

CHEMICAL AND PHYSICAL PROPERTIES OF LIGNITE SPOIL MATERIAL AND THEIR INFLUENCE UPON SUCCESSFUL RECLAMATION

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A three year forage crop study was initiated in 1975 at the Big Brown mine in Freestone County, Texas, to determine the yield and reclamation potentials of various grasses and legumes on a lignite mined soil. Grasses used in the study included NK-37 bermudagrass, Coastal bermudagrass, Kleingrass, bahiagrass, and Callie Giant bermudagrass. Legumes utilized included Yuchi arrowleaf clover, Crimson clover, and alfalfa. Kleingrass, Coastal bermudagrass, and Yuchi arrowleaf clover proved to be the most productive species of the forages tested.

Statistical analyses demonstrated that nitrogen was the most limiting fertilizer nutrient necessary for the production of grasses on the mined soil. Phosphorus was shown to be the most important fertilizer nutrient which must be added for adequate legume production.

Nitrate-N was more effective in increasing Kleingrass production than was $\text{NH}_4\text{-N}$ because of surface application of the nitrogen fertilizers, extremely low nitrification potentials in the mined soils, droughty soil surface conditions during summer months, and the low surface rooting density of Kleingrass. This result was also observed for Coastal bermudagrass when the nitrogen fertilization rate was less than 112 kg/ha/yr.

Ammonium fixation capacities as high as 7.8 meq $\text{NH}_4\text{-N}/100\text{g soil}$ were obtained with mined soil samples in the laboratory. Residual lignite in the soil was responsible for fixing a large portion of this $\text{NH}_4\text{-N}$. Decreased nitrogen availability because of NH_4 fixation should not be a problem on a field basis, however, as demonstrated by recoveries of applied NH_4 fertilizers.

Soil reaction apparently declined rapidly after mining until the readily oxidizable pyrite was consumed. Soil pH values then stabilized and did not change significantly during the three year period of study. The final mean pH of the study area was approximately 4.4.

Soil oxygen concentrations in the mined soils were correlated with soil moisture by volume and depth in linear regression models. Depth better explained the soil oxygen concentrations in wet portions of the year than did soil moisture. Soil moisture, however, explained as much or more of the soil oxygen concentration in drier portions of the year.

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