Comparing enhanced and non-enhanced grass seed types used in re-seeding rehabilitation practices

Y Brits and K Kellner*
*School of Environmental Science and Development, North-West University
Email: klaus.kellner@nwu.ac.za

Introduction

Environmental management considers the restoration and rehabilitation of neglected cultivated pastures, degraded rangelands (due to overgrazing and climatic impacts) as well as mining and industrial areas as top priorities (Bradshaw 1997, Urbanska *et al.* 2000). Highly degraded areas need to be re-seeded to increase re-vegetation cover, density and bio-mass (van den Berg 2002, Warren *et al.* 2002). Re-seeding activities require high input costs and are influenced by the quality and effectiveness of the seed used, especially with regard to the germination and establishment under natural field conditions (van den Berg, 2002, van den Berg and Kellner 2004, Snyman 1999, Snyman 2003, Edwards and Abivardi 2000). If techniques can be developed to improve the effectiveness of germination and establishment rates the rehabilitation process can be enhanced. Commercially available grass seed has a better germination and establishment rate in comparison with seed locally harvested (which might include many impurities). However, the availability of these seed types, especially of certain ecotypes adapted to specific environments, is poor.

Enhanced and non-enhanced seed

Advance Seed Company (Krugersdorp, South Africa) has taken commercial available grass seed to the next level by enhancing (coating) the seed with AgriCOTE^{GT} (containing a combination of binding material, fungicides, growth stimulants, rhizobia, lime and nutrients) which includes several treatments. Although the seed can be more expensive than non-enhanced seeds in the initial stages of sowing, it may increase the germination, establishment and growth of grasses in the long-term. Benefits of the enhancement include the better handling of the seed, better seed-to-soil contact, insecticides, growth stimulants, fungicides and pesticides, higher seed purity and increased seedling survival.

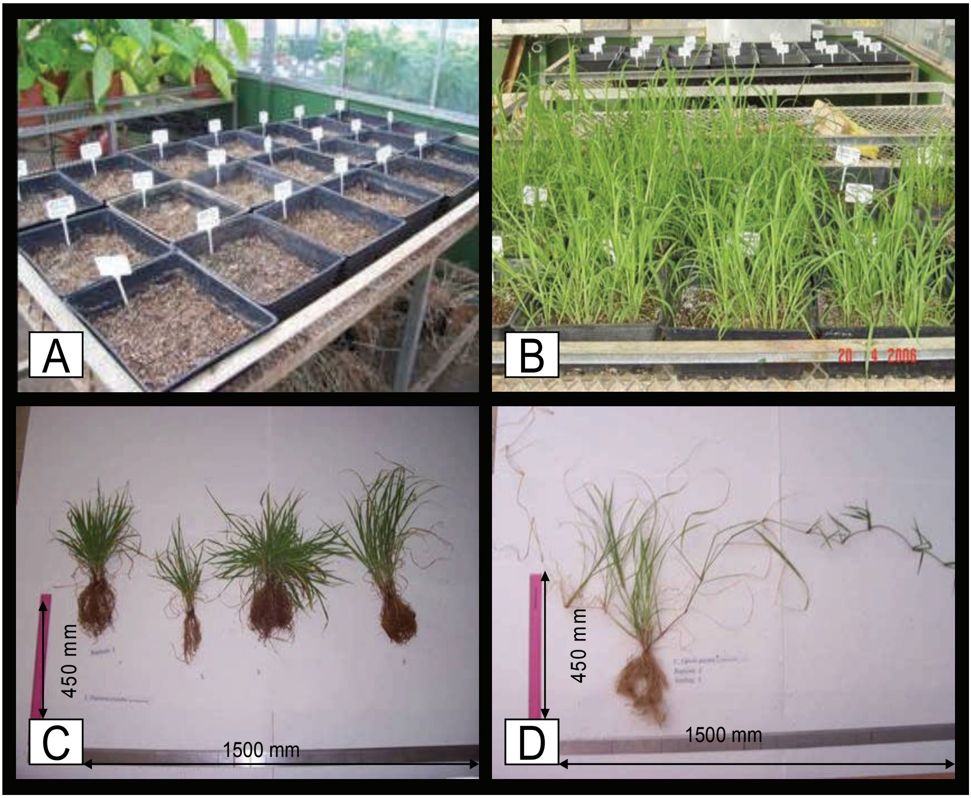

Figure 1 (A). The trays in which seeds were planted in Hygromix growth medium and kept moist; (B) The seedlings in the Hygromix growth medium after a growth period of 7 weeks, just before the first biomass monitoring; (C) *Digitaria eriantha* non-enhanced grass seed type as an example of the uprooted and washed seedlings used in the biomass monitoring; (D) *Chloris gayana* non-enhanced grass seed type as an example of the uprooted and washed seedlings used in the biomass monitoring.

Aims

Investigations on the dry matter biomass accumulation under controlled and natural conditions of selected enhanced and non-enhanced seed types.

Material and methods

Seed types used

We used four species, enhanced and non-enhanced: *Chloris gayana* (C.gay), *Cynodon dactylon* (C.dac), *Digitaria eriantha* (D.eri) and *Eragrostis curvula* (E.cur), (with several enhancements detailed below)

Glasshouse trials

For each grass seed sample, 100 seeds were sown in Hygromix growth medium in seedling trays (four replicates) and kept under controlled conditions at 20°C night and 25°C day temperature (Figure 1

A. & B.). After four months, the above (leaves) and below (root) ground biomass of the dry material was determined for each seed type (Figure 3). The seedlings used in the biomass measurements were randomly selected. The roots and leaves were cleaned form most impurities, before drying (Figure 1 C. & D.).

Natural field trials

Sites were established in March 2006 at the experimental farm of the Agricultural Research Council in Potchefstroom. Three replicates for each of the grass seed types were established. Seeds were sown in rows at seeding rates recommended by Advance Seed Company. Irrigation by means of a dragline sprinkle irrigation system was applied and weeds were chemically and mechanically controlled.

Vegetation surveys were carried out 9 months after establishment (Figure 2 D.). Density of each species per 1m² quadrat was determined. Biomass accumulation was determined by clipping all the above ground leaf material in three 1m² quadrats. Dry matter production was calculated as g/m² and kg/ha for

Figure 2: (A and B) The cultivation and preparation of the natural field before sowing the selected grass seed types; (C) Sowing the seeds in rows by hand; (D) Grass sward after a nine month growth period (January 2007).

each grass species (enhanced and non-enhanced).

Results and discussion

Glasshouse trials

Only the average above and below ground biomass for the enhanced seed types of *C. gayana* was slightly higher (Figure 3). The opposite is true for the above and below ground biomass of *C. dactylon*, *D. eriantha* and *E. curvula* (all treatments). The only significant difference ($p<0.05$) was observed in the case of above ($p=0.025$) and below ($p=0.043$) ground biomass of *D. eriantha*.

Natural field trials

All the enhanced seed types had a higher density under natural conditions, except for *D. eriantha* (Figure 4). The only significance occurred in the *C. dactylon* ($p=0.046$) and *D. eriantha* ($p=0.049$) sites.

All the enhanced seed types indicated higher dry matter biomass (g/m²) under natural conditions, except for *D. eriantha* (Figure 5). The only significance difference occurred in the *C. gayana* ($p=0.049$) and *C. dactylon* ($p=0.049$) sites. The average dry biomass in g/m² were converted to kg/ha.

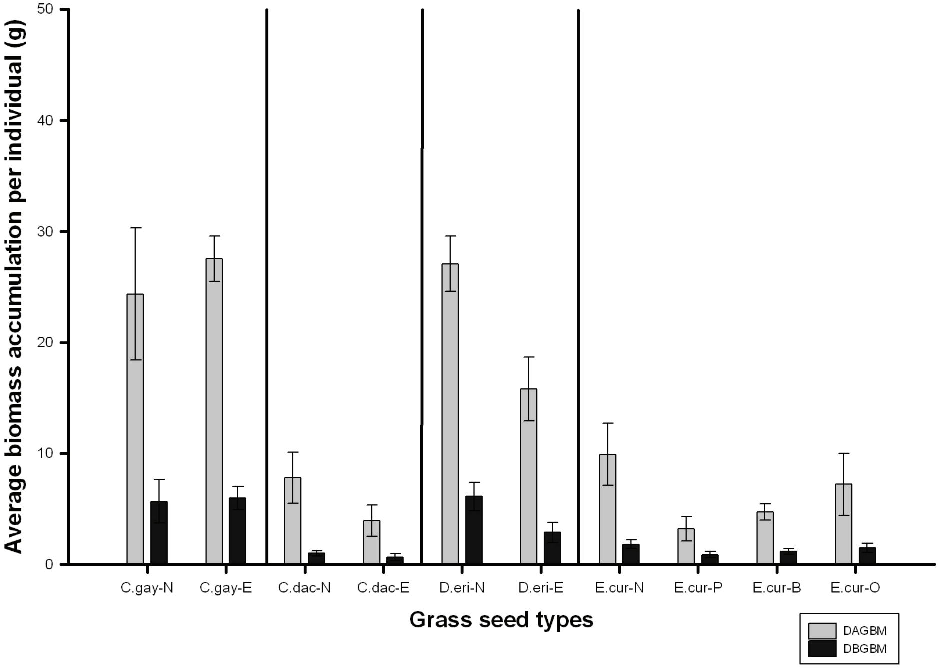

Figure 3: Average dry above (DAGBM) and below (DBGBM) ground biomass (g) of selected grass seed species after 4 months (July 2006) (N -non-enhanced; E – enhanced; P – plain coat (In the case of E. cur); B – insecticide on base of coat; O – insecticide on base of coat and as overspray.

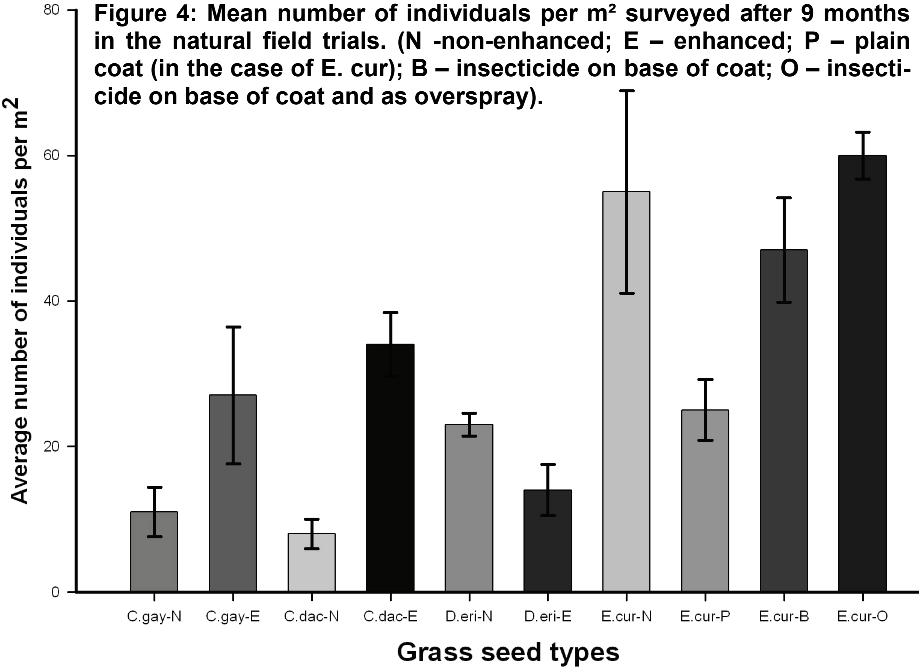

Figure 4: Mean number of individuals per m² surveyed after 9 months in the natural field trials. (N -non-enhanced; E – enhanced; P – plain coat (in the case of E. cur); B – insecticide on base of coat; O – insecticide on base of coat and as overspray).

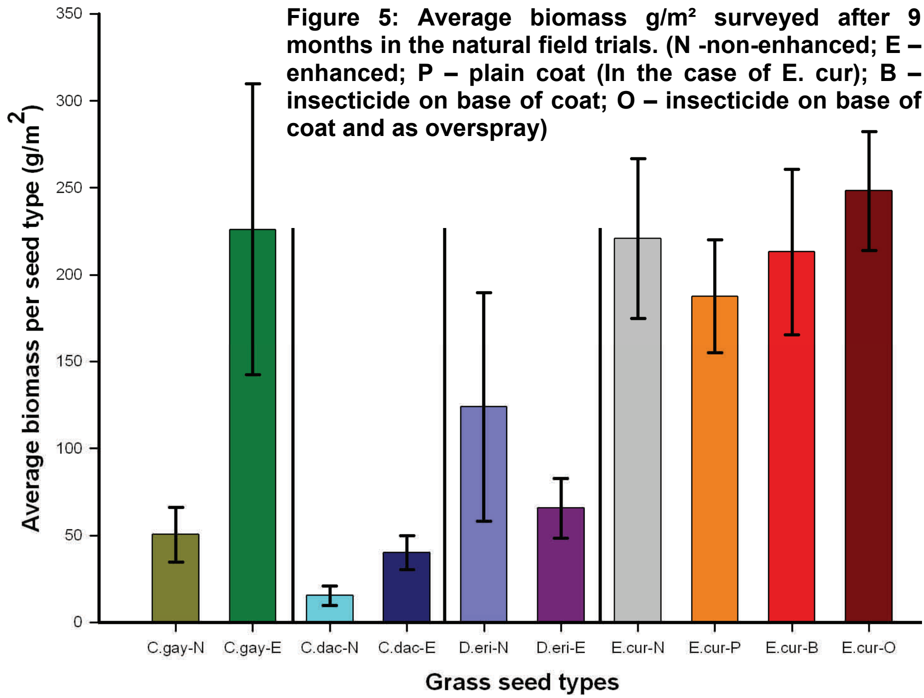

Figure 5: Average biomass g/m² surveyed after 9 months in the natural field trials. (N -non-enhanced; E – enhanced; P – plain coat (In the case of E. cur); B – insecticide on base of coat; O – insecticide on base of coat and as overspray)

Table 1: The average dry biomass yield for the selected grass types (kg/ha)

Grass seed types	Dry biomass yield (kg/ha)
C. gayana (non-enhanced)	504.8
C. gayana (enhanced)	2261.0
C. dactylon (non-enhanced)	153.4
C. dactylon (enhanced)	402.5
D. eriantha (non-enhanced)	1240.0
D. eriantha (enhanced)	656.3
E. curvula (non-enhanced)	2210.0
E. curvula (plain coat)	1876.0
E. curvula (base & over-spray)	2133.0
E. curvula (overspray)	2483.0

Conclusion

The enhanced seed types of *C. gayana* (glasshouse and field trials), *C. dactylon* (field trials) and *E. curvula* (field trials – insecticide on the base and as overspray) had a higher density and dry matter production. For the *D. eriantha* seed types, the non-enhanced seed type had the highest dry matter production and density in the glasshouse and the natural field trials. The biomass accumulation between the glasshouse and field trials do not correspond in most instances. The explanation for this difference can be attributed to the fact that the seeds in the glasshouse trials were sown in a Hygromix growth medium that included a number of nutrients, which could have benefited the non-enhanced seed types. Another explanation to the non corresponding data is that the DM for the glasshouse were measured only four months after establishment under controlled conditions, while the DM production for the field trials were determined after 9 months after being subjected to natural conditions. These results indicate that it is advised to use enhanced seed types of mainly *C. gayana*, *C. dactylon* and certain types of *E. curvula* in seed mixtures to increase the establishment and DM production in the rehabilitation practices of degraded natural fields.

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Congress 2009 Special Session

Determining the biodiversity benefits of agricultural good management practices for animal production

World Wildlife Fund-South Africa, in conjunction with South African National Biodiversity Institute's Grasslands Programme and University of Kwazulu Natal's School of Biological and Conservation Sciences, wants to explore the link between agricultural good management practices for animal production systems on natural grasslands and biodiversity conservation

The key question: If agricultural good management practices are implemented, what biodiversity features are well conserved, which ones are not well conserved and which ones need further research?

WWF's work with the Grasslands Programme is focused on mainstreaming biodiversity in the agricultural sector. One of the key deliverables is to explore how biodiversity can be considered more effectively in animal production systems on natural grasslands. Therefore, instead of handing over all possible biodiversity good management practice guidelines for use in the agricultural sector, the approach is to consider what is agricultural good management practice for animal production systems, what guidelines exist, what are the benefits for biodiversity and for ecosystem goods and services (i.e. grazing resources, pollinators, water, carbon, sedimentation), and then to consider what biodiversity good management practice needs to be incorporated into agricultural good management practices.

A Concept Paper will be prepared in advance of the session. This will be emailed out by early July 2009 to those attending the Special Session.

The Special Session will be an open session, but every attempt will be made to identify and invite specific specialists from the agriculture and conservation sectors to participate in the session.