EVALUATION OF MICROBIAL POPULATIONS, *RHIZOBIUM TRIFOLII* AND ENDOMYCORRHIZAL ASSOCIATIONS IN RECLAMATION OF SURFACE MINE SPOILS IN TEXAS

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The deficiency of nitrogen and phosphorus in mixed overburden mine spoils has resulted in interest in strategies to minimize fertilizer application. In this study, the abundance of microbial populations, with emphasis on those involved in nitrogen cycle transformations was estimated in variously aged spoils. Two beneficial plant-microbe associations, the clover-*Rhizobium trifolii* symbiosis and endomycorrhizal associations, were investigated in field and laboratory studies.

While most groups of microorganisms regained pre-mining levels in revegetated spoils within 1.5 years after disturbance, algal populations were still reduced ten years after mining. Populations of nitrifying bacteria and a symbiotic nitrogen-fixing bacteria were as high in all spoils as in unmined soil. Microbial populations in recently levelled spoil did not show the usual decline with depth down to 90 cm.

Indigenous populations of ineffective *R. trifolii* were present in spoil banks and older revegetated spoil. Introduced *R. trifolii* strains established in spoil, nodulated subterranean and arrowleaf clovers and fixed nitrogen (acetylene reduction). Populations of *Rhizobium* increased during the clover growing season, and although numbers declined during summer months, they were sufficient to nodulate plants the following season. A laboratory study of survival of three commercial strains of *R. trifolii* for subterranean clover showed lethal effects of high temperature (45^{o}C) especially in moist spoil, and superior survival of strain 162x95.

Endomycorrhizal associations, evaluated by assessment of root infection in bermudagrass, reached pre-mining levels by three to seven years after disturbance. Production of spores by endomycorrhizal fungi, however, was greatly reduced in all spoils.

Growth chamber studies to investigate the effects of the two symbiotic associations on subterranean clover in mine spoil at different fertility levels indicated that dual infection with *Rhizobium* and VAM fungi was most beneficial for plant growth, nitrogen fixation, and nitrogen and phosphorus contents. Dually infected plants grown at lower fertility levels produced as much dry matter as uninoculated plants grown at higher fertility levels. Neither symbiotic association was inhibited by the addition of 57 kg N, 25 kg P/ha and only the endomycorrhizal association was inhibited by addition of 114 kg N, and 50 kg P/ha.

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