific individuals are vital as concentrations below or above the threshold may lead to various deficiencies such as infertility, stillbirths, retarded growth rates and high death rates in young lambs. The aim of the project is to determine the causes for the overall low productivity within the Steinkopf communal area. The objectives are to:

1. study the diet preference of the livestock;
2. identify the essential nutrients in preferred fodder species;
3. test for sufficient quantities of particular essential elements present within livestock by analysing blood plasma; and
4. correlate the quality of diet with livestock performance indicators.

To achieve these objectives, this study will evaluate the soil and plant content as well as livestock interactions with the plant material. Furthermore, this study intends to analyse soil and plant samples to conduct nutrient analysis. In addition, blood plasma will be analysed for trace element analysis. This study is relevant as it helps farmers to understand the quality of available forages and may assist farmers in managing their livestock productivity more efficiently. Consequently, improved productivity of farms in Steinkopf contributes to farmers generating a better income.

Keywords: communal farms, drought, livestock, disease, fodder, blood plasma

Assessing the concept: Livestock water productivity in the rehabilitation and management of rangelands after the clearing of invasive alien plants

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Livestock ranching is a significant livelihood strategy for communal farmers in Africa. In land under communal tenure and traditional ownership, livestock's contribution to livelihoods is mainly through providing different products and services, however their productivities are generally low. Livestock outputs in these traditional economies include many different products such as meat, hides and skin, milk, draught power, manure and transport, as well as services such as risk spreading, socio-cultural roles and nutrient cycling. Livestock and water interactions are crucial challenges as livestock production generally utilizes large quantities of water for feed production and is responsible for environmental degradation due to overgrazing. Assessing livestock water productivity for specific products still needs to be undertaken for communal areas. Therefore, this study will assist in improving the understanding and knowledge of communal people on how to produce more outputs from their livestock while using minimal water. Using livestock water productivity model, the study will provide an overview of primary factors of livestock water productivity at local scale and quantify livestock water use and productivity.

Keywords: livestock water productivity, livestock water productivity model, livelihood, water interactions.

Unpacking the role of urban-rural linkages associated with livestock production on livelihoods, rangeland management and water supply in the rural areas of the Eastern Cape

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Livestock production plays an important but complex role economically, socially and environmentally. It contributes significantly to rural livelihoods and has cultural and spiritual attachments to most people. These continue even when people leave their rural homes to seek employment in urban areas. Purchasing livestock is one of the ways these urban migrants might maintain strong linkages with their rural homes. However livestock production also puts pressure on the ecosystem and natural resource such as land, air, biodiversity and water. This is more prevalent in villages where the grazing land is open access; and livestock owners do not need to account for how they manage the rangeland which often leads to rangeland degradation. Rangeland degradation adversely affects water quality and quantity as they result in high storm flows and rapid erosion, silting the dams and rivers; reducing their capacity and the water quality. This denotes that a solution depends on an understanding of the strong links between the different components in livestock keeping; that is livelihoods derived from livestock, cultural and spiritual significance and the impact on the ecosystem (vegetation cover changes and water supply) is required. Using a transdisciplinary approach, the present study will attempt to unpack how urban-rural linkages on livestock production impact rural livelihoods, rangeland management and water quality and quantity. To establish an understanding of how people perceive the current condition of their rangeland and water resource, a combination of focus groups, structured interviews and participatory GIS (PGIS), is used. While collection of the scientific evidence of the actual condition makes use of Remote Sensing, GIS, hydrological methods and ground measurements of biomass cover from the rangelands of the study sites.

Keywords: urban-rural linkages, livestock, rangelands, livelihoods

Investigating intergenerational dynamics and agrarian institutions in South Africa's semi-arid rangeland commons

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In rural development literature, agriculture is considered as the best vehicle to reduce rural poverty. Across the African continent aging of the farming population is causing concern as many young people are reportedly choosing not to pursue livelihoods in the agriculture sector, especially as farmers. Various commentators regard an aging farming population as a wake-up call for policy makers, in that inaction can lead to increasing food insecurity, rural poverty, increasing urban slums and economic decline. An aging farming population is also argued to be a sign of a lost opportunity to bring young people into the sector and benefit from their energy and greater openness to innovation. The claims that the youth are not interested in agriculture, and even the evidence on which these claims are based, needs thorough investigation. More recent studies revealed that rather than a lack of interest, the problem is with agrarian institutions and dynamics, e.g. around land, or older community members in rural areas discouraging bright, educated and ambitious young people to participate in agricultural activities. The tension between the desires of the older generation to retain control of resources and the desire of young people to receive their share of these resources, to form their own independent farms and households, and attain the status of economic and social adulthood is a common feature of many agrarian societies, but surprisingly neglected in research. The challenges of overcrowding and overgrazing that takes place in most semi-arid rangeland commons highlights that there is already competition over grazing resources and this is mainly as a result of lack of land that was caused by colonialism and Apartheid. In these semi-arid areas farmers also have limited options to diversify and this also leaves little opportunity for youth to start farming and accumulate livestock. Moreover, the land reform process so far has failed to create conditions in which the youth could participate and engage meaningfully. Thus, despite the fact that halve of the demand for land in SA are from those age 18-35, the youth play little or no role in land reform projects. This research will therefore first explore the participation or non-participation of rural youth in farming in 4 former Coloured reserves in the Northern Cape. It will further investigate the agrarian institutions and dynamics that might inhibit youth from participating in agriculture. Semi structured questionnaires and Q methodology (Q) will be conducted with 100 interviewees in total, which includes both youth and the current farmers. Semi-structured interviews will be preceded by observations, informal and unstructured interviewing in order to develop relevant and meaningful semi structured questions. Q Methodology provides a well-established means of systematically exploring and analysing different perspectives on a question or issue. Q is an appropriate methodology with which to explore questions about personal experience and matters of taste, values and beliefs and combines both qualitative and quantitative analysis.

Keywords: youth, agriculture, rangelands commons, unemployment, land reform

Medicinal uses of cactus pear by livestock farmers in Makhuduthamaga local municipality in the Limpopo province

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For decades, cacti have been exploited for their medicinal value all over the world. While most of the health benefits from cactus pear are based on studies that used humans and rats as models, very little is known about medicinal uses of cactus for livestock production. The aim of this study is to document farmers' knowledge on the utilisation of cactus species as medicine in livestock production at Makhuduthamaga area. Secondly, this study seeks to compare bioactivity among cactus species found in the wild with the cultivated cactus species. The study will be conducted at Makhuduthamaga municipality, in Limpopo Province. Focused individual interviews and focus group discussions will be used to investigate the knowledge of ethnoveterinary medicine in the area. Laboratory investigation will be done for validation purpose, chemical compositions will be determined using the Thin Layer Chromatography (TLC) and biological properties will be determined using the microplate method for Minimum Inhibitory Concentration.

Keywords: ethnoveterinary medicine, ailments, bioactive compounds, medicinal plants, cactus

The effect of fire history on root carbohydrate concentrations of encroaching *Terminalia sericea* at the Waterberg Plateau Park, central Namibia

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Fire is considered as an ecological disturbance that may kill or top-kill woody plants and may in turn maintain the co-existence of trees and grasses in savanna ecosystems. Fire may also be used as a preventative measure to combat encroachment of woody plants. The ability of encroaching woody plants to resprout after top kill by fire is due to the already established and functioning carbohydrate reserves stored in the roots. It might be possible to reduce the regrowth of woody encroaching species through the more frequent use of fire, if it is known how fast the root carbohydrate concentrations of encroaching resprouts return to pre-fire concentrations. The objectives of the present study are to determine and compare how different fire histories in the savanna woodland of the Waterberg Plateau Park affect the concentration of root carbohydrate reserves of encroaching *Terminalia sericea*. The Waterberg Plateau is divided into different blocks of different fire histories. The present study intends to address the following questions, "How does the concentration of root carbohydrate reserves of *Terminalia sericea* differ among blocks of different fire histories?" and "how rapidly do the root carbohydrate concentrations of *Terminalia sericea* return to pre-fire concentrations?". A total of 12 resprouts of *Terminalia sericea* will be collected from four treatment blocks, block 2a, 1a, 2b and 1b which were last burnt 1, 2, 15 and 25 years ago, respectively. Above ground and below ground biomass of the resprouts will be measured. The BECVOL method will be used to measure above ground biomass. The roots will be excavated and three discs will be sawn from the top 50cm of the main root which will be removed for carbohydrate analysis. Material used for Total Non-structural Carbohydrate (TNC) analysis will be oven dried, milled and sieved. For TNC analysis, polysaccharides, oligosaccharides and starch will be extracted. A two-way ANOVA will be used to compare normally distributed data to test for significant differences in root carbohydrate concentrations in blocks of different fire histories (time since last burn and average fire return interval). Post-hoc comparisons will be performed. Where log transformations do not satisfy ANOVA requirements, non-parametric tests and multiple post hoc comparisons by mean rank test will be used. From the preliminary data of above ground measurements, the mean tree height for blocks burnt 1, 2, 15 and 25 years ago are 0.74 m, 1.20 m, 2.22 m and 2.52 m respectively. The mean stem diameter for the same fire blocks are 1.24 cm, 1.81 cm, 4.90 cm and 5.02 cm.

Keywords: root carbohydrates, resprouts, *Terminalia sericea*, bush encroachment, fire, Waterberg Plateau Park

General

The effect of environmental factors and rangeland condition on *Seriphium plumosum* L. invasion susceptibility

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A complex interaction of factors has been proposed to cause woody plant encroachment and/or invasion. This suggests that development of any effective control method requires in-depth understanding of the ecology of encroaching and invasive species. One of the invasive species with little understood ecology is *Seriphium plumosum* L. This is an unpalatable fynbos shrub that is indigenous to South Africa. It is currently invading over half of the country's grassland biome and none of the proposed control methods has proven successful yet. The aims of this study are to; 1) understand the biotic and abiotic factors of rangelands invaded by *S. plumosum* in South African semi-arid grassland and, 2) predict its invasion susceptibility in un-invaded areas. The experiment will consist of a randomized block design, with 36 farms as blocks and 72 (36 encroached and 36 non-encroached) sites as treatments. The sites will be analysed for variance among environmental factors, with 95% level of confidence. Multivariate predictor of *S. plumosum* invasion will be analysed using regression trees and multiple regressions. The study will provide an insight on the factors determining the success of *S. plumosum* invasion of semi-arid grassland communities.

Keywords: grassland, shrub invasion

Improving soil surface conditions by using brush-packing to facilitate germination establishment on overgrazed rangelands

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Ecosystem changes indicated by degradation are mostly caused by livestock overgrazing, drought, woodcutting and veld fires. These ecosystem changes include decreased cover of vegetation. Overgrazing which is the repeated utilisation of grass plants until all reserved nutrients for regrowth are depleted, is characterized by the loss of biodiversity, reduction of species richness, loss of native topsoil and increase in surface runoff. The National Land Cover has indicated that 80% of South African land is used for agriculture and only about 11% has arable potential, the remaining 69% is used for grazing. It is therefore imperative to ensure proper land use is maintained in order to avoid possible land degradation. It is generally assumed that exclosures lead to better conditions of overgrazed lands; however the assumption is not well supported by studies. The major concern with exclosures is that, it is not always practical to remove all animals from the site and this method needs to allow natural plant succession which takes a long period. Because this passive restoration intervention cannot always work, a number of active restoration techniques can be used as alternatives such as brushpacking. Brushpacking is the use of tree branches as above ground obstruction to let seedlings establish without the threat of herbivores. Studies however do not report on microclimate conditions which are affected when brushpacking is used. This will mainly be a principle study looking at how brushpacking improves soil surface conditions to facilitate germination in overgrazed degraded lands. To test whether brushpacking improves the soil surface properties, soil moisture content, light interception, and soil surface temperature will be measured weekly after planting. Thereafter survival rates of the seedlings will be measured in order to evaluate which grass species will grow or mature under brushpack conditions. The aim is to scientifically classify and quantify a brushpack by packing different densities as treatments. Six tufted grass species will be tested on three treatments and replicated three times over two seasons; this will give a total of fifty-four plots per season in the study. The study will look at two study areas; firstly field experiments where a split-plot trial will be used, and secondly glasshouse experiments where a fully randomised pot-trial will be used. It is expected that the brushpack will provide favourable microclimate conditions to allow germination establishment of grass species in overgrazed rangelands. Furthermore when the brushpack improves soil surface conditions it will have a direct effect on the survival rates of the seedlings over time. Overgrazing is a major contributor to soil erosion. The research seeks to mitigate the impact of overgrazing before it leads to excessive and irreversible soil erosion by using cost effective and natural materials.

Keywords: land degradation, overgrazing, restoration, brushpacking

Ecosystems, carbon and nitrogen responses to bush encroachment in the semi-arid areas of the Eastern Cape

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Bush encroachment and its effects is still a debate among researchers; however there is evidence that poor land management and increased atmospheric carbon dioxide are considered to be the main drivers facilitating the spread of encroacher species. In semi-arid rangelands, bush encroachment leads to dense thicket bushes which negatively affect the carrying capacity and ultimately the economic value of rangelands. On the other hand trees assist in carbon sequestration and ultimately reduce global warming. When woody plant abundance increases in grasslands and savannas, there is significant uncertainty as to whether grass biomass productivity, change in soil properties, ecosystem carbon (C) and nitrogen (N) pools increase, decrease, or remain the same. Therefore, further investigation of the responses of ecosystems, carbon and nitrogen to bush encroachment are required. To understand the impacts of trees on these attributes, the following questions will be examined using different levels of indigenous bush density in the semi-arid region of the Eastern Cape as the case study: (1) Do trees increase or decrease grass species composition, quality and biomass, organic carbon and soil nitrogen content? (2) Which level of tree density has a stronger effect on grass and soil properties? Five plots of different simulated bush densities (12%, 25%, 50%, 75% and 100%) will be used to measure parameters. The study will be carried on four different seasons of the year to measure variations. Carbon and nitrogen will be examined on the leaves of the trees, grass component, and soil. Physical properties of soil such as compaction, texture, aggregate stability and moisture will be measured. Data will be analysed using general linear model (GLM) procedure of the SAS 1999 and results will be compared from different treatments and seasons to identify any significance related to hypothesis of the study.

Keywords: biomass, soil nitrogen, organic carbon, bush encroachment, overgrazing, soil moisture, semi-arid savanna

The effect of fire and grazing on soil microbial and plant diversity in fynbos and renosterveld vegetation types in Nieuwoudtville

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Fire has been used successfully to promote the growth of palatable fodder species for livestock, however little is known of the impact of this practise on soil communities. Soil is a dominant factor in determining the productivity and distribution of plant communities and thus we need to understand how fire affects soil biological processes, nutrient cycling and soil fertility. However, we also need to consider the additional effects of livestock grazing and trampling on soil characteristics. The aim of this study is to assess the impact of fire and grazing on soil and plant communities, by exploring the soil microbial community and botanical diversity of extensive rangelands. This aim will be addressed through the following objectives: (1) determining the impact of fire and grazing on soil microbial communities; (2) determining the impact of fire and grazing on plant diversity and composition. This study will be conducted in the Hantam-Tanqua Roggeveld situated in the Northern Cape, South Africa and forms part of one of two globally recognised arid biodiversity hotspots. The microbial community composition will be assessed using the phospholipid fatty acid (PLFA) analysis, a rapid and inexpensive way of assaying the biomass and composition of microbial communities in soils. Fatty acids will be extracted from whole soil samples and prepared for gas chromatography after being separated into lipid classes using solid phase extraction disposable cartridges. Whilst the impact of fire and grazing on vegetation will be assessed using the descending point method along a 50 m transect line at each site. The vegetation present will be investigated in terms of: (a) total vegetation cover, (b) total species richness, (c) indices of plant diversity, and (d) vegetation cover per life form. Fire may promote soil microbial diversity, which in turn promotes botanical diversity, eliciting a change in the response of the community to future disturbance. Therefore microbial diversity is an important factor when seeking to promote, sustain or manage both biodiversity and pasture productivity.

Keywords: Succulent Karoo, Renosterveld vegetation, fire, grazing, agrobiodiversity

How does burning, mowing and high-intensity grazing affect tuft and seedling dynamics of key species in the tall dry grassveld in KwaZulu-Natal, South Africa?

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Persistence and recruitment of new plants via seed germination and tiller production contribute to the biological productivity of a rangeland. Therefore studies focusing on the response of individual tufts and seedlings, as well as their micro-environment, will contribute to the development of sustainable rangeland management practices. Ukulinga Research Farm at the University of KwaZulu-Natal, Pietermaritzburg, provides an opportunity to study the long-term effects of burning and mowing on tuft dynamics and seedling success in trials established in 1950. We hypothesise that (1) long term burn/mow treatments will affect tuft and plant morphology of grass species and seedling germination; (2) water and light availability will affect *D. eriantha* seedling germination and growth rate; and (3) *D. eriantha* tuft response to defoliation will vary under different water and light availability treatments. In order to determine the physical differences between tufts under different intensities of burning and mowing, we will record tuft diameter, plant height, specific leaf area and number of tillers per tuft. Similarly to the burn/mow study, we will investigate the effects of high intensity grazing on the tuft dynamics of the same key species. To determine seedling success, we will plant *Digitaria eriantha* seed within the same treatments used for the tuft morphology study, record germination success and compare this between defoliation treatments. In the burn, mow and graze trials we will record the following micro-environment characteristics; soil Nitrogen, moisture and organic matter. In addition to field trials, we will conduct two greenhouse trials to determine the effect of light intensity and water availability on (1) seedling germination and (2) tuft response to defoliation. Seedlings and tufts will be studied under combination effects of high, medium and low water availability and high, medium and low light intensity. we will record germination and growth rate of *D. eriantha* seedlings and the effects of burning and clipping on tufts under the same water/light treatment combinations.

Keywords: tuft morphology; seedling germination; seedling growth rate; water and light availability.

Pastures

Effects of cultivar selection, planting date and cutting frequency on dry matter yield of *Raphanus sativus*, in the North West Province, South Africa

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Japanese radish (*Raphanus sativus*) is a cool-season, fast-maturing, easy-to-grow crop. The crops are utilised once, in a highly mature state when nutrients are known to be declining. Therefore, the study will concentrate on selecting a champion cultivar, planting dates and cutting frequency most suited in Potchefstroom area, North West Province. Japanese radish is highly valuable since it contains a higher crude protein percentage than most cultivated pastures and the lifespan is short so as to provide quick abundant feed for livestock, especially sheep. Japanese radish is also important in that they are frost resistance and they tolerate dry periods. The trial will take place in Potchefstroom (Department of Rural, Environment and Agricultural Development). The lands are characterised by loamy to clay soils, with the mean annual rainfall of 621 mm. Three radish cultivars, viz. Geisha, Star 1650 and Nooitgedacht, will be planted on three separate dates, March, April and May. Each plot will consist of three rows of 10 m long, with inter-row spacing of 700 mm. The three rows in each plot will represent the sub plots (split plot) were the different cutting treatments will be applied randomly. Seeds will be planted by hand in shallow furrows of ~3 cm with no distinguished inter-row spacing. In order to determine the dry matter yield of the above ground vegetative material, data will be collected at the different cutting frequencies. The above ground biomass will be cut approximately at 5 cm as anything lower will reduce the ability to produce re-growth material. Harvesting will take place at three different frequencies at 10 weeks + regrowth, 14 weeks + regrowth and 18 weeks. Tubers will be harvested at 18 weeks, weighed and oven dried at 70 °C to constant weight.

Keywords: Japanese radish, cutting frequency, dry matter yield, planting dates, cultivar

Assessing the potential of tagasaste for forage improvement in Eastern Cape Thornveld

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tagasaste is an evergreen leguminous shrub that grows 3-4 m high. It is a member of the Fabaceae (pea) family and is indigenous to the Canary Islands, but it is now grown in many parts of the world as a fodder crop. Across the whole of South Africa it is estimated that 28% of the total ruminant livestock are owned by people in the "second economy" (the subsistence sector), but that their share of the commercial meat and fibre market is less than 5%. Specifically, the rural communities of the Eastern Cape Province principally produce livestock products, with the province carrying 50% of the goats, 85% of the sheep and 40% of the cattle within the "second economy" of South Africa. About 4 million people are dependent on 5 million ha of communally managed land, which comprises veld (for grazing), abandoned arable land (used for grazing), cropping lands and homestead gardens and residential areas. The abandoned arable lands, which are the primary focus of this project, occupy ca. 750 000 ha of the communal lands of the Eastern Cape. The objectives of this project is to determine if tagasaste shrubs do influence the protein content and dry matter (DM) production of the surrounding grass plants and establish if a correlation exists between size of the shrub and the distance from the shrub that the quality and quantity of the grass is influenced. The experiment will be carried out at the Bathurst Experimental Farm in the Eastern Cape province of South Africa, in a tagasaste plantation that was established in 1992. Nine treatment combinations will be assigned to 27 plots in a complete randomized block design, with each treatment replicated three times. Forage yield and quality will be determined at three intervals vz. endof winter, mid summer and end of summer. The forage quality parameters to be determined include crude protein content, metabolisable energy, neutral detergent fibre and acid detergent fibre. The present low turnover and inefficiency of the livestock sector within the community flocks/herds is primarily caused by inadequate feeding, both quantity and quality. This study will help to determine whether it is possible to improve the quantity and quality of the forage available to the animals on the old lands by establishing tagasaste on these lands.

Keywords: tagasaste, abandoned arable land, protein content, forage yield

Legumes from the Northern Cape Province of South Africa and their potential use as forage crops

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In order to meet the growing demand for livestock products in South Africa (SA), livestock production has to increase in areas with marginal climatic conditions. Currently there are few, if any, commercially available forage legume species suitable for dryland livestock production in areas that receive less than 300 mm of rainfall per annum in SA. Therefore, to meet this growing demand for livestock products, new forage species that can tolerate these marginal climatic conditions need to be identified. The Northern Cape Province (NCP) has a mean annual precipitation of 200 mm, ranging from 20 mm in the west to 540 mm in the east with winter temperatures as low as -10 °C and summer temperatures often greater than 40 °C. However, according to PRECIS records, the NCP houses a total of 399 legume species in 66 genera. Our work will therefore aim to identify legume species with forage potential from the NCP by comparing the PRECIS list of species for the NCP to a list of priority legume species in southern Africa compiled by the Agricultural Research Council in 2013. Those legume species that occur on both lists will further be evaluated using plant functional traits suitable for these marginal climatic conditions and those traits beneficial for forage production. These functional traits include plant regenerative traits, seed traits, plant height, traits that reduce water loss and traits that aid in water uptake. The final list of species will be evaluated for their pasture and forage potential by evaluating their nutritional quality, drought tolerance, breakdown of seed dormancy, their ability to grow in phosphate limited environments and to regenerate and persist after defoliation.

Keywords: native legume species, pastures, forages, Northern Cape Province, livestock

The reinforcement of aged *Digitaria eriantha* cultivations

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The mismanagement of, especially, dryland cultivation can leave a big gap in the production of feed for animals, which forms part of the chain of food security. Further repercussions can lead to soil being depleted and neglected to a point of no return. Within the agricultural environment there are substantial land portions that is either lying fallow or under neglected dry-land fodder cultivations, resulting in more underutilised resources, which in the end may effect animal production. Similar land portions have been identified at the New Machavie research farm of the NW READ, in Potchefstroom. A large portion of land has been under cultivated dryland *Digitaria eriantha* (Smuts finger grass) since the 1970s. Over the years, these portions have on and off been utilised as foggage and for building up the fodder bank, but in the later years these portions have been neglected due to budget constraints being the biggest reason. As the Pasture Division is responsible for fodder provision on the farm, the need for reinforcement of earlier cultivated *D. eriantha* has emerged. Time and money always play a great role in approaching any endeavour. Therefore several pilot reinforcement strategies, old and new, will be examined. These strategies will include active reinforcement, such as ripping at various interval levels using a tractor and ripper plough, different fertiliser products form different nitrogen sources, based on currently running related fertilisation trials, sowing in of the relevant seed and combinations thereof. The better reinforcement outcome thereof will then be applied to the bigger areas, therefore being cautious of over expenditure on the larger areas.

Keywords: Smuts finger grass, dry land cultivation, fodder, *Digitaria eriantha*

Nutritional impact of supplementing tree lucerne (*Chamaecytisus palmensis*) on dry season productivity of growing goats

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Dry season feed shortage is a problem in drier zones of South Africa. Most ruminants in rural areas of Limpopo Province survive on meagre and low quality roughages on rangelands during the dry seasons. Supplementary rations of grass and lucerne (*Medicago sativa*) hay that are managed through the provincial drought relief programs contribute insignificantly to needs of the large ruminant populations in Limpopo province. Productivity of lucerne under dry land farming is low and hay has less digestible fibre, hence the current drought relief program will not improve the nutrition rural livestock. Alternative climate smart forages that are also protein rich sources such as tagasaste (*Chamaecytisus palmensis*) commonly known as tree lucerne were established at the Towoomba and Madzivhandila research stations for augmenting supplies of high quality fodder. The forage, although used widely for improving nutrition of ruminants in Oceania and East Africa, has not been evaluated as drought relief protein source for small ruminants in Southern Africa. Tree lucerne is an evergreen leguminous fodder shrub that is also drought tolerant. It reaches 6 m in height with over 10 m root depth, hence the plant relies mostly on deep underground water. Edible components have over 20% crude protein and is low in indigestible fibre. It is clear from literature that the chemical composition of tree lucerne and lucerne are relatively similar, there is however stronger evidence that the herbaceous lucerne is a premium forage in livestock productions, but it is costly to produce relative to tree lucerne. Incorporating tree lucerne and upscaling its production of the forage from the provincial fodder banks will impact productivity of small ruminants during the dry seasons. The nutritional impact of supplementing tree lucerne (*Chamaecytisus palmensis*) on dry season productivity of growing goats will be evaluated

Keywords: tagasaste, fodder shrub, lucerne

Introduction of tree lucerne (*Chamaecytisus palmensis*) on an existing *Eragrostis curvula* pasture stand.

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Eragrostis curvula continues to be an important cultivated grass pasture on the highveld of Mpumalanga province, and continuing research efforts on optimum herbage production remain a priority. Investigations on legume and grass mixed pasture research has showed a significant improvement in herbage production with reference to the mutual relationships of pasture species. An effort to introduce *Chamaecytisus palmensis* (tree lucerne) was sought at Nooitgedacht ADC where tree lucerne will be introduced on existing *Eragrostis curvula* pasture stands with the following objectives: (1) evaluate the adaptation ability in the province; (2) improve fodder flow; and (3) improve carrying capacity of veld**.** The study will initially be conducted on three farms within Province's three agro- ecological zones on experimental plots. A total of 12 plots, which comprise 4 treatments (one species x four row spacing treatments) with three replications (blocks) will be laid out in complete randomized block design (CRBD). The field experiment will be planted under dry land conditions during October 2014. The existing *Eragrostis curvula* hayland will be mown and then worked with a disc harrow to remove previous season *E. curvula* canopy cover where five tree lucerne seedlings will be planted at four meter intervals per sub-plot. Each individual plot will be 4 x 6 m, 4 x 8 m and 4 x 10 m and will consist of one rows of 16 m length. The total trial size is 1 440 m^2. Tree Survival, growth rate, animal production and herbage production ability will continuously be determined from this study sites**.** Benefits of this study include development and establishment of sustainable quality fodder and guideline throughout the province in 2027.

Keywords: *Chamaecytisus palmensis*, *Eragrostis curvula*, dryland, highveld, production, seedling, survival

Seasonal effects on pasture establishment of three grass-legume seed mixtures used for coal mine rehabilitation

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The global increase in demand for minerals is the reason for the rapid increase of coal, gold and platinum mining in South Africa. By law, all mined areas are required to be rehabilitated. In the process of rehabilitating open cast coal mines in Mpumalanga, a mixture of five grass species is conventionally used in the re-vegetation phase. This mixture consists of a nurse crop *Eragrostis teff* together with *Digitaria eriantha*, *Eragrostis curvula*, *Chloris gayana* and the legume *Medicago sativa*. Each of these species can differ in terms of their optimal growing conditions (i.e. soil surface temperature or daylight length) as well as season of establishment. Pasture establishment in the mining industry is done as soon as mining of the area is concluded and the soils are replaced and leveled. In practice, the same specific mixture of species is planted in order to try and establish pastures, without considering the current season and its possible effect on establishment success rate. Consequently, poor germination results, and a poor stand of pasture is established. The aim of this study is to develop a guideline for mines on the optimal grass-legume seed mixture to plant in the respective seasons. These improved pasture stands will be of high quality, ensuring an improved agricultural potential on rehabilitated coal mines, which contributes to food security by means of red meat production from pastures. The study objective is to identify the optimal soil surface temperature at which each of the seven test species will germinate. This study will include coated and non-coated seeds of the perennial species. The study will entail three different experiments conducted on the Hatfield experimental farm in Pretoria. All experiments will be conducted in a randomized block design. The first experiment will determine the germination of the different species (coated and non-coated) at four different predetermined controlled temperature ranges using a Thermogradient table. The temperature ranges will be 10 – 15 °C, 15 – 20 °C, 20 – 25 °C and 25 – 30 °C. The second experiment will determine the effect of environmental soil surface temperatures on the germination of each species. This experiment will be a pot trial where each species (coated and non-coated seed) will be planted in seed trays every month of the year. The seed trays will be left outdoors and exposed to environmental conditions. Daily soil surface temperature readings will be taken using a Thermochron iButton data logger. The third experiment will look at the effect of planting season on the establishment of different grass-legume seed mixtures, and will be conducted in field. In the study, the effect of competition (intraspecific vs interspecific) and management (cutting vs no cutting) on the species composition, basal cover and forage quality of the different mixtures will be examined. It is hypothesized that the success rate of pasture establishment on rehabilitated mines is largely affected by seasonal climate variations and will reflect in different mixtures. Finally, mines will need to consider season or soil surface temperature as a key indicator when choosing the species mixture when re-vegetating an area.

Keywords: mine rehabilitation, grass mixtures, soil surface temperature, nurse crop, germination