PERFORMANCE OF HYBRID POPLAR CLONES ON AN ALKALINE SOIL

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Introduction

With timber supplies from Pacific Northwest public lands becoming less available, sawmills and timber products companies are searching for alternatives. Hybrid poplar wood has proven to have desirable characteristics for many nonstructural timber products. Plantings of hybrid poplar for sawlogs have increased in the Treasure Valley.

Some hybrid poplar clones are susceptible to nutrient deficiencies in alkaline soils, leading to poor growth. Clone trials planted in 1995 in Malheur County demonstrated that clone OP-367 (hybrid of *Populus deltoides* x *P. nigra*) was the only clone performing well on alkaline soils. Growers in Malheur County have made experimental plantings of hybrid poplars and found that other clones have higher productivity on soils with nearly neutral pH. New poplar clones are continually being developed. Poplar growers need updated information on the vigor and adaptability of new clones to alkaline soils.

Materials and Methods

The trial was conducted on a Nyssa silt loam with a pH of 8.4 and 1.3 percent organic matter. The field was planted to wheat in the fall of 2002. On March 28, 2003, the wheat was sprayed with Roundup (glyphosate) at 1.5 lb ai/acre. Based on a soil analysis, on April 9, 20 lb Mg, 40 lb K, 1 lb B, and 1 lb Cu per acre were broadcast. The field was again sprayed with Roundup at 1.5 lb ai/acre on April 9. On April 10, 9-inch poplar sticks of 24 clones (Table 1) were planted in a randomized complete block design with 5 replicates. Tree rows were spaced 5 ft apart and trees were spaced 5 ft apart within the row. Each plot consisted of four trees, two rows wide and two trees long. Goal herbicide (oxyfluorfen) at 2 lb ai/acre was sprayed on April 11. The field was irrigated with 0.6 inch of water on April 11.

Drip tubing (Netafim Irrigation, Inc., Fresno, CA) was laid along the tree rows prior to planting. The drip tubing has two emitters (Netafim On-line button dripper) spaced 12 inches apart for each tree. Emitters have a flow rate of 0.5 gal/hour. The field was irrigated when the soil water potential at 8-inch depth reached -25 kPa. Each irrigation applied 0.6 inch of water based on an 8-ft^2 area for each tree. This irrigation strategy maintained the soil water potential above -25 kPa until around mid-July, when the irrigation rate was increased to 1 inch per irrigation. The increased irrigation rate was not effective in maintaining the soil water potential above -25 kPa, so starting in

mid-August the field was irrigated 5-7 times per week until the last irrigation on September 30. Soil water potential was measured with six Watermark soil moisture sensors model 200SS (Irrometer Company, Riverside, CA) installed at 8-inch depth. The soil moisture sensors are read every 8 hours by a Hansen Unit datalogger (Mike Hansen Co., Wenatchee, WA).

Analysis of leaf samples (first fully expanded leaf from clone OP-367) on July 11 indicated the unexpected needs for boron and sulfur fertilization (Table 1). On July 28, sulfur at 10 lb/acre as ammonium sulfate and boron at 0.2 lb/acre as boric acid were injected through the drip system.

The heights and diameter at breast height (DBH, 4.5 ft from ground) of all trees in each plot were measured on October 6, 2003. Stem volumes (excluding bark and including stump and top) were calculated for each tree using an equation developed for poplars that uses tree height and DBH (Browne 1962). Clonal differences in height, DBH, and wood volume were compared using ANOVA and least significant differences at the 5 percent probability level, LSD (0.05).

Results and Discussion

Starting around mid-July, the soil water potential did not remain above the target of -25 kPa (Fig. 1). The increased irrigation frequency in mid-August raised the soil water potential, but was not successful in maintaining it above the target. A total of 19.2 inches of water were applied during the season to the whole field (Fig. 2). Greater tree growth and wood volume would have been obtained if the intended soil water potential had been maintained, which would have required a higher amount of water to be applied.

The LSD (0.05) values at the bottom of Table 2 should be considered when comparisons are made between clones for significant differences in performance characteristics. Differences between clones equal to or greater than the LSD (0.05) value for a characteristic should exist before any clone is considered different from any other clone in that characteristic.

Height on October 6 ranged from 7.36 ft for clone 50-184 to 10.90 ft for clone 59-289 (Table 2). Diameter at breast height on October 6 ranged from 0.45 inch for 50-184 to 0.73 inch for clone 59-289. Wood volume on October 6 ranged from 5.84 inches^3 for clone 50-184 to 22.34 inches^3 for clone 59-289. Tree heights for clones 59-289, 184-401, 309-74, 195-529, NM-6, 57-276, OP-367, 15-29, and 56-273 were among the highest. Tree volumes for clones 59-289, 184-401, 309-74, 57-276, 195-529, NM-6, 15-29, OP-367, 56-273, and 50-197 were among the highest.

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 Div., Victoria, B.C.

Table 1. Analysis of leaf samples (first fully expanded leaf from clone OP-367) on July 11, 2003, Malheur Experiment Station, Oregon State University, Ontario, OR.

Nutrient	Sufficiency range*	Analysis
N (%)	3 - 3.5	4.02
P (%)	0.3 - 0.4	0.45
K (%)	1.7 - 2.1	5.88
S (%)	0.3 - 0.4	0.22
Ca (%)	0.8 - 1.2	0.9
Mg (%)	0.15 - 0.25	0.29
Zn (ppm)	15 - 25	36
Mn (ppm)	70 - 110	81
Cu (ppm)	3 - 5	12
Fe (ppm)	65 - 95	256
B (ppm)	35 - 45	17

* supplied by Western Labs, Parma, ID.

Table 2. Height, diameter at breast height (DBH), and wood volume on October 6, 2003 of hybrid poplar clones planted on April 10, 2003 at the Malheur Experiment Station, Oregon State University, Ontario, OR.

Clone	Cross	Height	DBH	Wood volume
		ft	inch	$inch^3$/tree
15-29	P. trichocarpa X P. deltoides	9.82	0.63	16.69
50-184	P. trichocarpa X P. deltoides	7.36	0.45	5.84
50-197	P. trichocarpa X P. deltoides	9.46	0.64	15.03
52-225	P. trichocarpa X P. deltoides	8.86	0.58	11.66
55-260	P. trichocarpa X P. deltoides	9.36	0.54	11.74
56-273	P. trichocarpa X P. deltoides	9.71	0.63	15.39
57-276	P. trichocarpa X P. deltoides	10.19	0.68	18.75
58-280	P. trichocarpa X P. deltoides	8.74	0.60	12.01
59-289	P. trichocarpa X P. deltoides	10.90	0.73	22.34
184-401	P. trichocarpa X P. deltoides	10.78	0.71	21.00
184-411	P. trichocarpa X P. deltoides	8.85	0.56	12.41
195-529	P. trichocarpa X P. deltoides	10.41	0.67	18.69
309-74	P. trichocarpa X P. nigra	10.48	0.65	20.26
311-93	P. trichocarpa X P. nigra	8.72	0.46	7.87
NM-6	P. nigra X P. maximowiczii	10.34	0.64	17.32
DTAC-7	P. trichocarpa X P. deltoides	7.94	0.46	8.32
OP-367	P. deltoides X P. nigra	9.95	0.63	15.84
PC1	P. deltoides X P. nigra	9.18	0.53	10.36
PC2	P. trichocarpa X P. deltoides	9.21	0.59	12.47
49-177	P. trichocarpa X P. deltoides	8.57	0.49	8.77
Clint1	native poplar, Malheur County, OR	8.47	0.46	9.36
Clint2	native poplar, Malheur County, OR	8.81	0.51	10.32
Clint3	native poplar, Malheur County, OR	9.00	0.55	11.55
DN-34	P. deltoides X P. nigra	8.01	0.51	8.87
LSD (0.05)		1.29	0.14	7.78

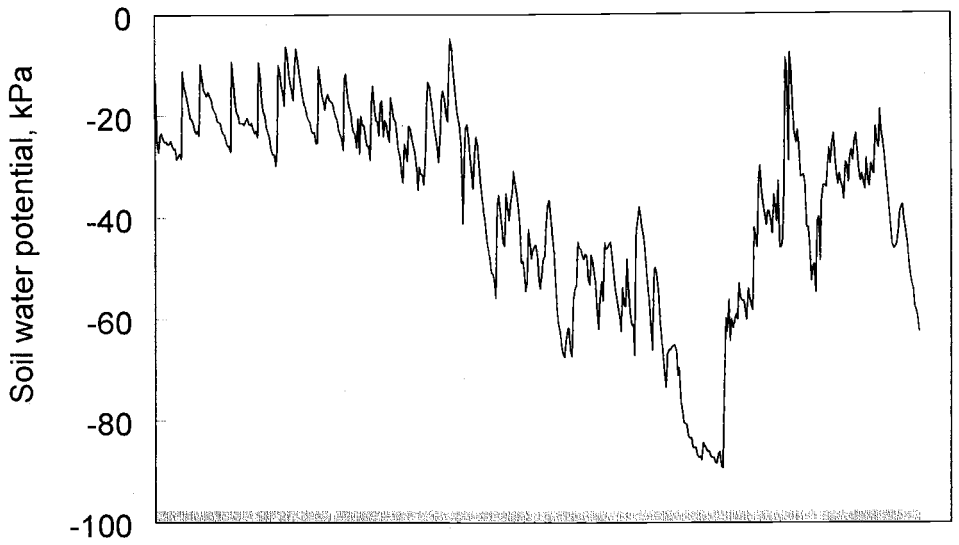

Figure 1. Soil water potential at 8-inch depth for poplar clones irrigated with a drip irrigation system with two emitters per tree, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

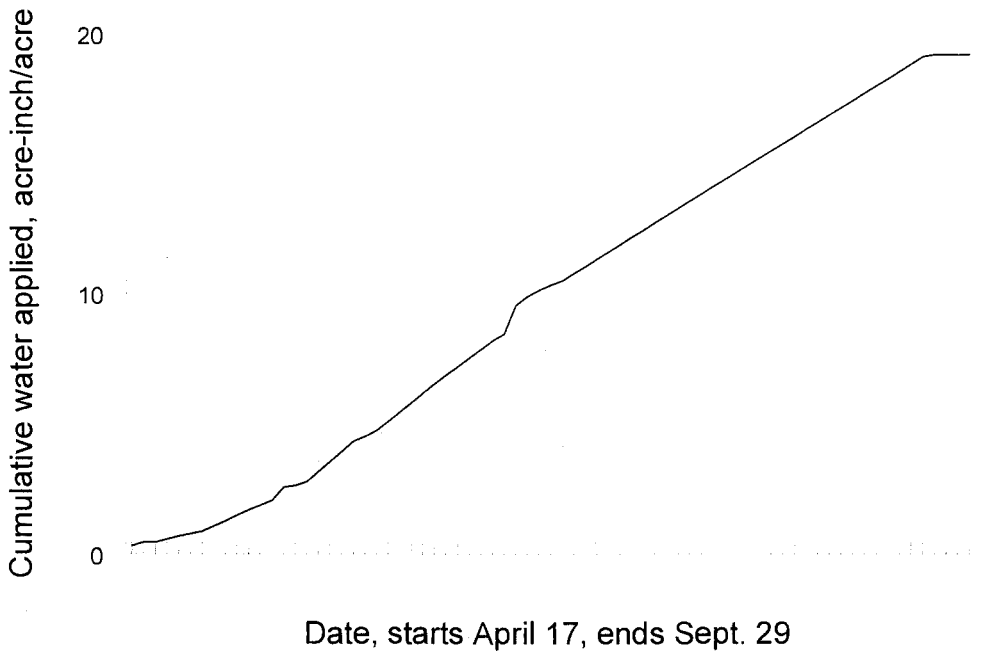

Figure 2. Cumulative water applied to poplar clones irrigated with a drip irrigation system with two emitters per tree, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.