EFFECT OF PRUNING SEVERITY ON THE ANNUAL GROWTH OF HYBRID POPLAR THROUGH 2006

Clinton C. Shock, Erik B. G. Feibert, and Jake Eaton
Malheur Experiment Station
Oregon State University
Ontario, OR

Summary

Pruning the side branches of trees allows the early formation of clear, knot-free wood in the trunk and increases the trees' value as saw logs and peeler logs. The amount of live crown removed might have an effect on tree growth. More severe pruning might improve the efficiency of the pruning operation (fewer pruning operations to reach the final pruning height), but could reduce growth excessively. The objective of this study was to evaluate the effect of pruning severity on tree growth.

Hybrid poplar (clone OP-367) planted at 14-ft by 14-ft spacing in 1997 was submitted to three pruning treatments. Pruning treatments consisted of the rate at which the side branches were removed from the tree to achieve an 18-ft branch-free stem. Starting with a 6-ft (from ground) pruned trunk, 3-year-old trees were pruned to 18 ft in either 3, 4, or 5 years. Starting in March 2000, the side branches on the trunk were pruned to a height of 6, 9, or 12 ft. In subsequent years, the trees in all treatments had 3 ft of stem pruned yearly. At the start of the trial in 2000, the trees averaged 3.9 inches diameter at breast height and 29.7 ft tall. The average pruning intensities in 2000 ranged from 22.2 percent of the total stem that was pruned (least intensive treatment) to 47.3 percent (most intensive treatment). Treatments were complete in 2004. Stem volume growth in 2006 and over the previous six seasons was not affected by the pruning treatments.

Introduction

With reductions in timber supplies from Pacific Northwest public lands, sawmills and timber products companies are searching for alternatives. Hybrid poplar wood has proven to have desirable characteristics for many timber products. Growers in Malheur County, Oregon have made experimental plantings of hybrid poplar and demonstrated that the clone OP-367 (hybrid of *Populus deltoides x P. nigra*) performs well on alkaline soils for at least 7 years of growth. Research at the Malheur Experiment Station during 1997-1999 determined optimum irrigation criteria and water application rates for the first 3 years (Shock et al. 2002a).

Materials and Methods

The trial is being conducted on a Nyssa-Malheur silt loam (bench soil) with 6 percent slope at the Malheur Experiment Station. The soil has a pH of 8.1 and 0.8 percent organic matter. The field had been planted to wheat for the 2 years prior to 1997 and before that to alfalfa. Hybrid poplar sticks, cultivar OP-367, were planted on April 25, 1997 on a 14-ft by 14-ft spacing. The field was used for irrigation management research (Shock et al. 2002a) and groundcover research (Shock et al. 2002b) from 1997 through 1999. All side branches on the lower 6 ft of all trees had been pruned in February 1999.

In March 2000, the field was divided into 20 plots that were 6 rows wide and 7 trees long. The plots were allocated to five irrigation treatments that consisted of microsprinkler irrigation with three irrigation intensities and drip irrigation. The microsprinkler-irrigated plots used the existing irrigation system. For the drip-irrigated plots, either one or two drip tapes (Nelson Pathfinder, Nelson Irrigation Corp., Walla Walla, WA) were laid along the tree row in early May 2000. The management of the irrigation trial is discussed in an accompanying article (see "Mircro-irrigation Alternatives for Hybrid Poplar Production, 2006 Trial" in this report).

For the pruning study, only plots in the two wetter microsprinkler-irrigated treatments and the drip-irrigated treatments were used. The middle two rows in each irrigation plot were assigned to pruning treatment 2 (Table 1). The remaining two pairs of border rows in each plot were randomly assigned to pruning treatments 1 and 3. The pruning treatments consisted of the height from the ground to which the stem was pruned. In the first year (2000), the trees in each treatment were pruned to different heights (intensities). Thereafter the trees in each treatment had 3 ft of stem pruned each year until the final pruned height of 18 ft was reached. The pruning treatments were replicated eight times. There was no significant difference between treatments in average DBH, height, or wood volume in the spring of 2000 (Table 3). The trees in treatments 1, 2, and 3 were pruned on March 27, 2000; March 14, 2001; March 12, 2002; March 12, 2003; and March 19, 2004. All pruning treatments were completed in March of 2004. Trees were pruned by cutting all the side branches up to the specified height on the trunk, measured from ground level. The side branches were cut using loppers and pole saws.

The five central trees in the middle two rows and the five central trees in each inside row of each border pair in each plot were measured monthly for DBH and height. Trunk volumes were calculated for each of the measured trees in each plot using an equation developed for poplars that uses tree height and DBH (Browne 1962). Growth increments for height, DBH, and stem volume for 2005 were calculated as the difference in the respective parameter between October 2004 and October 2005. Growth increments for the seven seasons (2000-2006) were calculated as the difference in the respective parameter between October 1999 and October 2006.

Results and Discussion

The differences between treatments in the percentage of the tree stem that was pruned decreased over the years (Table 1). Starting in 2004, when the pruning treatments were completed, there were no differences in the percentage of the tree stem that was pruned. There was no significant difference between treatments in wood volume growth over the years (Table 2). In the fall of 2006, there was no significant difference between treatments in DBH, height, or wood volume (Table 3).

The lack of response of tree growth to pruning intensity in this study is consistent with the Oregon State University Extension recommendation to limit pruning to 50 percent of total height (Hibbs 1996). The highest pruning intensity achieved in this study was 47 percent in 2000.

References

Browne, J.E. 1962. Standard cubic-foot volume tables for the commercial tree species of British Columbia. British Columbia Forest Service, Forest Surveys and Inventory Division, Victoria, B.C.

Hibbs, D.E. 1996. Managing hardwood stands for timber production. The Woodland Workbook, Oregon State University Extension Service, Oregon State University, Corvallis.

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Table 1. Poplar pruning treatments and actual percentage of total height pruned (percentage of total height that is branch-free stem after pruning) in successive years. Trees were planted in April 1997, Malheur Experiment Station, Oregon State University, Ontario, OR.

Treatment	Pruning height[a] (ft from ground)						Actual percentage of total tree height that was pruned trunk in March						
	1999	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004	2005	2006
1	6	6	9	12	15	18	22.2	22.9	26.1	28.1	30.5	27.7	25.6
2	6	9	12	15	18	18	33.7	29.3	32.0	35.3	29.9	29.9	25.2
3	6	12	15	18	18	18	47.3	39.4	35.2	33.5	30.0	27.5	25.5
LSD (0.05)							2.8	1.9	4.6	2.5	NS	NS	NS

[a]Trunk height to which all side branches were removed in March of the respective year.

Table 2. Wood volume increment for three pruning intensity treatments in hybrid poplar, Malheur Experiment Station, Oregon State University, Ontario, OR.

	Growth increment							
Treatment	2000	2001	2002	2003	2004	2005	2006	1999-2006
	---------- ft^3/acre ----------							
1	369.3	379.0	397.4	552.4	571.3	413.7	523.6	3,207
2	360.1	414.5	356.4	542.4	570.3	541.1	478.8	3,264
3	318.9	423.5	328.1	547.8	529.7	473.8	479.6	3,101
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Hybrid poplar tree measurements before and 2 years after the end of pruning treatments, Malheur Experiment Station, Oregon State University, Ontario, OR.

	Nov 99			Nov 06		
Treatment	DBH	Height	Volume	DBH	Height	Volume
	inch	feet	ft^3/acre	inch	feet	ft^3/acre
1	4.3	30.5	1.1	10.5	70.6	3449.2
2	3.8	29.6	0.9	10.1	72.2	3460.2
3	3.6	29.1	0.8	9.7	70.5	3273.8
average	3.9	29.7	0.9	10.1	71.1	3394.4
LSD (0.05)	NS	NS	NS	NS	NS	NS