Frontline EXPRESS
Canadian Forest Service, Great Lakes Forestry Centre

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EFFECTS OF PARTIAL CUTTING ON EASTERN WHITE PINE AND RED PINE

INTRODUCTION

Eastern white pine (*Pinus strobus* L.) often grows in association with red pine (*Pinus resinosa* Ait.) in fire adapted stands. Both pines may be well-suited to partial cutting because of their high value and white pine's susceptibility to white pine weevil (*Pissodes strobi* Peck) damage when grown in open areas. Natural regeneration of pine after harvesting is often unacceptably low and debate continues about how these stands can best be regenerated.

Few field studies have assessed the impacts of silvicultural treatments on soils and other environmental factors that affect natural white pine regeneration survival and growth. Vegetative competition is a major problem on better quality white pine sites and silvicultural techniques are needed to promote pine regeneration. On competition-prone sites, thinning is typically followed by site preparation to reduce vegetative competition and to create suitable seedbeds for natural regeneration. Mechanical scarification is common and may be followed by herbicide treatment.

The objectives of this research are to assess commercial thinning and site preparation treatments as methods for obtaining and promoting pine regeneration, and to investigate the underlying causes of differences in regeneration responses. The experiment is situated in a 110-year-old white pine stand. Main plot treatments (overstory thinnings) are one-crown, two-crown and control (uncut) crown spacings. Sub-plot treatments (site preparation treatments) consist: of 1) blade scarification, 2) brush control using herbicide, 3) blade scarification and brush control, and 4) untreated (controls). Half the area was underplanted, the other half left to regenerate naturally. Natural and planted early growth response, nutrient availability and uptake, photosynthetically active radiation (PAR), soil temperature, and soil moisture are being examined.

LOCATION

Field research is underway in the Petawawa Research Forest at Chalk River, Ontario.

RESULTS

Only 2% of residual trees were damaged during partial cut harvesting, with half of those having only minor wounds smaller than 100cm^2. Windthrow losses were small, with the highest number occurring in the heaviest thinning treatment.

Scarification increased pine regeneration, but also increased seedling numbers for some major competitors. The amount of white pine regeneration was greatest in non-thinned areas where the number of white pine trees bearing seed was largest. Natural pine stocking also increased with scarification from 62% to 87%. Brush control had little effect on regeneration numbers and no effect on pine stocking. This treatment may have had a greater influence, especially on white pine regeneration success, if completed one year earlier during a good white pine seed year. The planted white pine seedlings had a high survival rate in all treatments and averaged 94.1% overall.

Fig. 1. Regeneration of white pine after thinning.

Thinning and site preparation markedly increased mean shoot mass of three-year-old natural white pine seedlings. Seedling height and root collar diameter were also significantly influenced and increased. Scarification decreased needle N concentrations for natural white pine seedlings. The largest seedlings were from plots that were scarified, brush-controlled and thinned to a two-crown opening between residual trees. The number of stress days increased with both scarification and brush control in the one-crown thinned plots. Scarification increased the total number of stress days in the two-crown thinned plots.

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Soils were consistently warmer in the scarified and brush controlled plots in the control, one-crown and two-crown thinned plots. The warmer soil conditions persisted through most of the growing season.

Fig. 2. Thinning to a one-crown spacing between trees.

MANAGEMENT IMPLICATIONS

The early growth and nutrient status of natural and planted white pine was improved by applying a combination of thinning, scarification, and brush control treatments. The fact that white pine height growth was almost as good in the one-crown as the two-crown thinning is of particular interest when considering the added advantage of shade conditions in the control of white pine weevil. The trade-off between protection from the weevil with only marginal decreases in biomass accumulation makes this species an ideal candidate for a shelterwood or selection cutting system. Partial cutting in mature pine stands can be completed without causing significant damage to residual trees. However, as the thinning intensity increases, so do losses to windthrow. Forest managers may be able to scarify within pine stands prior to thinning to encourage advance regeneration of white pine. Red pine, however, has infrequent seed years, is more shade tolerant and is more difficult to regenerate.

SOURCES OF RELEVANT INFORMATION

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