Controlled Release Container Nursery Fertilizer Evaluations

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Purpose:

The purpose of this trial was to evaluate controlled release nursery fertilizers under typical nursery conditions. The products and funding were solicited from established companies and used at the rates they suggested. The products were evaluated by monitoring the nutrient levels in the potting mix and in the plant tissue, by determining the dry weight of the tops produced and by a visual quality ranking at the end of the production season.

Methods & Materials:

At the Center for Applied Nursery Research, an evaluation of 8-9 month controlled release fertilizers were trialed for the 1997 growing season. Three ornamental crops were potted up or moved on site and treatments top dressed on April 11 and 12, 1997. The crops were grown under normal nursery conditions with irrigation, weed control and pesticide applications as needed. The project was terminated on October 16, 1997, six months later.

Four companies provided fertilizer products for evaluation. They were:

Helena Chemical Company
IMC Vigoro
O.M. Scotts and Sons Company
Wilbro, Inc.

Treatments were applied to the Blue Pacific shore juniper, H.H. Hume azalea and Compacta holly. The junipers and azaleas liners in 2 1/4" pots were transplanted into trade gallons. The potting mix was 90% ground pine bark and 10% sand with 2 pounds of Micromax minor nutrients, 6 pounds dolomitic lime, 2 pounds gypsum and Talstar insecticide for fire ants. The hollies were small established gallons potted late in 1996 and needed another seasons growth to reach saleable size.

Plants were maintained under normal nursery production conditions. The azaleas required several applications of insecticide to control lace bug. They were also drenched once with aluminum sulfate to lower the pH. The junipers were drenched with Subdue in August to overcome root rot (*Phytophthora*). The hollies received no special treatment during the growing season. The azaleas and junipers were pruned back once in mid-season to improve quality and the hollies remained unpruned.

All treatments were completely randomized within each crop. Two rows of plants were used on the outside of the treated plants as a boundary to protect against any edge effects. Plants sampled once for soil or plant tissue were excluded from all future evaluations.

Each experimental crop and its treatments are listed in Table 1. The Blue Pacific juniper had eight treatments. The control fertilizer was Scotts High N, 24-4-7, which is used as the standard at McCorkle Nurseries. The H.H. Hume azaleas and Compacta hollies had 14 treatments each. The rates were those suggested by the product suppliers as grams per pot. Also listed, is the grams of nitrogen per pot (GN/Pot) for each treatment. When the product analysis is followed by an "E", it represents an experimental product.

Table 1. 1997 Controlled Release Fertilizer Treatments

Juniper Crop - *Juniperus conferta* 'Blue Pacific'

Treatment#	Company	Product*	Rate	GN/Pot
1	Helena	17-6-10	18g	3.06
2	Helena	18-6-12	15g	2.7
3	Wilbro	20-10-10	18g	3.6
4	Wilbro	20-10-10	22g	4.4
5	Wilbro	16-5-10	18g	2.88
6	Wilbro	16-5-10	22g	3.52
7	Vigoro	21-8-12 E	19g	3.99
8	Control (High N)	24-4-7	20g	4.8
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Azalea Crop - *Rhododendron* 'H.H. Hume'

Treatment #	Company	Product	Rate	GN/Pot
1	Helena	17-6-10	18g	3.06
2	Helena	18-6-12	15g	2.7
3	Wilbro	20-10-10	18g	3.6
4	Wilbro	20-10-10	22g	4.4
5	Wilbro	16-5-10	18g	2.88
6	Wilbro	16-5-10	22g	3.52
7	Vigoro	21-8-12 E	16g	3.36
8	Scotts	19-5-9	18g	3.42
9	Scotts	19-5-9	22g	4.18
10	Scotts	15-9-11	22.5g	3.375
11	Scotts	15-9-11	27.5g	4.125
12	Scotts	19-6-12 E	18g	3.42
13	Scotts	19-6-12 E	22g	4.18
14	Control	24-4-7	15g	3.6
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Table 1. 1997 Controlled Release Fertilizer Treatments (continued)

Holly Crop - *Ilex crenata* 'Compacta'

Treatment #	Company	Product	Rate	GN/Pot
1	Helena	17-6-10	18g	3.06
2	Helena	18-6-12	15g	2.7
3	Wilbro	20-10-10	18g	3.6
4	Wilbro	20-10-10	22g	4.4
5	Wilbro	16-5-10	18g	2.88
6	Wilbro	16-5-10	22g	3.52
7	Vigoro	21-8-12 E	19g	3.99
8	Scotts	19-5-9	24g	4.56
9	Scotts	19-5-9	28g	5.32
10	Scotts	15-9-11	30.5g	4.575
11	Scotts	15-9-11	35.5g	5.325
12	Scotts	19-6-12 E	24g	4.56
13	Scotts	19-6-12 E	28g	5.32
14	Control	24-4-7	20g	4.8
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* Fertilizer analysis followed by "E", means Experimental product.

Evaluation of the products was done by monitoring the nutrient levels in the potting mix and in the plant tissue in August and October. Ten pots for each treatment were monitored by the Virginia Tech Extraction Method (VTEM) in mid summer. Growth was determined by weighing the dry weight of the top growth produced by October. At seasons end, a visual ranking of the plant quality was assigned by the product representatives, the nursery representatives and University of Georgia representatives.

The azalea and juniper crops were pruned back to a standard height and width to encourage branching and improved quality. The clippings removed from each plant were dried and weighed. This dry weight should serve as a determination of the early season growth. The junipers were pruned on August 15 to a height of 5" above the medium and to the edge of the pot. The azaleas were pruned on July 15 to 7" and the pot edge. The holly crop remained unpruned in 1997.

Visual rankings of all crops and treatment were conducted on October 16 and were based on perceived plant quality. Evaluators included product representatives, nursery employees and UGA faculty. The treatments were randomized and the fertilizer product on the media surface was covered. A blind test was conducted by 14 evaluators on a 4 point scale with the 4 ranking the best and the 1 ranking the poorest.

After the visual evaluation, the plants from each treatment for each crop were harvested at the soil line. These tops were dried and weighed. These top dry weights represent the amount of growth produced during this project, as well as the initial size of the liners or plants. The initial plants were selected for uniformity and pruned to a standard size to reduce the amount of variation.

Results: Leachate, Media and Tissue Analysis

The juniper crop was slow to initiate growth from the liners and by June had produced little foliage to cover the pot surface. The azalea liner crops produced good early growth. Plants were slightly yellow. The one gallon hollies produced good early growth with a uniform look over all treatments.

The junipers were young liners providing little shading of the product on the medium surface and probably little uptake by the plants. The soluble salt levels in June were considered high overall. Only treatments 1 and 2 were at 1 mmhos/cm^3 or less. The highest levels certainly could have caused some plant root damage. There was a direct correlation with grams of nitrogen/pot and level of soluble salts recorded (except treatment 1). The azalea liners were larger and produced good early growth. The soluble salt levels were mostly within the acceptable range. Several treatments were high (6, 10, 3, 4, 11) but not excessively so. The hollies were well established gallons with roots to the bottom of the pots and a healthy demand for nutrients and water. All the soluble salts were within the desirable range for growth.

The junipers were sampled August 11, the azaleas on July 15 and the hollies on Augsut 21 (media) and August 26 (leaf tissue). Composite samples from three or four individual plants were combined to form a single mixed sample for both media and tissue samples.

The August 11 juniper nutrient levels, the media nitrogen and potassium levels were all low. The phosphorous levels were acceptable or better for treatment 4, 6, and 7. The tissue nutrient levels were acceptable for nitrogen in all treatments, phosphorous acceptable for treatments 1, 3, 4, 6, and 7; and potassium was low for all treatments.

The media nutrient levels for the azalea treatments had low nitrogen and potassium for all treatments. The phosphorous was acceptable for treatments 3, 7, 10, 11 and 13. The leaf tissue nutrients were acceptable for nitrogen and phosphorous for all treatments. The potassium levels were low for treatments 3, 5, 6, 8, 9, 10 and 14.

The holly treatments media had low nitrogen and potassium for all treatments. Acceptable levels of phosphorous were found in treatments 1, 4, 10, 11, 12 and 13. The holly leaf tissue had good nitrogen levels, phosphorous levels all slightly low, and potassium levels were all low.

All crops and all treatments were low for the October termination media nitrate and potassium. The media phosphorous levels were low for the junipers and azalea crop for all

treatments. Only treatment 2 and 5 were low for the hollies. The plant tissue nitrogen was acceptable for all crops and all treatments. The tissue phosphorous levels were slightly low to acceptable for the junipers and azaleas. The hollies were all low in phosphorous. Potassium levels were low for all crops and all treatments. Generally the October media and tissue levels were lower than the July and August levels.

Results: Pruning Weights

In August the junipers were pruned back to 5" tall and to the edge of the pot. The clippings were dried and weighed. No significant differences were found among the treatments for the junipers.

The azalea pruning weights showed a large block of treatments (1, 10, 14, 9, 7, 11, 8, 6, 2, 3) that produced more dry weight than treatments 13, 4, 12 (5). Treatment 1 produced the greatest weight with the lowest grams of nitrogen/pot of the prunings on July 15.

Results: Termination Dry Weights

The plants were harvested on October 16 and dried to determine the top growth dry weight. The juniper treatments produced no significant differences in their October growth dry weights. The azalea top dry weights did produce differences. The mean dry weights are presented in Table 2.

Table 2. Terminal Top Dry Weights of H.H. Hume Azalea

Treatment #	Product	GN/Pot	Mean Dry Weight (g)	Non-significant Ranges
3	W 20-10-10	3.6	18.9	a
4	W 20-10-10	4.4	19.4	ab
12	S 19-6-12 E	3.42	22.2	abc
2	H 18-6-12	2.7	22.7	abc
14	C 24-4-7	3.6	23.2	abc
6	W 16-5-10	3.52	23.4	abc
7	V 21-8-12 E	3.36	23.6	abc
1	H 17-6-10	3.06	24.0	abc
13	S 19-6-12 E	4.18	24.2	abc
5	W 16-5-10	2.88	24.8	bc
10	S 15-9-11	3.38	25.3	c
8	S 19-5-9	3.42	26.2	c
11	S 15-9-11	4.12	27.1	c
9	S 19-5-9	4.18	28.1	c

The holly top dry weights produced significant differences amount treatments. Their mean dry weights are presented in Table 3.

Table 3. Top Dry Weights of Compacta Holly

Treatment #	Product	GN/Pot	Mean Dry Weight (g)	Non-significant Ranges
1	H 17-6-10	3.06	97.6	a
2	H 18-6-12	2.7	98.0	a
5	W 16-5-10	2.88	103.0	ab
7	V 21-8-12 E	3.99	103.5	ab
4	W 20-10-10	4.4	107.4	abc
14	C 24-4-7	4.8	111.2	abc
3	W 20-10-10	3.6	111.5	abc
8	S 19-5-9	4.56	115.5	bcd
12	S 19-6-12 E	4.56	117.1	bcd
9	S 19-5-9	5.32	118.1	bcde
13	S 19-6-12 E	5.32	120.4	cde
6	W 16-5-10	3.52	120.8	cde
10	S 15-9-11	4.575	130.3	de
11	S 15-9-11	5.325	132.1	e

The juniper crop produced no dry weight differences. The azaleas did produce statistically heavier and lighter dry weights, however there was not a lot of separation between treatments. The greatest weights were produced by treatments 9, 11, 8 and 10. Treatments 5, 13, 1, 7, 6, 14, 2 and 12 were not significantly different from these top four treatments. Treatment 5 was notable because of its low GN/Pot rate of 2.88. The holly treatments that produced the greatest dry weight were 11, 10, 6, 13 and 9. Treatment 6 had the lowest GN/Pot in this group of treatments.

Results: Visual Rankings

Fourteen individuals ranked the crops and treatments for visual quality. The ranking are on a 4 point scale with a #4 excellent and #1 poor. Four product representatives, eight nursery representatives and two university representatives made up the group evaluating the treatments for visual quality. The rankings of each representative were statistically analyzed and the highest and lowest were used in the table listings.

Visual ranking for the junipers had 9 individuals ranking no differences between treatments. Five individuals ranked treatments 1(2), 2, 3(2), 5, 6, 8(2) best and treatments 2,

6(2), 7(5) the poorest treatments. Treatment 4(5) was ranked not significantly different from the best treatments. The number in "( )" indicates the number of individuals ranking this treatments as best or poorest.

Twelve individuals found differences in the azalea treatments and two did not. Treatments receiving the highest visual rating were 11(8), 6(4), 9(4), 10(4), 5(3) and 8(2). Treatments with the lowest ratings were treatments 3(7), 4(4), 2(3), 7(3), 12(3), 13(3), 12(2), 1(1), 5(1), 8(1), 9(1), 10(1) and 14(1).

The holly treatments that received the highest rankings were 13(6), 9(5), 10(5), 11(4), 6(1), 8(1), 12(1) and 14(1). The lowest ranking treatments were 2(7), 3(3), 4(3), 7(2), 1(1) and 12(1).

Table 4. Summary of Visual Rankings

Blue Pacific Juniper		H.H. Hume Azalea		Compacta Holly	
Highest Ranking Treatments*	Lowest Ranking Treatments	Highest Ranking Treatments	Lowest Ranking Treatments	Highest Ranking Treatments	Lowest Ranking Treatments
1(2)	7(5)	11(8)	3(7)	13(6)	2(7)
3(2)	6(2)	6(4)	4(4)	9(5)	3(3)
8(2)	2	9(4)	2(3)	10(5)	4(3)
2		10(4)	7(3)	11(4)	7(2)
5		5(3)	12(3)	6(1)	1(1)
6		8(2)	13(3)	8(1)	
			12(2)	12(1)	
			1(1)	14(1)	
			5(1)		
			8(1)		
			9(1)		
			10(1)		
			14(1)		

*Number in "( )" represent the total number of representatives ranking this treatment high or low.

Table 5. Total High and Low Visual Rankings for All Crops

Total Highs				Total Lows			
Treatment	Number Selected Total		Total	Treatment	Number Selected		
1	(2+0+0)	=	2	1	(0+1+1)	=	2
	(1+0+0)	=	1	2	(1+3+7)	=	11
3	(2+0+0)	=	2	3	(0+7+2)	=	9
4	(0+0+0)	=	0	4	(0+4+3)	=	7
5	(1+3)+0)	=	4	5	(0+1+0)	=	1
6	(1+4+1)	=	6	6	(2+0+0)	=	2
7	(0+0+0)	=	0	7	(5+0+2)	=	7
8	(-+2+1)	=	3	8	(-+1+0)	=	1
9	(-+4+5)	=	9	9	(-+1+0)	=	1
10	(-+4+5)	=	9	10	(-+1+0)	=	1
11	(-+8+4)	=	12	11	(-+0+0)	=	0
12	(-+0+1)	=	1	12	(-+3+3)	=	6
13	(-+0+6)	=	6	13	(-+3+0)	=	3
14	(2+0+1)	=	3	14	(0+1+0)	=	1

* Number in "( )" represent the total number of representatives ranking this treatment high or low with junipers, azaleas and hollies listed in order. Treatment 8 for the junipers was treatment 14 for the azaleas and hollies and moved to treatment 14. Treatment 8-13 for the azaleas and hollies were not applied to the junipers.

Treatments 11, 9, 10 visually ranked very high over all groups followed by treatments 6, 13 and 5 even though treatments 9, 10, 11, 12 and 13 were not applied to the junipers. Treatments that visually ranked low over all crops included 2, 3, 4, 7 and 12. These visual rankings were not statistically evaluated and are used to give an over view of each individuals evaluation.

Summary:

The leachate soluble salt levels in June were high for the junipers, acceptable for the azaleas and hollies. The August media samples had low nitrate and potassium levels for the junipers, azaleas and hollies while the phosphorous levels varied among treatments. The tissue nutrient levels for nitrogen were acceptable for all the juniper, azalea and holly treatments. The juniper tissue phosphorous level was mostly acceptable but the potassium level was low. The azalea tissue phosphorous levels were acceptable while the potassium levels were slightly low to acceptable. The holly tissue phosphorous and potassium levels were all low.

The October media analysis had low nitrate and potassium levels for all crops and treatments. The phosphorous levels were low for all juniper and azalea treatments. The holly treatment phosphorous levels were acceptable, except for treatments 2 and 5. The October tissue analysis had acceptable nitrogen levels for all crops and all treatments. The phosphorous levels were acceptable for all junipers, low to acceptable for the azaleas, and low for all holly treatments.

The potassium levels were low for all crops and all treatments. No treatment or group of treatments appeared to stand out over all crops for the leachate, media or tissue nutrient levels.

The dry weight of the juniper prunings showed no treatment differences. The azalea dry pruning weight showed treatments 1, 10, 14, 9, 7, 11, 8, 6, 2, and 3 produced more early growth than 13, 4 and 12. The October top dry weights produced no differences in the juniper treatments. The azalea treatments produced a large group of the heaviest plants with a few treatments being significantly lighter. The best treatments were 9, 11, 8 and 10. The best of the holly treatments were 11, 10, 6, 13 and 9.

The visual rankings were summarized to include the total number of highest rankings by each representative. These rankings were totaled for all crops although not all treatments were applied to the junipers. Nine of the fourteen representatives ranked no treatment differences for the junipers. The treatments for all crops that ranked the highest most frequently were 11, 10, 9, 13 and 6 for visual quality. The lowest ranking treatments were 2, 3, 4, 7 and 12.

Table 6. Summary Comparison of Best Dry Weight and Visual Ranking

Heaviest by Dry Weight*				**Highest Visual Rankings**	
Azalea		Holly		Juniper, Azalea and Holly	
Treatment	Mean Dry Weight(s)	Treatment	Mean Dry Weight(s)	Treatment	Number of High Rankings
9	28.1	11	132.1	11	12
11	27.1	10	130.3	10	9
8	26.2	6	120.8	9	9
10	25.3	13	120.4	6	6
5	24.8	9	118.1	13	6
13	24.2	12	117.1	5	4
1	24.0	8	115.5	8	3
7	23.6	3	111.5	14	3
6	23.4	14	111.2		
14	23.2				

*Junipers were not included since no dry weight differences existed statistically

The best treatments ranking above our control fertilizer treatment summarizing from Table 24 appear to be:

Treatment	11	Scotts	15-9-11	27.5-35.5 g	4.125-5.325 GN/Pot
Treatment	10	Scotts	15-9-11	22.5-30.5 g	3.375-4.575 GN/Pot
Treatment	9	Scotts	19-5-9	22-28 g	4.18-5.32 GN/Pot
Treatment	13	Scotts	19-6-12 E	22-28 g	4.18-5.32 GN/Pot
Treatment	6	Wilbro	16-5-10	22 g	3.52 GN/Pot
Treatment	5	Wilbro	16-5-6	18g	2.88 GN/Pot
Tretment	8	Scotts	19-5-9	18-24 g	3.42-4.56 GN/Pot
Treatment	14	Control High N	24-4-7	20 g	4.8 GN/Pot

The highest rates of nitrogen being applied by these treatments have produced larger plants and more visually appealing plants. Plants of acceptable quality were produced by other treatments and were equal to or better than our control treatment. Users will want to compare costs of these treatments at the rates used to produce an acceptable to high quality crop.