

Effect of Ectomycorrhizae on 1-year-old Northern Red Oak Seedlings in Response to Overstory and Understory Manipulations in Oak and Pine Stands

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Abstract: Development of ectomycorrhizae (ECM) and establishment of northern red oak (*Quercus rubra* L.) seedlings in response to overstory and understory manipulations were studied in oak and pine forests in northern Lower Michigan. A split-plot experimental design was employed with four levels of canopy cover (0, 50, 75 and 100% (uncut)) and two understory treatments (shrub removal and untreated). Northern red oak seeds from a common source were sown in each treatment. The ECM were classified and quantified by morphological type for emerged seedlings in the first growing season. Seedling growth and its relation to mycorrhizal colonization were evaluated. A higher ECM density (no./g) of northern red oak seedlings was found in pine stands than in oak stands. ECM colonization was significantly greater in seedlings under 50% canopy cover than in those under other canopy covers. No significant difference was found in ECM development between understory treatments. Black-type ECM (*Cenococcum geophilum* Fr.) was highest soil moisture and temperatures occurred. White-type ECM was associated with increases in stem diameter, leaf area and total biomass of the seedlings. A positive relationship was found between root/shoot ratio and total ECM density. These results suggest that conditions associated with partial canopy cover stimulate ECM development of northern red oak and may also help to explain the greater success of northern red oak regeneration beneath pines than beneath oaks.

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