EFFECT OF PINE STRAW HARVESTING ON SURVIVAL AND GROWTH OF LOBLOLLY PINE

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ABSTRACT

Pine needles that accumulate on the forest floor help to conserve soil moisture, protect the soil surface against erosion, moderate soil temperature, inhibit weed growth, and provide soil nutrients and organic matter. Pine needles tend to interlock and form a straw layer that is not easily dislodged by high winds or water flows, but retains a loose structure that allows air, water, and nutrients to easily infiltrate the soil surface. These qualities have made pine straw a valuable landscaping mulch, and a multimillion-dollar business in several southeastern states. However, some forest managers are concerned that loss of those mulching benefits from forests may hinder timber productivity in areas where pine straw has been harvested. Therefore, an experiment was conducted for seven years to determine pine straw harvesting effects on tree mortality and growth rates in an established loblolly (*Pinus taeda* L.) plantation (3.0 x 1.5 m tree spacing). Four pine straw management practices were compared in the presence and absence of fertilizer additions. There were 24 plots (0.044 ha each) to provide three replications of each harvesting/fertilization treatment combination. Results showed that pine straw harvesting had no significant effects on tree growth and overall survival, regardless of fertilizer applications.

Keywords: agroforestry, pine straw harvesting, loblolly pine, tree survival, tree growth, mulch

INTRODUCTION

Pine needles that accumulate on the forest floor help to conserve soil moisture, protect the soil surface against erosion, moderate soil temperature, inhibit weed growth, and provide soil nutrients and organic matter. Pine needles tend to interlock and form a straw layer that is not easily dislodged by high winds or water flows, but retains a loose structure that allows air, water, and nutrients to easily infiltrate the soil surface (Carson 1994).

These qualities have made pine straw a valuable landscaping mulch, and harvesting it has become a multimillion-dollar business in several southeastern states. However, Pote et al. (2004) found that the loss of those mulching benefits from forests where pine straw has been harvested can cause significant environmental impacts by decreasing the water-holding capacity of the forest floor while increasing runoff, soil erosion, and nutrient loss. They also found that two years of pine straw accumulation were required to restore the mulching effects to preharvest levels. Some forest managers have been concerned that the impacts of pine straw harvesting may hinder timber productivity by increasing tree mortality rates and slowing the growth of surviving trees in areas where pine straw harvests are common. Therefore, the objective of this study was to determine pine straw harvesting effects on tree mortality and growth rates.

METHODS

An experiment was conducted for seven years in an established loblolly (*Pinus taeda* L.) pine plantation (3.0 x 1.5 m tree spacing) near Booneville, AR. Three management regimes for pine-straw harvesting and a control treatment (no straw harvest) were compared to determine the harvesting effects on tree mortality and growth rates, in the presence or absence of fertilizer additions. Management practices for harvesting pine straw included: rake each year, rake two years and defer one year, rake one year and defer two years, or never rake (control). These harvesting schedules began when the pines were 11-years old, and continued until tree measurements were taken at age 18. During that time interval, half of the plots from each treatment received no fertilizer, and the other half received 50 kg N and 56 kg P/ha/yr. There were 24 plots (0.044 ha each) to provide three replications of each harvesting/fertilization treatment combination.

Tree growth and survival measurements included bole diameter at breast height (DBH), basal area, total height, crown length, and frequency of surviving trees, missing trees (reflecting early tree mortality), and standing dead trees (indicating recent mortality). The DBH was measured at 1.37 m above the ground with a diameter tape. Total tree height was measured with a Haga altimeter, and crown length was calculated as total height minus height to the base of the crown (lowest portion of green foliage).

Analysis of variance followed a strip-plot model with fertilization regime (fixed effect) as the main plot and raking frequency (fixed effect) as the subplot. Normality was tested using the Wilk-Shapiro test, and homogeneity of variance with the Bartlett test. Percentage data were normalized using the arcsin square root (X/100) transformation.

RESULTS AND CONCLUSIONS

Growth measurements of the loblolly pines at age 18 averaged across all treatments showed that mean DBH was 21.3 cm, basal area was 46.6 m^2/ha, total tree height was 14.0 m, and crown length was 4.0 m. On average, 71.5% of the trees survived, while 22.7% experienced early mortality, and 5.8% died recently. Treatment comparisons showed that during the seven years of the study, pine straw harvesting neither significantly affected tree growth, nor overall survival, regardless of fertilizer applications.

REFERENCES CITED

Carson, J. B. 1994. Pine straw mulch in the landscape. Arkansas Cooperative Extension Service FSA6044. Little Rock, AR: University of Arkansas Cooperative Extension Service.

Pote, D. H., B. C. Grigg, C. A. Blanche, and T. C. Daniel. 2004. Effects of pine straw harvesting on quantity and quality of surface runoff. *J. Soil and Water Conserv.* 59(5):197-203.