



Session 18: Pastures III

Chair: Erika van Zyl

Salinity effects on germination potential of selected pasture grass species used for mine rehabilitation

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Coal mining destroys the environment and soil structure. A wide range of commercial grass/legume mixtures are used in rehabilitation of mined areas. The grasses are adaptable to the high levels of elemental contaminants and high salinity or electrical conductivity (EC). The aim of this study was to evaluate germination of three commonly used grasses, *viz.* *Cynodon dactylon*, *Digitaria eriantha* and *Panicum maximum* in solutions of varying EC. For each species 100 seeds were placed in 9 cm Petri dishes lined with Whatman #2 filter paper and allowed to germinate in distilled water or solutions of 100, 200, 400, 600, 800, 1000 mS/m (using NaCl) or Kleinkopje mine water with 405 mS/m. The design was a Completely Randomized Design comprising four replicates. Seeds were germinated in growth chambers at 25 °C and with 8 hours of light. The highest ($p < .05$) mean total germination was 71.3% for *C. dactylon* in distilled water. As EC increased, germination rate of *C. dactylon* declined linearly with a strong negative relationship ($p < .05$; $R^2 = 0.90$). The respective values for *P. maximum* and *D. eriantha* were 30.5% and 6.1% under distilled water. Germination of *P. maximum* decreased linearly with increasing EC ($p < .05$; $R^2 = 0.77$) whereas for *D. eriantha* germination decreased exponentially ($R^2 = 0.64$). When *C. dactylon*, *P. maximum* and *D. eriantha* seeds were germinated under Kleinkopje mine water, mean germination were 84.1%, 12.3% and 17.3% respectively. When seeds for *C. dactylon*, *P. maximum* and *D. eriantha* were germinated in varying EC, T_{50} was reached on day 3, 4 and 4.2 respectively. T_{50} of seeds in Kleinkopje water significantly ($p < .01$) decreased when compared to water for *P. maximum* and *D. eriantha*. Overall, the results demonstrated interspecific variations in grass species germination under saline conditions.

Keywords: germination rate, salinity stress, disturbed mine lands



The value of coated Rhodes grass seed in rehabilitation

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The increase in degraded areas by mining and poor agricultural practices, the quest for sustainable farming and rehabilitation challenges initiated a research project conducted by the University of Pretoria and North West University. One of the aims of the research is to identify if Rhodes grass (*Chloris gayana*) physiology is suitable to survive environments where rehabilitation is required. In addition, the research aimed to determine whether seed coating can benefit the establishment of Rhodes grass, and under which environmental conditions coating will improve the success of the rehabilitation effort. The objectives were met by conducting germination, emergence, establishment, production and survival and sustainability trials under controlled laboratory and phytotron conditions in addition to field conditions. We hypothesised that the use of coated Rhodes grass seed will improve establishment and subsequent stand success. The methodology focused on comparative analysis for the use of coated and uncoated seeds and included parameters often encountered by rehabilitation practitioners, such as water availability, growth medium amelioration, nurse crop inclusions and seeding rate variations. Results from the emergence trials showed that coated Rhodes grass seeds had higher emergence (up to 15% more) in a sandy loam soil. Amelioration of the growth medium influenced the emergence of seedlings from both coated and uncoated seeds. Coating can act as a water reservoir under dry conditions to improve the germination under these conditions. The subsequent success of establishment was evident in a field trial where the plant density was consistently higher when coated seeds were used, regardless of the sowing density. The higher plant density also influenced the number of weeds established in the stand, and the dry matter production of the stand. The coating ratio and the subsequent seeds per kg influenced the establishment when sowing at a fixed seeding rate (e.g. 7 kg.ha⁻¹). A coating ratio of 1:5, that is five times less coated seeds than uncoated seeds, exerted more effective competition to exclude weeds when compared to a 1:7 coating ratio. This suggests that an adjustment in seeding rate must be considered under such conditions. The data from this research project show that Rhodes grass is able to adapt to several severe environmental conditions, such as drought, acidic or saline conditions and is able to utilize resources very efficiently. The benefits of using coated Rhodes grass seed are evident from these comparative studies.

Keywords: *Chloris gayana*, seed coating, establishment, production



Inter- and intra-species competition as influenced by variable seeding rates and nurse crop association

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The secret of successful planted pastures lies in the execution of good pre-establishment techniques such as optimal seeding rates and nurse crop function. The current debate on the value of higher or lower seeding rates of pasture species, and the inclusion of a nurse crop in production systems, raises the concern of whether significant competitive effects exist amongst plants in the sward. *Eragrostis curvula*, *Digitaria eriantha* and *Chloris gayana* are commonly cultivated subtropical grass species in South Africa and are used as test species in this field study. Replicated field experiments in a Randomized Block Design were conducted, evaluating the pasture growth response to variable seeding rate treatments (80% of selected seeding rate, selected seeding rate and 120% selected seeding rate) of uncoated and conventionally coated seed; in the case of *D. eriantha* and *C. gayana* Mycortex coated seed was also used. The experiments included the measurement of the effects of an annual nurse crop, *Eragrostis tef*, on the establishment of associated perennial grass species. A primary function of the nurse crop planted with a perennial grass species is to minimize fierce weed competition. It was concluded that a higher seeding rate gave a better first season plant density, however, the following season this treatment had an equal plant density as the original lower seeding rate treatments for *E. curvula* and *C. gayana*. This was due to intraspecies competition (competition between plants of the same species) in season one resulting in plants out competing one another. The establishment success of perennial species was lower, where nurse crops were included as a result of interspecies competition (competition between plants of different species). Season two data indicated that *D. eriantha* and *C. gayana* did not have lower plant densities where a nurse crop was planted, whereas *E. curvula* still had significantly lower plant densities. The results highlight the interactive effects between seed coatings, seeding rates and nurse crop treatments as a function of selected species.

Keywords: nurse crop, seeding rate, *Eragrostis curvula*, *Digitaria eriantha*, *Chloris gayana*