

Irrigation Timing and Emitter Selection Affects Irrigation Efficiency and Plant Growth

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Project Objectives

To develop economically feasible management practices that promote water conservation and protect water quality while maintaining crop quality, production, and profitability.

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Problem Statement

Container nursery production requires large inputs of water and nutrients but often irrigation inputs have exceeded plant demand and lacked application precision. As a result of excess irrigation, excessive leaching of nutrients, such as nitrogen and phosphorus from container growing systems, occurs. During a 3 year test, plant response and irrigation efficiency with micro-spray stakes combined with time of day of irrigation for production of container grown trees was evaluated.

Experiment Objectives:

1. Evaluate time of day of irrigation
2. Evaluate efficiency of the emitter style
3. Analyze leachate volume, NO₃-N and PO₄
4. Monitor plant growth

Material and Methods

Acer rubrum 'Sun Valley' bare root liners
(3-4 feet, lightly branched)

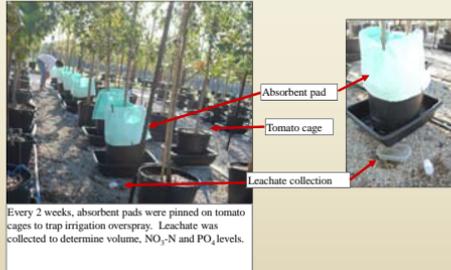
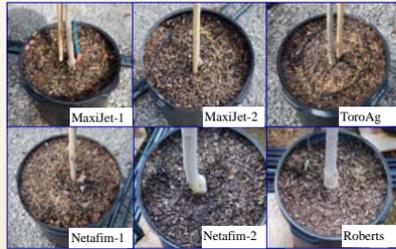
Potted: 23 Apr 2008

Substrate: 100% pine bark mended per yard with:
11.0 lbs. 19-5-9 Osmocote Pro
1.0 lb. Micromax
1.0 lb. Aqua-Gro

Cyclic irrigation regimes:

- 5-6-7 am
- 9-12-3
- 12-3-6
- 3-6-9 pm

Leachate collected biweekly 18 June 2008 - 22 Nov 2008



Every 2 weeks, absorbent pads were pinned on tomato cages to trap irrigation overspray. Leachate was collected to determine volume, NO₃-N and PO₄ levels.

Results - Irrigation Timing

Time of Day	Leachate volume, ml	% Efficiency ²	NO ₃ -N, ppm	NO ₂ -N, mg	PO ₄ , ppm	PO ₄ , mg
5-6-7 am	704 a ¹	45 a	5.8 b	4.5 a	7.3 b	5.7 a
9-12-3	404 c	63 c	8.3 a	1.9 b	12.0 a	2.8 b
12-3-6	273 d	73 d	2.9 c	0.9 c	4.5 c	1.4 c
3-6-9 pm	489 b	56 b	2.6 c	1.2 c	4.0 c	1.8 bc

² Efficiency = 1 - [(100% * Overspray + Total Leachate) / Emitter Output]

¹ Means with the same letter within the same column are not significantly different using Fisher's LSD, p<0.05.

Results - Emitter Efficiency

Emitter Style	Overspray, ml	Leachate volume, ml	% Efficiency ²
MaxiJet -1	34.3 a ¹	490 c	69 c
MaxiJet -2	8.7 c	703 b	43 b
ToroAg	0 d	248 e	77 d
Netafim -1	1.7 d	394 d	67 c
Netafim -2	12.5 b	203 e	80 d
Roberts	8.3 c	769 a	21 a

² Efficiency = 1 - [(100% * Overspray + Total Leachate) / Emitter Output]

¹ Means with the same letter within the same column are not significantly different using Fisher's LSD, p<0.05.

Results - Growth

Time of Day	Caliper Growth, mm	Height Growth, cm
5-6-7 am	12.7 c ²	101.8 b
9-12-3	13.9 ab	115.9 a
12-3-6	14.1 a	120.7 a
3-6-9 pm	12.9 bc	114.4 a

² Means with the same letter within the same column are not



Summary

The efficiency of irrigation is improved if applications are made in mid day or late afternoon with micro-spray stake irrigation for production of container grown trees. Due to increased plant water use of mid day or late afternoon irrigation, trunk diameter growth was significantly larger compared to plants that received only early morning irrigation. Height growth was similar when trees were irrigated in early morning, in late afternoon or a combination of both. Container leachate volume was greater with early morning and evening irrigation than mid day or afternoon irrigation. Micro spray-stake design affected irrigation efficiency. Double sided stakes or rings had less overspray in #15 nursery containers than fan style stakes. Nutrient effluent was less in container leachate from mid day and late afternoon than early morning irrigation.