Soil Attributes at the Powell River Site as Compared to Optimum Soil Characteristics

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ABSTRACT

The Southwest Virginia Community College Region V Governor's School students participated in a research project at the Powell River Education Center located in Wise County, Virginia, during the summer of 2003. The purpose of this study was to collect and analyze soil data from three different locations at the Powell River Site. The Environmental Science students examined soil attributes at the three sites, using the forest site as a control, and compared them to representative optimal soil characteristics for post-mining land use. They did this to establish whether the quality of soil on the disturbed land is comparable to undisturbed forest soil and whether the soil in the disturbed areas is suitable for post-mining activities with no application of agrochemicals or other land treatments.

The students gathered soil samples from three soil pits selected randomly at the site. One set of samples was collected from an undisturbed forest site near the pavilion. A second set of samples was collected from an untreated section of reclaimed mine soil that was being used for pasture near the barn. The untreated soil consisted of only blended mine spoils. A third set of soil samples was collected from a section on reclaimed mine soil treated with municipal sewage sludge. This section was also in an area near the barn that was being used as pasture. Each of the three plots was sampled using sampling techniques and procedures described in the Soil Science Laboratory Manual for Community College Science Courses by Dr. Craig M. Ashbrook and the LaMotte soil analysis test kits. Samples were taken to determine whether soil nutrients and pH were at acceptable levels in each plot. The Lamotte Soil Analysis Test Kit was used to determine the phosphorus, potassium, nitrogen and pH levels of the sample soil.

Three soil pits were dug at each location with a "team of students" assigned to each soil pit to collect and analyze the soil for primary nutrients (nitrogen, potassium and phosphorus) and pH. Two soil density canisters were filled from each location to test for soil bulk density and particle density. Students measured the soil bulk density and particle density to determine soil porosity and how much the soil was compacted. The samples were returned to the lab where the soil was analyzed. The sampling was conducted within the soil horizon A at a depth of 15 cm below the surface, with sampling techniques applied to each soil pit. An average of the soil attributes from each location was established. Three pits were constructed within an undisturbed forest, which will stand as a control. The soil at the other two locations were compared or contrasted with the soil taken from the undisturbed forest site. The soils at the reclaimed mine land sites were also compared and contrasted to results from previous years. The soil attributes at each location were compared to optimum soil attributes of representative plant needs.

After testing the soil samples from the undisturbed forest, the untreated reclaimed mine soil, and the sludge treated reclaimed mine soil sites, the results concluded there is no significant difference of nutrient levels in soils tested from undisturbed forest and reclaimed mine land. The nutrient levels in the reclaimed mine land sites were similar enough to the forest site to suggest that the same type of vegetation that is found in the undisturbed forest should be viable in reclaimed mine land soil.

Summary Results - Average Soil Attributes

Attribute	Forest	Treated	Untreated
Nitrogen	35.8 Lb/acre	26.7 Lb/acre	12.5 Lb/acre
Potassium	123.3 Lb/acre	156.7 Lb/acre	130 Lb/acre
Phosphorus	15 Lb/acre	61 Lb/acre	45 Lb/acre
pH	5.75	6.28	6.17
Bulk Density	1.06 g/ml	1.69 g/ml	1.64 g/ml
Particle Density	1.83 g/ml	2.26 g/ml	2.7 g/ml
Porosity	42.65 %	25.05 %	36.75 %

Testing of three different soil samples of undisturbed forest, untreated pasture, and sludge treated pasture at the Powell River Project Site showed no major statistical difference in the soil nitrogen levels. The average nitrogen level in the undisturbed forest was 35.83 lbs/acre. This average included one sample that was very high (140 lbs/acre) compared to the other five samples (15lbs/acre) taken from the forest. In the undisturbed pasture the average nitrogen level dropped to 12.5lbs/acre, and increased to 26.67 lbs/acre (which included two samples measuring 50 lbs/acre and four samples of 15 lbs/acre) in the sludge treated pasture.

Statistical analysis using T-test procedures with an alpha value of .05 indicates that there is no significant statistical difference in the potassium levels of reclaimed mine land as compared to the natural undisturbed forest at the Powell River Site. The average potassium level of undisturbed forest soil was 123.33 lbs/acre. The untreated soil had an average potassium level of 130 lbs/acre. The potassium level in the treated soil was slightly higher than the other two, averaging out at 156.67 lbs/acre.

There was no significant difference in the levels of the phosphorous tested from each of the sites. The group average for trial 1 and trial 2 for the undisturbed forest soil was 15lbs/acre. The group average for trial 1 and trial 2 for the treated soil was 61lbs/acre. The group average for trial 1 and trial 2 for the untreated soil was 45lbs/acre. The phosphorous level in the treated soil was higher than both the undisturbed forest and the untreated soil. The phosphorous level of the forest was the lowest of the three tested sites.

The average pH of the treated mine reclaimed soil was 6.28. The pH of the untreated reclaimed mine soil was 6.17 and the pH of the undisturbed forest soil was 5.75. The pH of the forest was significantly lower than the pH of the reclaimed mine soil. All pH levels were within optimum pH levels for most forest vegetation. Some selectivity

in choosing plants for reseeding reclaimed mine land may be necessary due to the need of more specific pH levels for those plants.

The bulk density and particle density tests were used to determine the porosity of the soils at the 3 test sites. The average porosity for the forest was 42.65%. The untreated site was 36.75% and the treated site was 25.05%. The relatively high porosity level probably contributes to leaching of nitrogen resulting in reduced availability for plants.

The Powell River Research Project provides an excellent learning opportunity for students of the Region V Governor's School for Science and Technology to conduct research on previously donated strip-mined land.