LINER PRODUCTION OF *ACER RUBRUM* 'RED SUNSET' AND *MALUS* 'SNOWDRIFT' PROPAGATED IN VITRO

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Abstract. Potted liners of *Acer rubrum* 'Red Sunset' and *Malus* 'Snowdrift' grown from rooted microcuttings were planted January 21, 1988 in the greenhouse. The liners were transplanted to 10-gal. containers or to the field between June 5 and 10, 1988. They were grown with single stems, were drip irrigated and given one of seven fertilizer treatments. Container treatments were 150 ppm N, or 300 ppm N 20-10-20, applied 2X/week as a drip and 18-6-12 slow release as a topdressing at 160 g/container Field treatments were no fertilizer, 100 ppm N, 200 ppm N, and 400 ppm N 20-10-20 injected through drip irrigation at 1X/week. Data recorded in late August showed that container-grown plants had significantly taller stems and greater stem caliper than field-grown plants. Container-grown maple stem heights for 150 ppm N, 300 ppm N, and 18-6-12 slow release treatments were 68.3 in., 67.9 in , and 57 0 in , respectively. Crabapple stem heights for the same treatments were 40.5 in., 38.4 in. and 28.4 in. Stem heights of field-grown plants ranged from 48.2 in. to 35.9 in. for maples, and 21.3 in. to 20 6 in. for crabapples. Stem caliper (basal) was significantly greater for container-grown crabapples; some maple treatments were equal to field treatments Survival was 100 percent for the 210 plants in the experiment and quality was good to excellent.

REVIEW OF LITERATURE

In vitro lab techniques have been described for a number of woody ornamental plants, including economically important tree genera. Successful commercial production of trees propagated *in vitro* is equally dependent upon subsequent acclimation and nursery production stages. A number of authors have described general environmental parameters and cultural techniques for acclimating tissue-cultured plants, but important details concerning fertilization, light intensity, irrigation, and other postpropagation production tasks have generally been lacking. Recent reports (1, 2) showed that size and quality of several *Acer rubrum* cultivars and *Betula nigra* 'Heritage' are significantly affected by cultural variables such as shade regime during acclimation, fertilizer rate and plantlet size. For example, fertilizer injection with 100 ppm N resulted in high quality plants of 'Heritage' birch whereas 300 ppm N caused severe burn and stunting. However, 'Red Sunset' maples fertilized with 300 ppm N were of excellent quality and superior to those fertilized with 100 N ppm. Finished liners of maple, birch, and crabapple were better quality when grown from plantlets subjectively judged to be of higher quality prior to planting. The purpose of this study was to observe the performance of micropropagated ornamental trees in standard nursery production systems and to record the effects of various fertilizer treatments. This information would establish

basic guidelines for growers interested in using micropropagated plants.

MATERIALS AND METHODS

Greenhouse-acclimated liners of *Acer rubrum* 'Red Sunset' and *Malus* 'Snowdrift' planted January 21, 1988 as rooted micro-cuttings were transplanted into 4 field and 3 container treatments the first week of June, 1988 (Table 1). Field soil was an Etowa silt loam with pH 6.2, low phosphorus, and high potassium. The container medium was 3:1 (v/v) pine bark: peat, amended with 7 lbs. dolomite, 2 lbs. treble superphosphate, 2 lbs. 10-10-10-granular fertilizer, 2.5 lbs. gypsum, and 1.5 lbs micronutrients per cubic yard. The medium was about pH 5.0 at planting. Container and field plants were fertilized for 2 weeks after planting with 100 ppm N 20-10-20. Treatment fertilizer was initiated June 14 and performed 1×/week for field treatments (4 hours irrigation then 1 hour fertilizer) and 2×/week for container treatments (1 hour irrigation then 1 hour fertilizer). Plants were irrigated as needed based on daily observations. Soluble salt levels were determined each week throughout the experiment. The experiment was arranged in a randomized design with 5 replications and 3 plants/cultivar/replication. Stem height and caliper 3.5 in. above the medium were measured at the end of August, 1988 and mean separations determined using the SAS analysis procedures.

Table 1. Descriptions of field container treatments.

Field treatments
Control: Drip irrigation 1× per week. No fertilizer applied.
100 ppm N 20-10-20 applied 1× per week with drip irrigation as needed
200 ppm N 20-10-20 applied 1× per week with drip irrigation as needed
400 ppm N 20-10-20 applied 1× per week with drip irrigation as needed
Container treatments
150 ppm 20-10-20 applied 2× per week with drip irrigation as needed
300 ppm 20-10-20 applied 2× per week with drip irrigation as needed
18-6-12 slow release at 160 g/10 gal. container as a top dressing

RESULTS

Stem height for 'Red Sunset' maple and 'Snowdrift' crabapple was significantly affected by fertilizer treatment and production method (Table 2). Maples and crabapples grown in containers at 150 and 300 ppm N (20-10-20) were equal in height but significantly taller than all other treatments. The 18-6-12 slow-release container treatment was significantly better than field treatments for both maple and crabapple. Field-grown maples receiving no fertilizer or 100 ppm N were taller than those grown at the higher fertilizer rates.

Table 2. The effect of fertilizer treatment and production method on stem height of 'Red Sunset' maple and 'Snowdrift' crabapple.

Treatment	'Red Sunset' maple	'Snowdrift' crabapple
Container-grown (10 gal)	*Mean height[1] (in)*	
150 ppm 20-10-20	68.3a	40 5a
300 ppm 20-10-20	67.9a	38.4a
18-6-12 slow release	57 0b	28.4b
Field grown		
100 ppm 20-10-20	48 2c	20.6c
No fertilizer	46.7c	21.3c
200 ppm 20-10-20	36.6d	20.6c
400 ppm 20-10-20	35.9d	21 3c

[1]Means within a group followed by the same letter are not significantly different at the 5% level of probability according to Duncan's New Multiple Range Test.

Stem caliper for maple and crabapple in container treatments was significantly greater than those of field treatments (Table 3). Caliper of container maples receiving 150 ppm or 300 ppm was equal or greater than those in the 18-6-12 slow release treatment. There was no difference between caliper for field-grown crabapple treatments.

Table 3. The effect of fertilizer treatment and production method on stem caliper (mm) of 'Red Sunset' maple and 'Snowdrift' crabapple.

Treatment	'Red Sunset' maple	'Snowdrift' crabapple
Container-grown (10 gal)	*mean caliper[1] (mm)*	
150 ppm N 20-10-20	13 7a	8.4a
300 ppm N 20-10-20	13.5a	8.1a
18-6-12 slow release	11.5b	7 7a
Field grown		
100 ppm N 20-10-20	10.7bc	6.8b
No fertilizer	10 3cd	6 5b
200 ppm N 20-10-20	9.2de	6.5b
400 ppm N 20-10-20	9.1de	6 5b

[1]Means within a column followed by the same letter are not significantly different at the 5% level of probability according to Duncan's New Multiple Range Test.

DISCUSSION

Maples and crabapples grown in containers were significantly taller than plants grown in the field. Both liquid-feed treatments (150 ppm N [20-10-20] and 300 ppm N [20-10-20]) produced taller plants than 160g/container 18-6-12 slow-release. Fertilizer treatments in the field had no effect on the height of crabapple, but the two highest rates (200 ppm N [20-10-20] and 400 ppm N [20-10-20]) suppressed the height of maples. Caliper followed the same trends as plant height except there was no difference in caliper of

crabapples grown in containers in any of the three fertilizer treatments.

Plant growth in the field was significantly less than growth in containers and may have been influenced by soil drainage conditions. The starting pH of 6.2 dropped to about 6.0 in the no fertilizer or 100 ppm N treatments, but to about 5.0 in the higher fertilization treatments. Soluble salt concentrations in the field soil tended to be low, 50 to 100 micromhos in the no fertilizer treatment, and 80 to 150 micromhos for the 400 ppm N treatment. The higher values were recorded near the end of the experiment. Container pH was 0.5 to 1.0 units greater at the end of the experiment, probably due to the alkaline city water supply. Container soluble salts were higher (250+/− micromhos) than in the field.

Soil and container temperature may have reduced plant growth in this experiment. Container-medium temperatures as high as 104°F were recorded on the west side of containers in the 18-6-12 slow-release treatment. The remaining container treatments were shaded to some extent, which may have contributed to their superior performance. Soil surface temperatures as high as 100°F were recorded adjacent to field plants.

Better growth might have been realized if liners had been planted 4 to 6 weeks earlier. Although plants apparently never suffered drought stress, the extremely hot summer may have delayed bud break in crabapple causing many plants to stop growth prematurely. Maple and 'Heritage' birch (not reported) had continuous growth throughout the growing period.

This work shows that rooted microcuttings propagated in a typical polyhouse using a midwinter production system and standard nursery production procedures can be used to produce satisfactory growth.

LITERATURE CITED

1. Day, J. W., W. T. Witte, and H. L. Dickerson. 1988. Acclimation of micropropagated tree liners: The response of *Acer rubrum* cvs. and *Betula nigra* 'Heritage' to fertilizer rate and light regime. *HortScience* (abstract, in press)
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