Effects of Fall Fertilization on Frost Hardiness of Azaleas

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Purpose: Fall Fertilization improves spring growth in many woody nursery crops. However, lack of research and fear of frost damage may be preventing proper fall fertilization. The purpose of this research was to determine the effects of fall fertilization on cold hardiness and growth of *Rhododendron x Kurume 'Hinodegiri'* .

Materials & Methods: Rhododendron L. 'Hinodegiri' (evergreen kurume azalea), liners were transplanted into 2.2-liter containers on May 1, 2002. The growing media was aged pine bark amended with 2 kilograms (~4 pounds) of dolomitic limestone, and 0.25 kilograms (~1 pound) of Micromax micronutrient per cubic yard. Prior to the initiation of fertility treatments on August 1, all plants were fertilized daily with 0.5 liter (~1 inch) of 75 ppm Peters 20-10-20. Electrical conductivity of leachate was monitored daily throughout the study using the Pour Thru Extraction Method. Plants were leached to maintain soluble salt levels below 1.0 mS/cm. Fertility treatment consisted of constant liquid feed application of 0.5 liter of a 16-8-8 liquid fertilizer solution. Beginning August 1, plants were grown under 5 different fall fertility regimes:

1) August 1 - September 29, 75 ppm;
2) August 1 - September 29 ,125 ppm;
3) No additional fertilizer;
4) August 1 - November 28, 75 ppm; and
5) August 1 - November 28 ,125 ppm N.

Providing 75 ppm N from August 1 - September 29 was considered the industry standard for this study; stopping fertilization 6 weeks before the predicted frost date. Plants were arranged as a randomized complete block design with 3 replications for each fertility regime. Azaleas from each fertility regime were harvested November 12 and December 11, 2002, and subjected to progressively lower temperature intervals under laboratory conditions. The Spearman-Karber Method was used to estimate T_{50} values (temperature at which 50% of accessions are killed). Growth index (GI) was determined August 1 and December 13, 2002 on 5 plants per treatment x replication combination. Growth index measurements were determined by measuring maximum height (H), maximum width (W1), and width perpendicular to W1 (W2) and calculated as GI = (H+(W1 + W2)/2)/2.

Data Analysis: Analysis of variance was performed on T_{50} and GI values. The August 1 - September 29, 75 ppm fertility treatment was compared to all other treatments using Dunnett's Comparisons twoway analysis of variance.

Results and Discussion:

November Results: Analysis of frost hardiness began with the onset of cold weather in November. When compared to the industry control, cold hardiness of leaves from the November harvest were not affected by fall fertilization (Table 1.). However, providing fertilization at 125 ppm regardless of whether or not fertilization was extended through September or November, reduced frost hardiness of stems in the November harvest (Table 1). Cold hardiness was not different from the control when fertilization was either discontinued at the end of July or applied at the 75 ppm rate through the November harvest.

Table 1. Effects of fertilization treatments on frost hardiness of leaf and stem tissue harvested November 12, 2002

Fertilization treatment (ppm)			
8/01 - 9/29	**9/30 - 11/12**	**Leaf T_{50} (°C)**	**Stem T_{50} (°C)**
75	0	-9.00	-15.50
125	0	-9.50	-11.50*
0	0	-8.75	-13.50
75	75	-7.75	-13.75
125	125	-6.00	-9.25*

* Implies significant difference from the control at a = 0.05

December Results: Only the high rate of extended fertilization (August - November) reduced stem frost hardiness for the December harvest (Table 2). Leaf tissue was unaffected by fertilizer treatments.

Table 2. Effects of fertilization treatments on frost hardiness of leaf and stem tissue harvested December 11, 2002

Fertilization treatment (ppm)			
8/01 - 9/29	**9/30 - 11/28**	**Leaf T_{50} (^oC)**	**Stem T_{50} (^oC)**
75	0	-19.75	-21.25
125	0	-18.00	-20.75
0	0	-20.00	-22.50
75	75	-18.75	-19.50
125	125	-18.50	-9.50*

* Implies significant difference from the control at a = 0.05

Growth Index: Following completion of fertility treatments in December, only the GI of plants of the lowest fertility regime was less than the industry standard. Compared to the **industry** standard, additional fertilizer did not increase growth during the season in which it was applied, but reducing fertility decreased growth.

Table 3. Effects of fertilization treatments on Growth Index, December13, 2002

Fertilization treatment (ppm)		
8/01 - 9/29	**9/30 - 11/28**	**GI**
75	0	24.17
125	0	24.48
0	0	22.28*
75	75	24.50
125	125	24.67

* Implies significant difference from the control at a = 0.05

Significance to the Industry: A 125 ppm rate of fertilization applied in either late summer, or in both late summer and fall reduced evergreen azalea stem frost hardiness in November. In addition, higher (125 ppm) fertility through October and November continued to suppress frost hardening through December. In contrast, extending fertilization at 75 ppm N through October and November did not reduce fall or early winter frost hardiness. Nursery production using high rates of fertilization may reduce frost hardiness even if fertilization is terminated well before first frost. However, by maintaining a moderate fertility rate, nursery producers may be able to realize the benefit of fall fertilization (potential increased growth the next year) without any reductions in cold hardiness.