

EFFECT OF HARVESTING SEASON ON HYBRID POPLAR COPPICING

by

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Abstract.--A study was begun in 1980 in a 4-year-old planting of *P. nigra* var. *betulifolia* x *P. trichocarpa* to identify the effects of harvesting season on coppice production. Parts of the plantation were harvested monthly from October 1980 to September 1981. The trees were cut leaving 10 and 30 cm (4 and 12 in) stumps. Coppice measurements were taken 1 year after harvest. Harvesting during the leafless season (October to mid May) positively affected (a) stump survival, (b) height and d.b.h. growth of dominant sprouts, and (c) number of live sprouts/stump taller than 1.37m. Harvesting during the growing season discouraged coppicing. Stump height had no effect on stump survival or growth of dominant sprouts. However, stump height positively affected number of sprouts/stump. Therefore, to concentrate growth on a few sprouts, the stumps should be kept short. The 10 cm (4 in) stumps proved adequate.

In their review of factors influencing coppicing, Blake and Raitanen (1981) state that where species exhibit a seasonal variation in coppicing, sprouting is usually maximal when trees are cut in winter and minimal when they are cut in mid-summer. With some caution, the same generalization could be made about hybrid poplar coppicing. Good coppicing and coppice growth followed dormant season harvest of eastern cottonwood (DeBell and Alford 1972), various *P. x euramericana* clones (Lee and McNabb 1979), and *P. 'Tristis #1'* (Strong and Zavitkovski 1982). Poor coppicing followed growing season harvest in those studies. However, Anderson's (1979 b) studies, although consistent with the above results for *P. x euramericana* (clone I-45/51), showed that some aspen-type clones had good tolerance to growing season (July or August) harvesting. Obviously, poplar clones may respond differently to the season of harvest and each clone should be tested separately to determine its optimum harvesting time. Such knowledge may substantially increase the yield of the subsequent poplar coppice.

The objective of this study was to assess the effect of harvesting time on coppicing of clone NE-299 (NC-5331), a hybrid between *P. nigra* var. *betulifolia* x *P. trichocarpa*. The specific objectives were to establish between season of harvesting and (a) stump survival, (b) number of shoots per stump, and (c) height and d.b.h. growth of the dominant sprouts 1 year after the harvest.

MATERIALS AND METHODS

The study was conducted in a 4-year-old 0.25 ha plantation of NE-299 (NC-5331) established at 1.2 x 1.2 m (4 x 4 ft) spacing at the Harshaw Forestry Research Farm near Rhinelander, Wisconsin. The plantation was divided into 2 replications. Within each replication we staked out 12 plots, each with 55 trees (5 rows with 11 trees each). The plot size was 6 x 13 1/2 m (20 x 44 ft).

The sequence of cutting was randomized within each replication. One plot in each replication was cut in the middle of every month from October 1980 to September 1981. Three rows were harvested leaving a 30 cm (1 ft) stump and 2 rows were harvested leaving a 10cm(4 in) stump. At the time of harvest, we recorded the diameter of the stump at the cut surface.

Coppice measurements were taken 1 year after harvest or, for trees harvested during the dormant season, any time during the following dormant season. The following data were recorded:

- (a) number of living stumps,
- (b) height of the dominant sprout on each stump,
- (c) d.b.h. of the dominant sprout on each stump, and
- (d) number of live sprouts/stump taller than 1.37 m.

We analyzed the data by means of analysis of variance and regression analysis, and we tested the significance of specific comparisons by a "t" test with a confidence level of 95%.

RESULTS AND DISCUSSION

Physiologically, October and May are not dormant season months. However, we found no significant difference between harvest months within the October to May period in stump survival, number of sprouts/stump, and height and d.b.h. growth. Therefore, we pooled the data for that period (called dormant season in this paper). Although stump survival following the September harvest did not differ from that of dormant season harvesting, number of sprouts, height, and d.b.h. were substantially smaller. Growing season harvesting, June through August, was the least productive and had the lowest stump survival.

Stump Survival

The average stump survival was 92% for the September through May harvests (table 1). It was 65% for the June harvest and less than 10% for the July and August harvests. Stump survival for the growing season harvests was lower than the 62% found in the previous study with *P. 'Tristis #1'* (Strong and Zavitkovski 1982).

harvested in July, August, and September. Whereas the July and August harvests were followed by low to intermediate stump survival (except for *P. canescens* cl. 'Ingolstadt' whose stump survival was 90 to 100% in all 3 months of testing), stump survival following the September harvest was 100% in three clones and 80 to 30%, respectively, for the other two clones. Such results are more typical of a dormant season month. However, based on height and d.b.h. growth reached in our study, September could be classified as a growing season month. Perhaps more appropriately, September is a transition month that may have dormant or growing season characteristics depending on the weather preceding the harvest.

Height of Dominant Sprouts

The average height of the dominant sprouts ranged from 0.9 for the June-August harvests to 2.3 m for the dormant season harvests (table 1). In a previous study with *P. 'Tristis #1'* (Strong and Zavitkovski 1982), the respective heights were 0.9 and 1.6 m. The ratio between the dormant season and growing season heights was 2.6 in the present study and 1.8 in the previous study. This compares with a ratio of 1.7 obtained by DeBell and Alford (1972) in a study with *P. deltoides* in Mississippi.

First year average height of the dominant sprouts developing after the dormant season harvesting, 2.3 m, was similar to heights reported by Anderson (1979 a) for clone 1-45/51 in Ontario

Table 1.--Effect of harvesting season on stump survival and coppice development of poplar hybrid NE-299 (NC-5331)

Month	Stump survival			Growth of dominant sprouts						Number of sprouts ^{1/}		
	Mean	SD	N ^{2/}	Height			d.b.h.			Mean	SD	N
				Mean	SD	N	Mean	SD	N			
	(%)			(m)			(cm)					
October to May	92 ^a	8	32	2.3	0.4	294	0.9	0.2	293	7.5	3.7	293
September	93 ^a	5	4	1.5	0.3	34	0.5	0.1	25	3.4	2.3	25
June	65 ^b	10	4	0.9	0.3	26	0.6	-	1	2.0	-	1
July	9 ^c	11	4	0.7	0.1	3	-	-	-	-	-	-
August	5 ^c	10	4	1.1	0.2	2	-	-	-	-	-	-

^{1/} Sprouts taller than breast height (1.37 m).

^{2/} Number of observations

It is difficult to classify September either as a growing season or dormant season month. Stump survival following September harvesting was typical of that achieved in dormant season harvesting. A similar conclusion could be drawn from Anderson's (1979 b) studies with five different poplar clones

(ranging from 1.96 to 2.04m), Crist et al (appears elsewhere in this publication) for *P. 'Tristis #1'* in Rhineland (ranging from 1.84 to 2.19m), and Zavitkovski (1982) for various northeastern (2.46m) and *P. x euramericana* clones (2.27m).

Diameter of Dominant Sprouts

The average d.b.h. of dominant sprouts of individuals harvested during the dormant season was 0.9 cm and that resulting from the September harvest 0.5 cm (table 1). Only one dominant sprout reached breast height (1.37 m) following the growing season (June to August) harvest. In our previous study with *P. 'Tristis #1'* (Strong and Zavitkovski 1982), the average dominant sprout d.b.h. following the dormant season harvest was 0.93 cm. Anderson (1979 a) reported average d.b.h.'s of winter harvested 1-45/51 ranging from 0.94 to 0.97 cm. Although the average d.b.h. of winter-harvested eastern cottonwood (DeBell and Alford 1972) was substantially greater than achieved in our study, the same principle of less growth after the growing season harvest applied.

Season of Harvest and Number of Sprouts/Stump

The average number of sprouts taller than 1.37 m (breast height) was 7.5 for stumps of trees

harvested during the dormant season and 3.4 for those harvested in September (table 1). Only one sprout taller than 1.37 m was produced following the June to August harvest. In the previous study with *P. 'Tristis #1'* (Strong and Zavitkovski 1982), an average of 2.5 sprouts/stump taller than breast height developed after the dormant season harvest. and winter harvested eastern cottonwood in Mississippi (DeBell and Alford 1972) produced an average of 5.3 sprouts/stump taller than breast height.

Stump Size and Coppicing

Stump height had little effect on stump survival or height of dominant sprout. Dominant sprouts originating from 30-cm stumps were only slightly larger in diameter than those originating from 10-cm stumps (table 2). However, stump height had a substantial effect on number of sprouts/stump. The 30-cm stumps had 8.8 sprouts/stump and the 10-cm stumps 6.2 sprouts. Similar findings were reported by Crist et al. (appears elsewhere in this publication) for *P. 'Tristis #1'* and Belander (1979) for sycamore. Both noted that several years after harvest, number of sprouts/stump tended to equalize

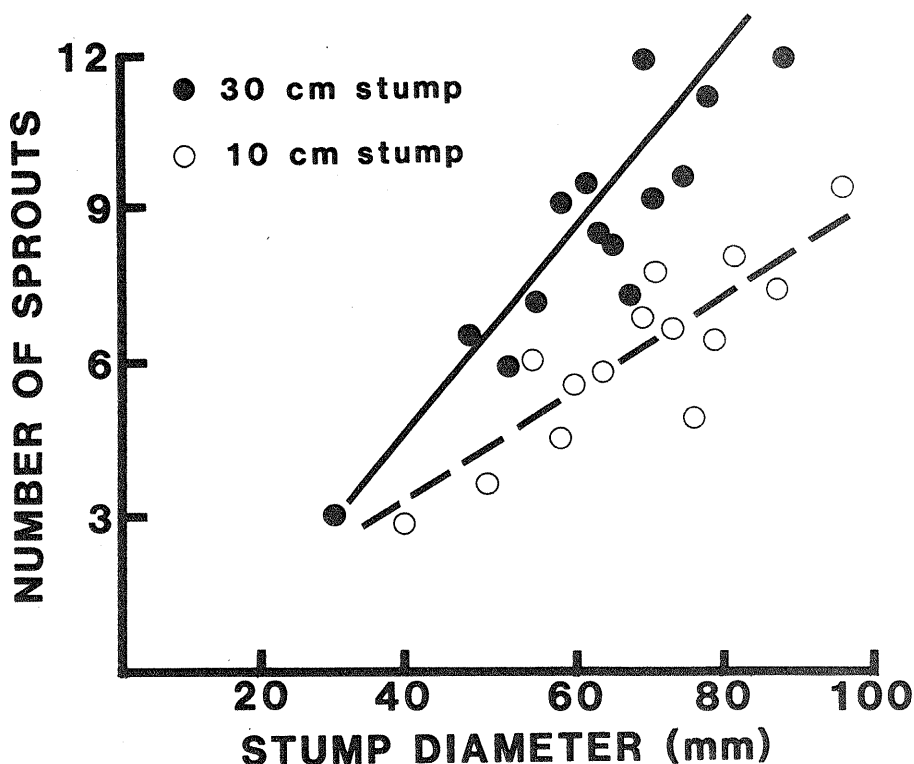


Figure 1.--Relation Between Stump Diameter and Number of Sprouts/Stump for 10-and 30-cm Stumps

due to sprout mortality. In a similar study with eastern cottonwood, DeBell and Alford (1972) found no significant difference due to stump height in number of sprouts/stump or diameter and height growth of sprouts.

Table 2.--Effect of stump height on coppice development

Stump Height (cm)	Coppice Development		
	Height (m)	d.b.h. (cm)	Sprouts/Stump (Number)
30	2.19	0.98	8.8
10	2.11	0.89	0.2
F-ratio	1.73	10.34*	40.97*

*Significant at the 95% confidence level.

Number of sprouts/stump was also positively related to stump diameter at the cut surface (fig. 1). Belanger (1979) reported similar relations for sycamore and we noted a similar trend in our studies with *P. 'Tristis #1'* (Strong and Zavitkovski 1982).

CONCLUSIONS

1. Dormant season harvest (October to May) of hybrid poplar NE-299 (NC-5331) positively affected (a) stump survival, (b) height and d.b.h. of dominant sprouts, and (c) number of sprouts/stump.
2. Dormant season harvesting is strongly recommended to maximize coppice production in the Lake States.
3. July-August is the best harvesting time to discourage sprouting.
4. Stump height positively affected number of sprouts/stump.

Therefore, to concentrate growth on a few sprouts, the stumps should be kept short. Here, stumps 10 cm (4 in) in height proved adequate. To encourage number of sprouts for cutting production, cut higher (30 cm).

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