Introduction

Coal is the world’s most abundant and widely distributed fossil fuel and is the primary energy source for several countries world-wide. The Mpumalanga province of South Africa is rich in coal reserves, and produces about 80% of the country’s coal. Coal extraction is essentially mined by two methods, namely underground and open-cast method. Unfortunately these are very destructive processes, and the environmental implications associated with this is very serious, such as disturbance of landscape topography, poor management of waste such as stock piles, spoils, tailings and dumps, loss of topsoil and greenery (due to topsoil removal and acid water) to name a few. Most importantly, mining also has a negative impact on soil fertility. Soil can become less fertile due to removal of top soil, destruction of crops through uncontrolled blasting activities, and contamination of soil and oil spillages. Soil can lost its ability to retain water through blasting-induced cracks and subsidence due to underground pillar collapse.

Natural soil horizons developed over thousands of years in a specific sequence and is the result of soil genesis of the parent rock driven by climatic conditions (temperature and moist) within a specific topography. Rehabilitation aim to reconstruct the original horizon sequences by stockpiling, where the different layers of topsoil are removed separately and dumped on separate sites, to in future replace them back as the final topsoil. Stripping and replacing of soil will always result in a moderate to severe disturbance of the natural balances in the soil’s physical, biological and chemical properties due to loss of organic material, loss of nitrogen and other nutrients, compaction, erosion and runoff amongst others. Because of these changes, the soil becomes a less favourable environment for soil organisms and consequently, have lower soil aggregate stability, lower infiltration rates, reduced water holding capacity, and a greater capacity to resist root extension, all of which inhibit the potential for plant growth and establishment on the rehabilitated soil.

Historically, when a coal measure was exhausted, production ceased and collieries were boarded up and abandoned. Today, the Government of South Africa, by law, requires that mines have to be rehabilitated and the post mining landscape returned to a sustainable land use.

Goal

To assist Wescoal Mining in the rehabilitation process to return the soil to its pre-mining potential and optimum agricultural land.

Procedure

A 1 ha area of land was identified and allocated for rehabilitation purposes at Khanyisa Colliery in the Ogies/Leandra district of Mpumalanga. Soil samples were taken and a standard soil analysis as well as a 1:2 water extract was conducted in order to determine the total nutrients that are in reserve in the soil as well as the plant available nutrients in the soil solution. A complete soil application and foliar spray recommendation was compiled according to the results of both analyses. The land was prepared by incorporating 20 t of chicken manure and 4 t of lime into the designated area.

A high yield N, P, K, Ca, Mg and S basic fertilizer programme was applied together with AgriLibrium’s soil and leaf applied growth stimulation programme.
Microorganisms (QCM360) and Fulvic Acid (ByoCarb50) was applied prior to planting and again at week 7 in order to re-populate the soil with beneficial organisms. Multi-Start was applied at planting to stimulate root growth and increase resistance against drought and other plant stress. Multi-Fol was applied every 3 weeks during the growth cycle to stimulate root growth and increase nutrient and water uptake. DynoMoB and CalTrain was applied at week 7 and week 13 after planting.

Climatic conditions however, were not favourable as South Africa experienced immense heat waves and drought conditions which lead to replanting of some of the seedlings.

Below are pictures of the rehabilitation process at Khanyisa Colliery.

![Planting of the spinach and cabbage seedlings in October 2015.](image_url)
Left: Spinach seedlings

Left: Cabbage seedlings
Above: The cabbage and spinach in December 2015

Left: Some of the plants did not survive the immense heat
Above: The produce was donated to a local retirement village.

The second phase of the rehabilitation project comprise of the planting of winter cover crops such as vetch and oats and will commence in April/May 2016. The planting of cover crops has quite a lot of advantages: it puts organic material back into the soil which in turn will help to improve the soil’s water holding capacity, provide food for beneficial organisms that has to be sustained in the soil, helps build soil structure, prevents erosion from wind and water and helps to cool and stabilize temperature.

The cover crops is also a source of feed for local farmers who will indeed need it for the cattle in the coming winter months due to the drought we experienced this season.

After the winter, the cover crop will be rolled flat as a mulch cover and dry land maize will be planted as the third phase of rehabilitation. The aim is to determine whether the same or an even better yield can be reached than what was attained before mining activities started.

At the present time there is little doubt that soils can be very successfully rehabilitated after open cast mining activities has ceased providing that the correct procedures are followed and the rehabilitation program is fully implemented.