GROUNDCOVERS FOR HYBRID POPLAR ESTABLISHMENT

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Summary

Hybrid poplar (*Populus deltoides* x *P. nigra*, cultivar 'OP-367') was planted in April 1997 at the Malheur Experiment Station and grown with five groundcovers. Groundcover treatments consisted of 1) bare ground maintained with a preplant herbicide and cultivations, 2) mowed weed cover, 3) alfalfa between tree rows, 4) wheat between tree rows, and 5) squash grown along the tree rows. The field was irrigated uniformly using microsprinklers along the tree row. Wood volume at the end of September 1997 was highest for the bare ground treatment and lowest for the mowed, alfalfa, and wheat treatments.

Introduction

With timber supplies from public lands in the Pacific Northwest becoming less available, economic opportunities may exist for alternatives. Hybrid poplar wood has proven to have desirable characteristics for many timber products. Growers in Malheur County have shown interest in growing hybrid poplars for saw logs. Clone trials in Malheur County have determined that the clone OP-367 (hybrid of *Populus deltoides* X *P. nigra*) performs well on alkaline soils for at least two years of growth.

Groundcover management could have a major influence on establishment cost and tree growth during the first few years before full canopy closure. Ideally, a groundcover should provide optimum tree growth with the least management cost. Studies with plantation forests (Nambiar and Sands, 1993) and orchards (Hogue and Neilsen, 1987) have shown the negative effect of cover crops and weeds on tree growth, specially in the first few years. Poplar root systems have a large horizontal spread, and one year old trees can have a horizontal root spread of up to 9 feet (Friend et al., 1991). Poplar root systems can also be concentrated on the surface soil. A study of the root systems of five 4-year-old hybrid poplar clones found that on average 61 percent of the total root mass was located in the upper 1.2 feet of soil (Heilman et al., 1994). Since poplar root systems have a large horizontal and superficial spread, tree growth should be very sensitive to the amount of weed-free area around the tree. The use of intercropping would be of benefit where a financial return was achieved during the plantation establishment without a reduction in tree growth. This study examined five groundcover options and their effect on first-year tree growth.

Materials and Methods

The trial was conducted on a Nyssa-Malheur silt loam (bench soil) with 6% slope at the Malheur Experiment Station. The soil has a pH of 8.2 and 0.8% organic matter. The field was planted to wheat for the previous two years and before that to alfalfa. The field was marked for planting by a tractor and a solid set sprinkler system was installed prior to planting. Hybrid poplar sticks, cultivar OP-367, were planted on April 25, 1997 on a 14 foot by 14 foot spacing. The sprinkler system applied 1.4 acre-inch/acre on the first irrigation immediately after planting. Thereafter the field was irrigated twice weekly at 0.6 acre-inch/acre per irrigation until May 26.

On May 27 the solid-set sprinkler system was removed and a microsprinkler system (R-5, Nelson Irrigation, Walla Walla, WA) was installed with the risers placed between trees along the tree row at 14 foot spacing. The microsprinklers had a water application rate of 0.12 inches per hour and a radius of 14 feet.

The experimental design was a randomized complete block with four replicates. The plots were three rows wide and 7 trees long. The five floor management systems were established and maintained as follows:

Bare soil: Treflan at 1 lb ai/acre was broadcast and incorporated on April 22. The plots were kept weed free by three rototilling operations and five hand weeding operations. Each hand weeding took approximately one man-day/acre.

Mowed: The ground between tree rows was mowed with a sickle bar mower 7 times to keep weeds below 6 inches in height. The ground along the tree row was hand weeded 5 times to maintain a 2-3 foot wide weed free strip.

Alfalfa: Alfalfa seed (cv. Vernema) was broadcast at 20 lb/acre and incorporated with a bed harrow and roller on April 22. Goal at 2 lb ai/acre was applied in a 2-3 foot wide band along the tree row immediately after planting. The alfalfa was harvested as forage three times during the season. The ground along the tree row was hand weeded 3 times to maintain a 2-3 foot wide weed-free strip.

Wheat: Wheat seed was drilled on April 22. Goal at 2 lb ai/acre was applied in a 2-3 foot wide band along the tree row immediately after planting. The wheat was mowed with a sickle bar mower at the heading stage on June 17. Thereafter the ground between tree rows was mowed as necessary to keep weed growth lower than 6 inches. The ground along the tree row was hand weeded 3 times to maintain a 2-3 foot wide weed-free strip.

Squash: Ten winter squash seeds (cv. Honey Boat) were planted every 2.5 feet along the tree row on May 28. The ground between tree rows was rototilled twice to maintain a weed-free condition using a PTO driven rototiller before vine growth prevented traffic between the tree rows. By July 11 the squash vines had started to grow up the tree trunks and had to be pulled away. The ground along the tree row was hand weeded once. The squash was harvested October 7.

Soil water potential (SWP) was measured in each plot by two granular matrix sensors (GMS; Watermark Soil Moisture Sensors model 200SS; Irrometer Co., Riverside, CA) at 8-inch depth. The GMS were installed along the middle row in each plot and between the riser and the third tree. The GMS were read at 8 A.M. daily starting on June 19. The field was irrigated when the average reading of all sensors reached -50 kPa.

The trees were fertilized on June 27 with 100 lb N/acre, 100 lb P_2O_5/acre, and 10 lb Zn/acre as a mixture of urea, monoammonium phosphate, and zinc sulfate. The fertilizer was applied on the surface in a ring around each tree and 2.5 feet away from the trunk.

Leaf tissue samples consisting of the first fully developed leaf in the adjacent poplar irrigation study were taken on July 24, August 11, and September 2 then analyzed for nutrients. Based on the leaf analyses, the trees were sprayed on July 30 with Fe at 0.2 lb/acre and K at 2 lb/acre; and on August 14 with Fe at 0.2 lb/acre, Mg at 2 lb/acre, and B at 0.1 lb/acre. Magnesium at 10 lb/acre as $MgSO_4$ was applied to the ground around each tree on September 15 using the same method as described in the previous paragraph. Boron at 0.2 lb/acre was injected into the sprinkler system on September 10.

The heights and diameters at 8-inch height of the central 5 trees in the middle row in each plot were measured at the end of June, August, and September. Diameter at breast height (4.5 ft from ground) was also measured at the end of August and September. Wood volumes were calculated for each of the central 5 trees in the middle row in each plot using an equation developed for poplars that uses tree height and diameter at breast height (Browne, 1962).

Results and Discussion

Tree height at the end of August and wood volume at the end of August and at the end of September were highest for the bare-soil plots and lowest for the mowed, alfalfa, and wheat plots (Table 1). Tree height at the end of September was highest for the bare soil or the squash cover crop. The amount of weed-free area was largest in the cultivated plots (100%), less in the squash plots (40%) and the least in the mowed, alfalfa, and wheat plots (20%). The wood volume at the end of September decreased with the treatments in the same order as the decrease in weed-free area, in accordance with research in orchards (Hogue and Neilsen, 1987) and plantation forests (Nambiar and Sands, 1993) .

Soil water potential at 8-inch depth was higher during the season in the bare-soil plots than in the other treatments (Figure 1). The season-long average SWP at 8-inch depth was -21, -36, -27, -27, and - 54 kPa for the bare soil, mowed, alfalfa, wheat and squash treatment, respectively. The SWP data suggest a lower evapotranspiration for the bare soil treatment than for the other treatments. The spray pattern of the microsprinklers in the squash plots was partly blocked by the vines, resulting in disuniform wetting of the soil surface.

The trees in the alfalfa and wheat plots showed injury symptoms early in the season from the Goal application, expressed as necrotic leaf margins and spots in the initial leaf flush. There was no difference in wood volume between alfalfa and wheat plots and the mowed plots, suggesting that the Goal injury might not have caused a significant reduction in tree growth. The 2-3 foot wide band along the tree row that received the Goal application in the alfalfa and wheat plots had less weed growth than the other plots and remained free of cover crop growth. Alfalfa yield averaged a total of 1.97 tons/acre (dry weight based on the whole area between tree rows) from the three harvests.

Squash yield averaged 6897 lb/acre based on the whole area between tree rows.

These results suggest that in the Treasure Valley, for first year establishment of poplar plantations, the optimum ground management strategy is bare ground without consideration of the economic value of cover crops. Cover crops should be of more benefit in orchards where weed growth is not precluded by canopy closure and in regions of high rainfall where erosion is a concern. In poplar plantations canopy closure may preclude any significant weed growth by the third year. The microsprinkler system used in this study had a low enough water application rate to avoid runoff and erosion, even with the 6% slope.

Literature cited

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Table 1. Hybrid poplar growth in response to five groundcovers, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1997.

Floor management	Tree height		Wood volume	
	August 31	September 30	August 31	September 30
	---- feet ----		---- ft^3/ac ----	
Bare soil	8.83	9.80	1.03	2.69
Mowed	6.27	7.60	0.26	0.76
Alfalfa	5.36	6.72	0.17	0.63
Wheat	6.36	7.70	0.28	0.90
Squash	7.55	9.04	0.62	1.52
LSD (0.05)	0.87	0.95	0.20	0.49

Figure 1. Soil water potential at 8-inch depth for poplar trees with five groundcovers. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1997.