Research Final Report

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Title: Effect of nitrogen fertilizer rates on shoot dieback of *Fraxinus pennsylvanica* 'Summit'.

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Abstract

Shoot dieback of green ash (*F. pennsylvanica* var. *lanceolata*) occurs periodically in nursery grown bare root and specimen trees. This dieback can occur anytime, and can affect as much as half of the tree canopy. Although earlier studies at the NWREC suggested that plant nutrition might play a role in ash dieback, *Fraxinus* has not been studied in nitrogen utilization studies and it is unknown if nitrogen effects shoot dieback. A research block of 260 container-grown *Fraxinus pennsylvanica* 'Summit' was established on March 4, 2005. The trees were arranged into six nitrogen treatment levels (0, 4.2, 8.4, 16.8, 33.6 grams nitrogen per tree from urea formaldehyde 38.0.0, and Osmocote 18.6.12 the rate of 32.7 grams nitrogen per tree). The nitrogen treatment plots were split into two groups and foliar urea (3% solution) was applied in early fall to one of the groups. One tree from each plot was harvested the week of November 6, 2005 for fresh weight measurements (fine roots, course roots, previous season shoot, current season shoot). A sub-sample was collected from each tissue group for plant nutrient analysis and the results are still pending. Although late-season terminal leaf necrosis was observed, there have been no observations of terminal shoot die-back. The nitrogen treatments had a significant effect on the growth of both roots and shoots of 'Summit' ash. This study is ongoing and additional discussion will be available after the plant nutrient analysis is completed and ash dieback is evaluated during the 2006 growing season.

Research Objective

The goal of this project is to determine if plant nitrogen levels effect the amount to shoot dieback in green ash and to better understand nitrogen utilization of container-grown trees.

Materials & Methods

A research block of container-grown ash trees was established at the North Willamette Research and Extension Center, Aurora, Oregon. On March 4, 2005, 260 one-year old uniform bare root *Fraxinus pennsylvanica* 'Summit' were potted into #7 size containers using a Douglas-fir based substrate and grown under a retractable roof structure. Irrigation was applied with micro-spray sprinklers located at the container substrate surface of each tree. Leaves attached to the main stem and side-shoots were removed to a height of about 1.0 meter. The shoots in the tree canopy were not pruned. Ash aphid infested the trees in early spring and was controlled using the systemic insecticide Marathon® applied to the container surface.

The trees were arranged into six main nitrogen treatments using a two-factor design with four trees per plot. The main treatments consisted of five levels of nitrogen: 1) no nitrogen fertilizer; 2) 4.2g nitrogen per tree ; 3) 8.4g nitrogen per tree; 4) 16.8g nitrogen per tree; 5) 33.6g nitrogen per tree; and 6) Osmocote (18.6.12) controlled release fertilizer at the rate of 32.7g nitrogen per tree (12lbs fertilizer/cubic yard). The nitrogen source for treatments numbers 2 through 5 was Nitroform (urea formaldehyde 38.0.0) applied in three split treatments every 10 weeks beginning one week after planting. Phosphorus and Potassium were supplied to all trees using rates equivalent to the Osmocote 18.6.12 treatment. The secondary treatment was foliar urea (3% solution) applied on September 22, 2005 to one half of the trees.

One tree from each plot was harvested the week of November 6, 2005 for fresh weight measurements and tissue analysis. After the root system was washed to remove container substrate, the tree was sectioned into four tissue groups (fine roots, course roots, previous season shoot, current season shoot) and fresh weight determined. A sub-sample was collected from each tissue group for plant nutrient analysis and send to the USDA-ARS Horticultural Crops Research Laboratory, Corvallis. Prior to planting, a sub-sample of 20 trees were sectioned into three tissue groups (roots, understock stem, scion stem) to measure nitrogen content and biomass.

Leaf necrosis of the terminal shoots was observed in some trees in the low or no nitrogen treatments beginning mid August. These symptoms continued to progress which prompted a leaf tissue analysis test. On September 19, 2005, three of the main treatment blocks were sample by collecting 20 leaflets from each treatment (five leaflets per tree) and dried for 48 hours. The samples were then send to Brookside Labs for a complete plant nutrient analysis. A visual rating on the amount of shoot necrosis/defoliation was conducted on October 7, 2005.

Results & Discussion

This study is ongoing and is not scheduled for completion until the summer of 2006. Although terminal leaf necrosis was observed in the low nitrogen treatments, there have been no observations of terminal shoot die-back. One-half of the study trees are being overwintered at the North Willamette Research & Extension Center. These trees will be fertilized with a standard rate of Osmocote in the spring and observed for die-back symptoms during the growing season.

The nitrogen treatments had a significant effect on the growth of both roots and shoots of 'Summit' ash. While these results were expected, it is possible that the trees growing in the Osmocote treatment had better utilization on nitrogen then the Nitroform source at the similar rate. Another point of interest were the results from the low nitrogen treatment compared to the no nitrogen treatment. Although not statistically different, the no nitrogen treatment had consistently higher plant growth values. This might be explained by the increase in microbial activity by the addition on a small amount of nitrogen. An increase in decomposition microbes could have utilized more of the plant available nitrogen. Additional discussion will be available after the plant nutrient analysis is completed.

Nitrogen Source	Rate N / Tree (g)	Total Root Fresh Weight (g)	Total Shoot Fresh Weight (g)	Foliar Nitrogen [Z] (%)	Foliage Rating [Y]
Osmocote 18.6.12	32.7	975.5 a [W]	1041.0 a	2.54	8.3 a
Nitroform 38.0.0	33.6	860.6 ab	922.0 a	2.34	4.8 b
Nitroform 38.0.0	16.8	786.9 ab	781.9 b	1.88	3.3 b
Nitroform 38.0.0	8.4	669.6 bc	636.7 c	1.58	1.3 c
Nitroform 38.0.0	4.2	540.3 c	534.1 c	1.42	0.6 c
None	None	638.2 bc	604.8 c	1.06	0.0 c

[Z] Mean value based on three samples per treatment. Statistical analysis not conducted.
[Y] Visual foliage rating on a scale 0 to 10 (0 = complete foliage necrosis/defoliation; 10 = green leaves).
[W] Column numbers followed by the same letter are not significantly different at P = 0.01 as determined by Tukey's multiple range test (NCSS, 2004).