The emergence and survival of *Digitaria eriantha* and *Chloris gayana* seedlings on mine tailings planted with coated and non-coated seed

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Introduction

The importance of vegetation in the process of rehabilitation and stabilization of mined land is becoming more critical as the size of the affected areas and the impact on urban development increase. Successful establishment of vegetation on these areas is complicated by adverse physical and chemical properties of the growth media. These include: soil compaction, acidity, salinity, heavy metal contamination, extreme temperatures, low soil water content and soil erosion (Oncel et al. 2000; Turner et al. 2006; Aken et al. 2007). Many of these soil/substrate conditions limit the establishment of vegetation from seed.

Turner et al. (2006) suggested that seed coating technologies were a possible solution to difficult seeding challenges, by facilitating more successful establishment of vegetation in these hostile environments. From humble beginnings, seed coating technologies can now be used to ameliorate the root zone by chemically changing the environment, aerating the root zone or improving the seedling's health through inoculation with beneficial micro-organisms (Harman 1991; Ashraf and Foolad 2005; Thrall et al. 2005; Turner et al. 2006). These specific attributes are not always clear and environmental specialists do not always know they have access to technologies that can change the micro-environment of a seedling.

Methodology

Phytotron studies at the University of Pretoria's Experimental Station were conducted to determine whether, and under which conditions, coated seed can assist in establishing a strong sward. Two species, *Digitaria eriantha* (Smuts finger grass) and *Chloris gayana* (Rhodes grass), were used to evaluate the efficacy of seed coating (AgriCOTE®) in improving growing conditions. Five replicates of 100 coated and uncoated seeds of each species were planted on the surface of the growth media and slightly compacted to ensure good soil contact. The 4 growth media used in this trial, namely: a red sandy loam; gold tailings with <1% pyrite; gold tailings with >2% pyrite; and platinum tailings, are described in Table 1.

Soil water content was manipulated by using field capacity (FC) (-0.03 MPa) as the reference point, adding 25% more (125%) and 25% less water (75%), to create 3 soil water content treatments. The treatments were placed in a randomized design, within a growth chamber at 23 ± 5 °C and covered with a clear plastic to prevent excessive water loss. The percentage of live seedlings was monitored daily over periods of 20 and 24 days for *D. eriantha* and *C. gayana*, respectively, to give an indication of germination percentage and survival likely under these growing conditions. This test was 10 days longer than the ISTA guidelines recommend for determining germination percentage for these species (ISTA 2006). Analysis of variance (PROC GLM) was done using SAS 9.2 software. Analysis was done within species and $P \leq 0.05$ was used to determine significant differences.

Results and Discussion

No consistent differences in germination and survival between coated and uncoated seed were observed for the two grass species tested on any growth medium (Figure 1). Overall germination and survival of the two species followed a similar pattern, with worst results on

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Table 1. Growth medium properties.

Growth medium	pH(KCl)	EC[1] (mS/m)	SO_4-S (mg/kg)	Texture		
				% sand	% silt	% clay
Red sandy loam	4.1	13.0	12.0	92.8	2.9	4.3
Platinum tailings	8.0	205.0	143.0	90.5	7.4	2.1
Gold tailings with <1% pyrite	5.3	193.0	1674.0	71.2	24.2	4.6
Gold tailings with >2% pyrite	6.4	422.0	447.0	86.1	11.8	2.1

[1]EC = electrical conductivity.

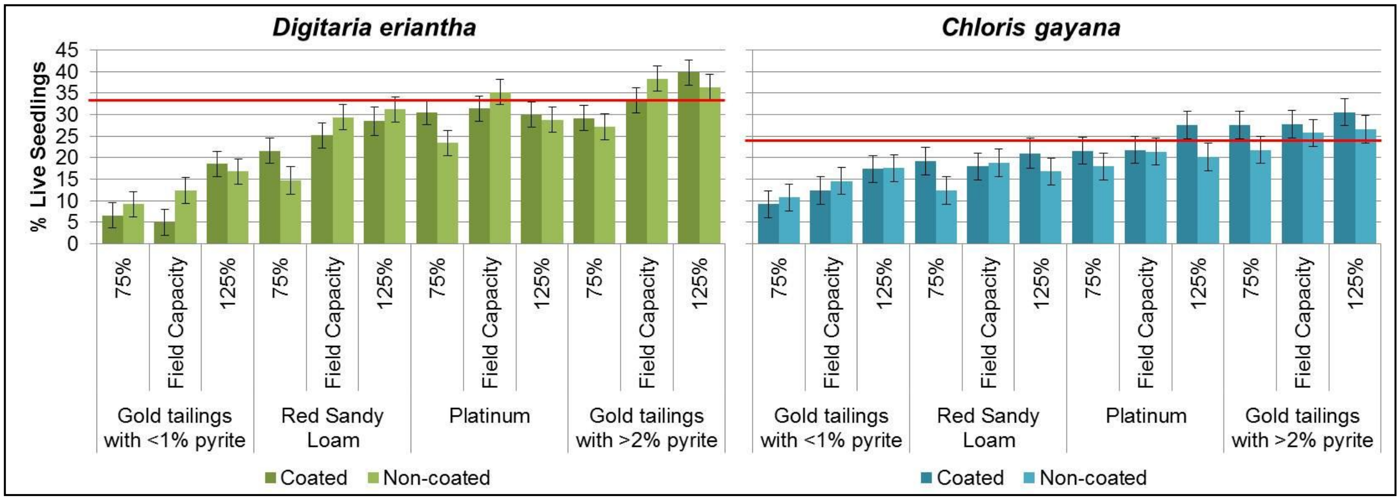

Figure 1. The maximum percentage live seedlings from coated and uncoated seed of *Digitaria eriantha* and *Chloris gayana* over 20−24 days for the different growth media, within a range of soil water content levels, field capacity (FC), 75% of FC and 125% of FC. Red lines show germination % for these species as reported by a seed test laboratory.

gold tailings with <1% pyrite and best on gold tailings with >2% pyrite; red sandy loam and platinum tailings were intermediate. The poor results on the gold tailings with <1% pyrite are possibly due to the high sulfate (SO_4-S) content of this growth medium responsible for the formation of sulfuric acid, which influences germination (ISTA 2006; Aken et al. 2007). The results may also be influenced by the large fraction of fine particles <75 µm in the gold tailings with <1% pyrite (28.8%), which can contribute to crust formation and sealing, and impede subsequent germination. It is also important to note that the clay fraction refers to the particle size of very fine grained rock <2 µm and not to a functional clay as found in natural soils (Ashraf and Foolad 2005).

In general, within growth media, there was a tendency for the best germination and survival levels to be obtained with the 125% field capacity treatments.

Conclusion

The results of this study failed to show any consistent benefit of seed coating on germination and survival of seedlings on the growth media tested. However, there was a trend for *C. gayana* to be more responsive to seed coating than *D. eriantha*.

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