FOLIAR AND SOIL CHEMISTRY AT RED SPRUCE SITES IN THE MONONGAHELA NATIONAL FOREST

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In 2005, soil and foliar chemistry were sampled from 10 sites in the Monongahela National Forest which support red spruce. Soils were sampled from hand-dug pits, by horizon, from the O-horizon to bedrock or 152 cm, and each pit was described fully. Replicate, archived samples also were collected. Analyses of air dried soil samples were performed at three laboratories. Chemical analyses were performed at the University of Maine. Aluminum extractions by strontium chloride, to estimate plant-available aluminum, were determined at The Pennsylvania State University soil testing laboratory, and soil taxonomy, mineralogy, chemical properties, and physical properties were analyzed at the Natural Resources Conservation Service (NRCS) soil survey laboratory in Lincoln, NE. Foliar samples were collected from 10 trees per site by shooting out upper sun-exposed branches with a shotgun. Ends of spruce branches containing current year's growth were excised and collected by tree. These air-dried samples were analyzed for chemistry at the University of Maine's analytical laboratory. Not surprisingly, average soil pH across the 10 sites was typically in the pH range of mid 4 or lower. The average pH through the entire mineral soil pedon at each site was almost always greater than that of the pH from the O-horizon – by as much as 1.1 pH units. Potassium was consistently the dominant base cation in foliar tissue; it was two to six times greater than calcium levels. By comparison, calcium levels in mineral soil were almost always at least twice as great as potassium, and the two had approximately equal concentrations in the organic horizon. Foliar aluminum concentration across all 10 sites averaged 39.8 ppm, which is greater than those typically reported in the literature. By contrast, average foliar manganese concentrations (718 ppm) were less than reported values. At almost all sites, the average aluminum concentrations were greater in the mineral soil than in the O-horizon. Calcium to aluminum (strontium chloride extraction) ratios in the organic layers for all sites were greater than 3, and averaged approximately 24. However, calcium to aluminum ratios in mineral soil were much less. Except for one site, calcium to aluminum ratios in the upper mineral zone (A and B horizons) ranged from 0.16 to 0.59. The differences between organic and mineral soil Ca/Al ratios raise questions about whether red spruce might shift its rooting zone more toward the organic layers to exploit less toxic Al conditions, and what associated physiological changes may occur.

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