Challenges of utilizing municipal compost as an amendment in boreal forest reclamation subsoil material

Erika Rovena Valek

Abstract

Forest reclamation sites are often located in areas not suited for agriculture and therefore have poor soil conditions. To assist in the rehabilitation of forests on these types of sites, organic amendments can be used. Close to large urban centers, compost derived from municipal organic waste can be utilized to enhance soil suitability for plant growth by increasing organic matter and nutrient availability. When organic amendments are incorporated into the soil surface, however, improved subsoil conditions are often accompanied by an increase in cover of disturbance adapted ruderal species that compete with planted tree seedlings. The primary objective of this thesis was to examine a novel site preparation technique that explores the impact of inverting a 25 cm organic layer (here compost) beneath a 20 cm mineral soil cap. We hypothesized that the buried compost layer would provide a deep, nutrient rich rooting environment for tree seedlings while the cover of mineral soil would limit interspecific competition from weedy species during the vulnerable initial years following planting. This method was compared to the more conventional treatment of applying materials at the soil surface including salvaged topsoil material and compost.

All soil treatments containing compost had poor seedling survival after the first growing season, with no seedling survival in the surface applied compost. Soil treatments with a mineral soil cap over compost initially had high mortality (70%); however, growth for the remaining tree

seedlings was better in the second growing season relative to other soil treatments. This poor survival was clearly influenced by the chemical composition of the compost and our failure to incorporate the material deep enough into the mineral subsoil. During the composting process at the waste plant, biosolids had been added, which significantly increased the salinity of the iii material and most likely led to the low tree seedling survival. Furthermore, a salt tolerant, aggressive annual weed (*Kochia scoparia*) established across the research site in the first growing season and established as a thriving monoculture in the soil treatments containing compost, further negatively influencing tree seedling survival. A mineral soil cap using fine textured soil was more effective in limiting *Kochia scoparia* than a coarse textured soil; however, a greater cap thickness would have been advantageous. The fine and coarse mineral soil cap insulated the underlying compost layer, creating conditions of higher soil temperature, greater moisture availability, but also limited oxygen availability compared to the surface applied compost. After the second growing season, the salinity of the compost was significantly reduced and surviving tree seedlings in soil treatments with a mineral soil cap over compost grew better. Likely their root systems accessed microsites with favorable soil conditions, most probable at the interface between the fine or coarse mineral soil cap and the compost.