



Session 15: Pasture posters viewing

Evaluation of tillage effects on soil quality of kikuyu-ryegrass pastures

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Agricultural management practices modify soil in one way or another. Poor management practices can lead to soil degradation, while sound management practices can sustain or enhance soil condition. Soil quality describes the ability of soil to function and encompass physical, chemical and biological processes in soil, which are equally important for to maintain a healthy agro-ecosystem. One of the farming practices which usually degrades soil is excessive soil tillage. Although most farmers in the southern Cape region of South Africa have adopted minimum-tillage practices, there are still farmers who till soil regularly. This, amongst other injudicious management practices, has resulted in concerns about kikuyu (*Pennisetum clandestinum*)–ryegrass (*Lolium* spp.) pasture systems in the southern Cape. The aim of this study was to assess tillage effects on soil quality with indexing methods. Pastures were identified throughout the southern Cape and divided into five groups of tillage according to the degree of soil disturbance. The soil management assessment framework (SMAF) and soil quality index for pastures (SQIP) were used to assess the impact of tillage on soil quality. Overall soil quality were assessed along with physical quality, chemical quality and biological quality. Soil physical quality was affected by tillage. Although this was dominantly as a function of the inherent pedological characteristics, the effects were aggravated by tillage. Reduced tillage alleviate compaction of these soils. Tillage did not affect the soil chemical quality, except for slight redistribution of nutrients to a maximum depth of 300 mm. Soil tillage severely affected soil biological quality. Deep tillage resulted in the lowest soil biological quality. Minimum-tillage with a permanent kikuyu-base was the most beneficial management option to maintain soil biological quality. Different indices or assessment tools exist, but because soil quality is site- and land-use specific, any soil quality assessment tool will not necessarily be adequate. The SQIP is an appropriate tool to assess soil quality for pastures in the southern Cape. The SQIP could facilitate adaptive management by using it as a tool to assess soil quality and enhance the understanding of processes affecting soil quality.

Keywords: land degradation, land-use effects on soil, pasture management, soil disturbance, soil health.



The monthly growth rate and total dry matter production of annual ryegrass cultivars in the southern Cape of South Africa

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Annual ryegrass (*Lolium multiflorum*) is a major contributor to fodder-flow programs in pasture based systems for dairy and beef production in the southern Cape of South Africa. Italian (*L. multiflorum* var. *italicum*) and Westerwolds (*L. multiflorum* var. *westerwoldicum*) ryegrass are sown as pure swards, in mixtures and over-sown into existing pastures to provide high quality, palatable forage to animals. The large number of annual ryegrass cultivars commercially available necessitates continuous evaluation to assist producers in selecting the most suitable cultivar based on dry matter (DM) production and the specific requirements within a fodder flow program. The aim of this study was to determine the monthly growth rate and total annual DM production of commercially available annual ryegrass cultivars. The study was carried out on the Outeniqua Research Farm near George in the Western Cape in the form of a small plot cutting trial under irrigation. The trial consisted of a randomised block design with three replicates established in March 2014. Diploid varieties were sown at a seeding rate of 25 kg.ha⁻¹ and diploids at 20 kg.ha⁻¹ into cultivated soil. Plots were harvested to a height of 50 mm at an approximate interval of 28 days or when the growing points of grasses were being overshadowed to determine DM yield. Treatments were terminated when they failed to recover after a harvest. Plots received 50 kg N.ha⁻¹ after each harvest. The mean monthly growth rate varied between 8 and 44 kg DM.ha⁻¹.day⁻¹ and was affected by month and cultivar. The annual DM production of the cultivars evaluated was between 3 441 and 7 789 kg DM.ha⁻¹. The Italian ryegrass cultivar Elvis had a similar total annual DM production to Italian ryegrass cultivars Tabu, Enhancer, Supreme Q, Sukari, Udine, Barmultra and Barmultima; the Westerwolds ryegrass cultivars Lolan and Hogan and the intermediate type Super T, but higher than the rest. Cultivars that obtained a high total annual dry matter production remained productive from May to December, while cultivars that only remained productive until October tended to have a lower total annual DM production. The selection of an annual ryegrass cultivar should be based on the specific requirement within a fodder flow program, the distribution of monthly growth rate and the total annual dry matter production .

Keywords: *Lolium multiflorum*, pasture, cultivar



Germination and seedling establishment of indigenous legumes seeded on degraded mine soils

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Open cast mining operations disturb the structure of many soils and the accompanying vegetation cover, which includes both native grasses and many forb species. Amongst the forbs, indigenous legumes are most important for ensuring some form of nitrogen (N) fixation, which often contributes to a more sustainable vegetation cover. Rehabilitation programmes are imperative to reinstate the productivity of degraded areas. Grass species are, however, easier to establish, whereas native legume species establishment is often restricted by hard seed coats. This study aimed to find the most suitable scarification technique to facilitate the germination and establishment of indigenous native legume species. The efficacy of different scarification treatments on the germination of six indigenous species of herbaceous nitrogen fixing legumes, namely *Indigofera melanadenia*, *Indigofera arrecta*, *Tephrosia elongata*, *Tephrosia longipes*, *Tephrosia cordata* and *Rynchosia adenoides* was compared to the commercial dryland lucerne, *Medicago sativa* which is the most commonly used in rehabilitation seed mixtures. Scarification treatments included: (1) seed soaked in 98% sulphuric acid for 30 minutes, (2) mechanical scarification by removing the seed coat with a nail buffer, (3) seed soaked in boiling water for 15 minutes and (4) non-scarified seed (control). Sterile petri-dishes with moistened filter papers and seeds were placed in a growth chamber at 25 °C, for a germination period of 21 days and time to germination recorded. The first germination was observed after five days of sowing. Acid scarified seeds of *I. arrecta* and *T. longipes* had the highest germination success of 56%. Hot water scarified seeds of *T. cordata* and *T. elongata* had a germination of 76%, and *R. adenoides* had a germination percentage of 72%. For all indigenous species, scarification increased the success of germination. *Medicago sativa* had an expected germination percentage of 62%. Subtropical indigenous legumes have the potential to germinate when subjected to different scarification techniques, hence their potential to establish when seeded after treatment. The preliminary results indicate that indigenous legumes can possibly play an important role in the rehabilitation of vegetation if seeds are scarified. The inclusion of these legumes can ultimately reduce the dependence on costly fertilisers and improve the forage quality of vegetation covers on rehabilitated mine soils.

Keywords: open cast mine, rehabilitation, indigenous legumes, scarification



Evaluation of four cultivated pasture species in different agro-ecological zones of Mpumalanga province

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Mpumalanga is the highest beef producing province in South Africa and contributes to 25% national beef production (DAFF, 2012). It is also true that an enormous fraction of beef produced is mainly on rangeland. However, planted pasture is known to contribute significant amount of fodder during dry season in the province. Thus evaluation of pasture species in different agro-ecological zones of Mpumalanga province was investigated for establishment of pasture for subsistence farmers. Four different varieties of perennial pastures, namely *Cenchrus ciliaris*, *Eragrostis curvula*, *Cynodon dactylon* and *Digitaria eriantha*, were laid down in a complete randomized block design with three replicates and were evaluated under dryland conditions in two agro-ecological zones of Mpumalanga province to quantify their adaptation and production ability. Mpumalanga Province is divided into three different agro-ecological zones, Highveld, Midveld and Lowveld; the study was carried out on Highveld and Midveld. The Highveld zone was represented by Zamakunzima Farm and Athole Research Farm situated near Piet Retief and Amsterdam Towns in Mkhondo Municipality, respectively. In the Midveld the study was carried out at Fundamlimi Agricultural Training Centre in Thembisile Hani municipality. Grass species were planted between last quarter of January 2014 and first quarter of April 2014.

Table 1: Production of pastures on different localities and different planting season

Localities	Planting Season	<i>Cenchrus ciliaris</i>	<i>Cynodon dactylon</i>	<i>Eragrostis curvula</i>	<i>Digitaria eriantha</i>
		Biomass(kg/ha)			
Zamakunzima Farm	January 2014	7 000	8 000	6 000	7 000
Fundamlimi Farm	February 2014	12 000	6 000	7 000	7 000
Athole Farm	April 2014	867	2 670	2 096	733

There was no significant different ($p=0.7$) in biomass production between localities that were planted between January and February and biomass production was severely low at locality planted during early April 2014 ($p=0.037$) when compared to the other months.

Keywords: agro-ecological zones, biomass production, cultivated pasture, highveld, midveld



Calibration of a disc pasture meter to estimate the differences in standing forage biomass in an oat (*Avena sativa*) trial in the Roggeveld region with three fertilization treatments:
Preliminary results

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The Roggeveld Region in the Northern Cape Province of South Africa encompasses a vast area in the south western corner of the Karoo plateau that extends from Calvinia southward along the Roggeveld Escarpment to the foothills at Matjiesfontein. This region produces some of the finest wool from the Merino sheep which are extensively farmed in the region. The Roggeveld Karoo vegetation has a rather low average grazing capacity potential of only 39 hectares per large stock unit (ha.LSU⁻¹). Land owners and –managers are forced to invest time, money and energy in establishing planted pastures in order to increase the available forage for their livestock in this semi-arid Karoo region. The aim of the study was to determine the differences in the standing forage biomass produced in an oat (*Avena sativa*) trial where three fertilization treatments were applied. The three fertilization treatments applied included a) a compost tea solution only, b) Fertilizer 4:1:1 (39) only, c) and in the last treatment both the Fertilizer 4:1:1 (39) and compost tea solution. The disc pasture meter (DPM) was calibrated during the study to determine whether it will be an applicable assessment tool for current and future estimations of the standing forage biomass in the dryland oat trails in the Roggeveld region. The DPM ensures more rapid assessments of the above ground forage biomass and is a less destructive sampling method compared to the clipping of 1 m² quadrants. The successful calibration of the DPM for estimating the above ground forage biomass in oat fields for grazing purposes was a particularly useful result. The coefficient of determination indicates that the disc height accounted for 85.3% of the variation in the standing forage biomass production. From the results obtained the DPM is recommended as a rapid assessment tool for scientist, extension officers, and land users to determine the standing forage biomass production on planted dryland oat fields in the Roggeveld region. From preliminary results the highest forage biomass yield was recorded under the fertilization treatment where both the fertilizer and compost tea solution was applied together. This will be expected due to the benefits gained from both fertilization treatments. The lowest forage biomass yield for the three fertilization treatments was produced under the compost tea solution only treatment. The results indicated that both the compost tea solution and Fertilizer 4:1:1 (39) applied together had a definite positive effect on the standing forage biomass produced. However, to apply both fertilization treatments would not be very applicable in the Roggeveld region. Land users plant additional pastures to increase the carrying capacity of the land and for the land users to apply both the fertilization treatments would not be timely and economically viable. Results from soil analyses are required before a final conclusion can be made on the most beneficial fertilizer to apply.

Keywords: Roggeveld, planted pasture, oat, disc pasture meter, compost tea solution



The production of different lucerne cultivars in the Fish River Valley of the Eastern Cape, South Africa

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Lucerne (*Medicago sativa*) is the most important crop grown in the Fish River Irrigation scheme. More than 25 000 ha is planted to lucerne in the valley. This crop plays an indispensable role in stabilizing the stock farming enterprises in the region. The aim of this study was to evaluate the production potential and persistence of 21 different lucerne cultivars over a five year period. The study was carried out at the Cradock Experimental Station outside the town of Cradock as a small plot cutting trial under irrigation. Plots were cut to a height of 50 mm before second regrowth reached cutter bar height. A Fisher's protected LSD (least significant difference) test, at 5% level, was used to compare the treatment means. SA Select was the cultivar with the highest total dry matter (DM) production for the trial period (90.4 ton.ha⁻¹) while DS598 produced the most DM (12.0 ton.ha⁻¹) with the last cut (totalled over 5 seasons). KKS 7000 was the least dormant cultivar producing a total DM yield for the first cut of 16.3 ton.ha⁻¹ (totalled over 5 seasons).

Table 1 The total dry matter production (ton DM.ha⁻¹) for the first cut, the last cut and all cuts for the trial period compared within cut. Values in the same column with the same superscript letters do not differ significantly according to Fisher's LSD test ($p \leq 0.05$)

Cultivar	First cut (total over 5 seasons)	Last cut (total over 5 seasons)	All cuts (total over 5 seasons)
SA Standard	14.0bcd	11.9de	85.0bcd
SA Select	15.4bcd	10.8bcde	90.4d
WL 711	15.9cd	10.7bcde	82.6abcd
WL 525 HO	14.2bcd	9.7ab	78.1abc
WL 414	9.9a	10.1abc	79.5abcd
KKS 9911	14.7bcd	9.6ab	77.3abc
DS 598	14.2bcd	12.0e	82.9abcd
DS 788	12.0ab	9.7ab	77.9abc
WL 903	14.6bcd	10.5abcd	85.9cd
KKS 7000	16.3d	10.8bcde	84.0abcd
Super Star	13.8bcd	10.7bcde	81.7abcd
Super Aurora	11.9ab	9.2a	73.6abc
Icon	12.4abc	10.1ab	77.8abc
Super Siriver	12.8abcd	9.4a	77.0abc
Super CUF	13.8bcd	10.6abcd	78.8abc
Haymaster 10	14.1bcd	10.1ab	76.5abc
Haymaster 9	15.3bcd	10.9cde	83.2abcd
Magna 995	13.8bcd	9.3a	74.2abc
Sardi 7	14.8bcd	10.1abc	80.8abcd
Sardi 10	12.4abc	9.8ab	75.7abc
Minerva	11.7ab	10.1ab	81.0abcd
LSD _F (0.05)	2.67	0.99	7.74

Keywords: lucerne; production; irrigation; cultivar



Quantitative characterization and fodder value of structural polysaccharides in maturing hybrid maize

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Maize (*Zea mays*) contributes millions of metric tonnes of grain, stems and cobs annually, which partly alleviate energy deficits of ruminant herds subsisting on rangelands often under harsh environments of low rainfall and poor soils. The increased frequency in mid-summer droughts due to the El Nino Southern Oscillation is affecting production and quality of mostly structural components, nutrient value and metabolic energy supply and increasing energy loss as methane. In drier regions the rate of dryland maize crop failure is increasing and severe, because the crop is inadvertently grazed by ruminants for energy supply and physical fill. There is limited research on changes in structural polysaccharides, non-digestible components-lignocellulose, and rumen fermentation of this “circumstantial” forage as mid-season drought would dictate alternative crop use. The aim of the study was to determine the changes in spatial accumulation of structural polysaccharide in failed maize crops and the disappearance rates of nutrients. One forage maize hybrid planted under conventional tillage system in 2013/14 season was harvested at two wilting stages: stage A: 60 to 75 days (assuming total wilting at 70 days) and stage B: 85 to 100 days, from planting. Samples were collected at daily intervals. At each stage, eight whole maize plants were randomly selected and harvested 30 cm above ground level. Plant parts were divided into cob with kernels, leaves, sheath and stems. Samples were oven dried at 60 °C for 7 days and analysed for nutrient content and in vitro disappearance of organic and fibre components in a daisy Ankom system for 4, 8, 18 and 24 hours. There were no differences at both stages in dry matter (DM) content of leaves, sheath and stems, but proportions of neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose, cellulose, and soluble components increased with plant maturity; acid detergent lignin (ADL) and ash levelled at 50 and 110 g.kg⁻¹ DM. The cob and kernels and leaf had the highest dry matter. The cob kernel mixture was least in ADF, ADL and cellulose and inversely correlated to dry matter disappearance; in vitro dry matter degradability (IVDMD) was 740 g.kg⁻¹ DM within 24 hours compared to 380 g.kg⁻¹ DM for stems. Throughout the wilting periods the leaf and sheath showed the greatest increase in dry matter whilst the stalk and cob had lower rates of increase. Organic matter content was low in stems, sheath and leaves, and did not seem to change rapidly with crop wilting, at any stage. Acid detergent lignin of all parts of the plant was high during stage B; cob (12.5%); leaves (11.8%); sheath (10.5%); stems (16.3%). Although farmers who face the greatest challenge of producing maize under severe drought conditions are selecting hybrids adaptable to abiotic stress with earlier grain filling, the risk of failure with global warming continues to increase. There is opportunity to immediately graze the maize during the early stages of wilting to salvage nutrients in fibre components. Further research is ongoing to fractionate the fibre components.

Keywords: forage, fibre fractions, wilting, degradation, nutrition



Growth characteristics and fodder production potential of *Sorghum bicolor*

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Rainfall in the Coastal savanna of Ghana is erratic and irrigation and fertilizer application to pastures uncommon, causing dry season feed deficit. *Sorghum bicolor* is drought resistant and adapted to marginal soils. This study was to investigate the effect of harvesting *Sorghum bicolor* at 3, 6, 9 and 12 weeks after emergence (WAE) on Dry Matter (DM) yield and nutritive quality. Dry matter yield increased with advancing age. The whole plant DM yield ranged from 0.65 ton.ha⁻¹ to 12.40 ton.ha⁻¹. Plant height and NDF increased with advancing maturity. Crude protein (CP), RGR (relative growth rate) and leaf to stem ratio decreased with age. A mean RGR of 0.05 g.g⁻¹.d⁻¹ was recorded. Results showed that for optimum quality fodder, sorghum should be harvested at 9 WAE with whole plant DM yield of 9.6 ton.ha⁻¹, leaf CP of 97.85 g.kg⁻¹ DM and stem CP of 73.7 g.kg⁻¹ DM.

Keywords: *Sorghum bicolor*, relative growth rate, chlorophyll content, dry matter yield, crude protein

Relating canopy cover to water use of kikuyu pasture over-sown with temperate grasses or legume

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Irrigated pastures play an important role in dairy production in the southern Cape region of South Africa. Irrigation scheduling guides managers to determine the timing and amount of water to apply. Irrigation scheduling is based on soil water conditions, crop water requirements and climatic variables. Scheduling is critical for optimising production and water use (WU) efficiency. High input cost, due to the high price of energy for irrigation, put strain on profitability and economic sustainability of irrigated pasture systems for dairy farming. Despite the latest irrigation application equipment and scientific guidelines, there is still a lack of reliable data and information pertaining to water requirements and irrigation scheduling guidelines of over-sown pastures under grazing. Such information needs to be obtained and applied in order to increase WU efficiency at farm level. Water use by the crop is influenced by weather conditions, availability of soil water, crop type and growth stage. Full canopy cover is a growth stage at which the canopy intercepts most of the incoming radiation. A study on the WU of kikuyu pasture over-sown with temperate grasses or legumes was conducted on the Outeniqua Research Farm near George. The aim of this study was to relate the canopy cover to WU of these over-sown pasture systems. The hypothesis was that WU of grazed kikuyu pasture over-sown with temperate grasses or legumes, is dependent on the canopy cover, irrespective of the botanical composition of the mixed sward. Therefore, the objectives were to determine canopy cover [intercepted radiation and leaf area index (LAI)] and correlate it with WU. A permanent sprinkler irrigation system was used to irrigate pastures. Scheduling was performed according to tensiometer readings which were kept between -10kPa and -25kPa. Climatic, soil water and canopy cover data were collected for kikuyu/perennial ryegrass, kikuyu/socksfoot and kikuyu/lucerne pastures. A soil water balance was used to calculate WU and a ceptometer was used to measure intercepted radiation and estimate LAI. Results showed that there was a strong positive relationship ($p < .05$) between WU and percentage intercepted radiation and LAI for all treatments. As canopy cover increase over time, WU increased. Water use is therefore dependent on pasture's canopy cover, irrespective of the botanical composition of the mixed sward. Irrigation scheduling guidelines can be predicted from canopy cover of over-sown pasture system.

Keywords: water requirements, over-sown pasture systems, photosynthetically active radiation



Water use of mixed grass (kikuyu, ryegrass, cocksfoot and tall fescue species) and legume (clover and lucerne) pastures

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The utilisation of mixed grass and legume pastures in livestock production has grown significantly in recent years. The value of incorporating legumes, particularly white clover and lucerne, in mixed grass pastures has been highly regarded because it has improved yield and quality of grasses. However, it is well known that water is a scarce resource in South Africa and has the potential to limit production of these mixed planted pastures. To date, little information is available on how much water is required to grow good quality and highly productive mixed pastures. High water use for a pasture could be due to a small canopy cover. At this stage, approximately 90% of the water loss is due to evaporation from the soil. In a well established pasture, the canopy cover is dense which shades the soil preventing high water loss from soil surface. The aim of this study was to compute water use of a monoculture- and mixed pasture in accordance to their developing canopy cover. The field experiment was conducted at the University of Pretoria Hatfield Experimental Farm. Pure stands of *Pennisetum clandenstinum* (kikuyu), *Lolium perenne* (perennial ryegrass) and *L.multiflorum* (annual ryegrass), *Festuca arundinaceae* (tall fescue), *Dactylis glomerata* (cocksfoot), *Medicago sativa* (lucerne), and *Trifolium repens* (white clover) were planted in addition to mixtures of the aforementioned species in a completely randomised block design. Growth cycles were set at a minimum of 28-day intervals (depending on pasture maturity) with biomass, soil moisture content and leaf area indices collected weekly (7 day) to monitor growth rates. Each plot was irrigated to field capacity using a drip irrigation system weekly. Water use (evapotranspiration) was calculated from the soil water balance equation using 503DR CPN hydroprobe to measure soil water content. Biomass was harvested by clipping samples in 0.09 m² quadrats. Percentage PAR was determined from the ceptometer. The tall fescue/white clover mixture showed the highest monthly biomass yield of 2 000 kg DM.ha⁻¹ in May-August growth period. It was characterised by % PAR ranging from 21% in the early stages to 89% at maturity. The mixture of kikuyu/annual ryegrass/lucerne gave the lowest yield of 1 200 kg DM.ha⁻¹ in the similar growth period with %PAR in the range of 15 – 35% in its growing cycle. Furthermore, monocultures of lucerne, white clover and tall fescue yielded between 2 500 – 3 000 kg DM.ha⁻¹ and had %PAR ranging from 15 – 80%. tall fescue/white clover mixture exhibited monthly water use of 76mm as compared with kikuyu/annual ryegrass/lucerne mixture having the monthly water use of 84mm during their comparative dry matter production periods. Percentage PAR has been used as an indicator of canopy development. Lower percentage of PAR indicates low canopy cover, thus high loss of water through soil evaporation. High percentage PAR shows dense canopy with increased transpiration and yield production. It can be concluded monitoring canopy development in relation to dry matter production can be used to predict water use of mixed pasture.

Keywords: water use, mixed grass and legume pastures, canopy cover, soil water content, irrigation



The water use efficiency of irrigated SA Standard and Super Cuf lucerne varieties, in relation to dry matter yield and leaf to stem ratio.

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Lucerne is regarded as the most important pasture legume crop produced in the drier parts of South Africa for its high quality roughage (hay), when produced under irrigated conditions. Lucerne is renowned for its drought tolerance, but at the same time it is very responsive to water. This research sought to show the differences in the water use efficiencies of two irrigated lucerne varieties. This research was done under irrigated field conditions using Super Cuf and SA standard lucerne varieties. It is well known that SA Standard is not commonly used for hay making, whereas Super Cuf is and that farm management can significantly influence the varieties' performance. A total of 100 plots with 50 SA Standard plots and 50 Super Cuf plots were established in spring of 2010. The results discussed here were obtained in November of 2012 to June 2013. There were no significant differences ($p > .05$) between the mean seasonal dry matter yield, water use efficiencies and leaf area indices of the two varieties. The highest DM production of more than 2 tons.ha⁻¹ for both varieties was achieved in the month of March while the highest leaf to stem ratio was achieved in May. With regards to yield, the highest water use efficiency was achieved in June. The water use efficiency of both varieties ranged between 6 and 21 kg DM.ha⁻¹. mm⁻¹. There was no correlation between the seasonal water use efficiency and dry matter production in both varieties. The mean dry matter yield over nine harvest cycles for SA Standard was 1.79 tons DM.ha⁻¹.month⁻¹ and for Super Cuf 1.93 tons DM.ha⁻¹.month⁻¹. From the results of this study it is concluded that variety plays no role in either the seasonal dry matter yield or water use efficiency under the same management. Research is however continuing to establish the months when the quality of varieties becomes more important than dry matter production with regards to water use efficiency.

Keywords: lucerne, SA Standard, Super Cuf, water use efficiency, dry matter yield, leaf to stem ratio



Water use and bioenergy potential of subtropical Poaceae species as second generation field crops

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Edible crops used for bioenergy production are generally not sustainable or economically attractive due to their harsh demand on the environment or their short supply of the quantities of biomass necessary to meet large scale energy demand. Knowledge is lacking in the areas of water use, potential yield and management of non-edible (second generation) bioenergy crops under the climatic conditions of a water scarce South Africa. A study was consequently conducted with the aim to determine the water use efficiency of selected Poaceae species for bioenergy purposes, exposed to three different water regimes. Additionally, the aim was to determine how biomass production and corresponding calorific value are affected by different water regimes and harvesting intervals. The field trial was structured as a completely randomized block design, with water regimes and selected Poaceae species as treatments for the two factorial experiment. A drip irrigation system was used to impose three regimes of increasing available soil water, namely dryland, weekly and two weekly irrigation according to soil water content measurements. Eight different Poaceae species were included, resulting in 24 treatment combinations. The species planted vegetatively included *Pennisetum purpureum* (Napier), *Miscanthus giganteus* (Miscanthus), *Chrysopogon zizanioides* (Vetiver), *Hyparrhenia tamba* (Blue thatch grass) and seeded species *Brachiaria brizantha* cv. Mulato II, *Panicum maximum* cv. Mombasa, and the two control species (first generation bioenergy crops); *Sorghum bicolor* (sweet sorghum) and *Sorghum* spp. (grain sorghum). Treatments were replicated three times giving a total of 72 plots. Monthly destructive biomass sampling was done for three months and then the same harvesting procedure followed for the next three months in order to impose two harvest cycles until species became reproductive (approximately 10% blooming stage). Fresh and dry matter yields were determined. A ceptometer was used to measure fractional interception of photosynthetically active radiation and a LI3100 leaf area meter was used to determine leaf area index. Preliminary yield data indicated that supplementary irrigation resulted in either increases or decreases of biomass production, depending on the species. However, in most cases more frequent irrigation resulted in higher biomass yields. *Brachiaria*, *Pennisetum* and *Hyparrhenia* spp. produced considerably more biomass compared to sorghum, the first generation bioenergy crop species (Controls).

It can be concluded from preliminary results that some second generation bioenergy crops show potential to produce a significant amount of biomass at a relatively low water requirement.

Keywords: bioenergy, *Poaceae*, second generation crops, South Africa



Germination response of coated *Digitaria eriantha* seed in soils/substrates with different pH and salinity levels

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Mining in South Africa is increasing rapidly due to the increase in the demand for minerals such as coal, gold and platinum. These mined areas need to be rehabilitated by law. Mining activities change the soil profiles and properties of the soil, resulting in poor growth conditions that hinder the establishment of grass species. These unfavourable growth conditions, both chemically and physically, in addition to the presence of potentially harmful elements in the soil/substrate, can often restrict germination and root development which complicates the establishment and rehabilitation process. The technology to coat seeds with herbicides, pesticides, nutrients, etc. have shown much potential in previous studies and can facilitate the establishment of grasses in these chemically or physically degraded soil/substrate (growth) environments. The aim of this study was to evaluate the effect of the seed coating on the seed germination and seedling establishment in soils/substrates with different chemical and physical properties. The soil/substrate mediums under investigation include; coal discard, gold mine tailings, kimberlite, andalusite, fluorspar, gypsum and a red sandy loam cover soil as control medium. The objective of the study was to determine the effect of the soil/substrate pH and salinity on the germination, emergence and growth of *D. eriantha*. The study was conducted in a growth chamber on the Hatfield experimental farm, Pretoria. The study entailed a comparative analysis between coated and uncoated seeds in three phases. The first phase evaluated the seed and seedling response in a control medium (physically uniform sand coir mixture) with different pH (3, 5, 7 and 9). The second phase evaluated the seed and seedling response in the control medium with different salinity levels (0.05 M and 0.1 M NaCl), with the third phase focussing on the actual mine substrates. Each substrate was placed in a container and planted to one hundred seeds where three different water regimes were maintained to determine how water, influences germination in these environments. These water regimes included (a) 75% of soil moisture capacity, (b) 100% soil moisture capacity and (c) 125% soil moisture capacity. The percentage of live seedlings was calculated at four time intervals. The first two counts were determined by the guidelines set by the International Seed Testing Association (ISTA) and the second two counts were included at 5 day intervals thereafter to account for germination delays. At pH 5 the germination of coated and uncoated seed remained the same, while at pH 3, 7 and 9, uncoated seed had the same germination percentage relative to coated seed. The salinity trials however, showed no significant results. These preliminary results concluded that the germination of coated and uncoated seeds in the actual mine soils/substrates, indicated that germination is rather influenced by other factors such as high levels of minerals. The seedling vigour and health is being investigated further for any indirect benefits of seed coating.

Keywords: *Digitaria eriantha*, germination, emergence, pH, salinity, mine soils and substrates