The effect of alternative soil amendments on the botanical composition, basal cover, dry matter production and chemical properties of re-vegetated mine land

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Keywords: acidic soils, infertile soils, fly ash, sewage sludge, soil amendment

Introduction Coal mining impacts large grassland areas of the Mpumalanga Province of South Africa. To mitigate such impacts, it is imperative to restore the once productive soils to the best possible condition. The re-vegetation of mine land presents a particular challenge. Soils being rehabilitated are often acidic and nutrient-deficient, which are major limiting factors in re-vegetation programmes. Conventional methods of liming and inorganic fertilisation have been used to improve the productivity of impacted soils. In the past few years the use of a coal combustion by-product, class F fly ash, and an organic material, such as sewage sludge, have demonstrated the feasibility of using such materials to amend acidic and infertile substrates (Truter, 2002; Norton *et al.*, 1998). The objective of this research was to determine if alternative amendments can create a more sustainable system where botanical composition, basal cover, dry matter production and soil chemical properties can be improved.

Materials and methods A field experiment was established in January 2000 at an opencast coal mine in the Mpumalanga Province. These soils were amended with class F fly ash, a mixture of fly ash and sewage sludge, dolomitic lime and compared to the standard mine treatment (conventional lime and inorganic fertilisers) and a control (no treatment). Soils were re-vegetated with a mixture of Teff (*Eragrostis tef)*, Rhodesgrass (*Chloris gayana),* Bermuda grass (*Cynodon dactylon)*, Smutsfinger grass (*Digitaria eriantha)* and lucerne (*Medicago sativa).* Botanical composition, basal cover, dry matter production and soil chemical properties (pH, P, K, Ca and Mg) were monitored seasonally.

Results The percentage basal cover and botanical composition in 2004 is given in Figures 1 and 2. It is evident, from the observations made four years after establishment, that soils receiving a mixture of fly ash and sewage sludge (S) had a higher percentage of Rhodesgrass, and a higher production, whereas the control (no treatment) had a higher plant diversity.

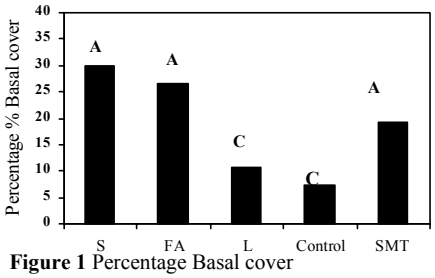

Figure 1 Percentage Basal cover

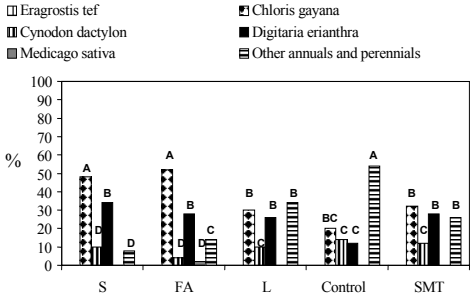

Figure 2 Botanical composition on soils receiving different amendments

*Means with same letter are not significantly different (*P*> 0.05) Tukey's Studentised Test.

Conclusions Results indicate that alternative ameliorants (fly ash and organic materials) can have a marked beneficial effect, which is still evident in the fifth season, despite no fertiliser having been applied since the first season. This would appear to indicate that such ameliorants produce a more sustainable vegetation than the current practice.

References

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