

EFFECT OF MAGNESIUM FERTILIZATION ON HYBRID POPLAR GROWTH

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Summary

Magnesium fertilization was tested for its effect on irrigated, second and third year hybrid poplar tree growth on a Nyssa-Malheur silt loam. The fertilized trees had magnesium sulfate at 10 lb Mg/acre applied twice in 1998 and once in 1999. Magnesium fertilization resulted in a small increase in tree height, but did not have any statistically significant effect on diameter at breast height (DBH) or wood volume.

Introduction

Analyses of hybrid poplar leaf tissue at the Malheur Experiment Station consistently have shown magnesium deficiency. This trial tested the effect of magnesium fertilization on tree growth.

Materials and Methods

The trial was conducted on a Nyssa-Malheur silt loam (bench soil) with 6 percent slope at the Malheur Experiment Station. The soil has a pH of 8.2, 0.8 percent organic matter, and a cation exchange capacity of 14. The soil had 78 percent of the total bases in calcium, 16 percent in magnesium, 2 percent in potassium, and 4 percent in sodium. The field was planted to wheat for the 2 years prior to poplars, 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-in/acre per irrigation until May 26, 1997.

On May 27, 1997, the solid-set sprinkler system was removed, and a microsprinkler system using R-5 nozzles (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 inch per hour and a radius of 14 feet at 25 PSI. The microsprinkler system was designed to have a low enough water application rate to avoid runoff and erosion, even with the 6 percent slope.

The area between trees was maintained as weed-free as practical. Treflan at 1 lb ai/acre was broadcast and incorporated on April 22, 1997. The plots were kept weed free by three rototilling operations and five hand-weeding operations in 1997. On April

8, 1998, the plots were disked and Goal at 2 lb ai/acre was broadcast between the tree rows with a field sprayer and along the tree rows with a backpack sprayer. In 1998, the plots were kept weed free by one spot spray with Roundup and one hand weeding operation. The spot spray with Roundup was applied with a backpack sprayer with a cone type drift guard. In 1999, the plots were disked on April 20 and Scepter herbicide at 1 oz ai/acre was applied on April 26. The herbicide was incorporated by 0.6 in of irrigation water. Three hand weedings were necessary to keep the ground weed free during the season.

Soil water potential (SWP) was measured by 40 granular matrix sensors (GMS; Watermark Soil Moisture Sensors model 200SS; Irrrometer Co., Riverside, CA) at 8-inch depth. The GMS were installed along the tree row between the riser and the third tree. The GMS were read at 8 A.M. daily, starting on May 1. The field was irrigated when the average reading of all sensors reached -50 kPa.

On April 13, 1998, eight groups of trees were chosen and each group was assigned to one of two treatments: magnesium fertilizer or an untreated check. Each group of trees consisted of approximately 15 trees. The magnesium was applied as magnesium sulfate (9.8 percent Mg) at 10 lb Mg/acre in a ring approximately 2.5 ft from the tree trunk on July 2, 1998, September 16, 1998, and May 28, 1999. On August 28, 1999, all trees that had at least one border tree on all sides in each group were sampled for leaf tissue. The leaf tissue samples consisted of three first-fully-developed leaves from each tree. The leaf tissue samples were analyzed for magnesium content.

The branches on the bottom third of the tree trunk were pruned in February of 1999. Sprouts emerging at the pruning cuts were pulled off by hand three times during the season in 1999. On May 19, 1999, the trees received 50 lb N/acre as urea spread in a ring 2.5 feet from the trunk. On September 4, 1999, the field was sprayed aerially with Diazinon AG500 at 0.48 qt ai/ac for leafhopper control.

Tree heights and diameter at breast height (DBH) for all trees were measured monthly from May through September in 1998 and 1999. Wood volumes were calculated for each tree using an equation developed for poplars that uses tree height and DBH (Browne, 1962).

Results and Discussion

Magnesium fertilization did not increase leaf magnesium content. Leaves from trees in both treatments had similar magnesium contents. Leaf magnesium content for the fertilized trees averaged 0.23 percent and for the unfertilized trees averaged 0.24 percent on August 28, 1999. These magnesium contents were below the sufficiency range. Without a response in leaf magnesium, it is not surprising that magnesium fertilization did not increase tree growth (Table 1).

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. 9 p.

Table 1. Hybrid poplar height, diameter at breast height (DBH), wood volume, and volume increment in response to magnesium fertilization on July 2, 1998, September 16, 1998 and May 28, 1999. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1999.

Treatment	July 1, 1998			September 30, 1999			Volume increment*
	Height	DBH	Volume	Height	DBH	Volume	
	feet	inch	ft ³ /tree	feet	inch	---- ft ³ /tree ----	
Mg fertilizer	11.1	1.38	0.043	26.4	4.24	0.91	0.87
Check	11.0	1.38	0.046	24.5	4.1	0.82	0.79
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS

*From July 1, 1998 to September 30, 1999.