Yard Trimmings Compost as a Growing Medium Component and Nutrient Source for Chrysanthemum and Fuchsia Production©

Rita L. Hummel, Charles R. Johnson, Robert Riley, and Susan Smith
Department of Horticulture and Landscape Architecture, Washington State University Puyallup Research and Extension Center, 7612 Pioneer Way, Puyallup, Washington 98371

Rooted cuttings of chrysanthemum and fuchsia were transplanted into 1.1-liter containers filled with a peat and perlite (PP) growing medium into which yard trimmings compost (YTC) was mixed at increasing rates (100% PP, 20% YTC, 50% YTC and 80% YTC). All plants received soluble 20N-3.5P-16.6K at a rate of 100 ppm N weekly. In addition, a slow-release fertilizer (17N-2.2P-9.1K) was topdressed at 0, 2, or 4 g per container. Growth of chrysanthemum and fuchsia was improved by the addition of YTC to the growing media. Growth of fuchsia in all growing media increased with increasing rates of slow-release fertilizer. Chrysanthemum growth increased in response to added slow-release fertilizer in all media except the 80% YTC. In 80% YTC medium chrysanthemum growth was not affected by the addition of slow-release fertilizer.

INTRODUCTION

Composting is an alternative to the traditional waste disposal methods of landfilling and incineration that allows organic municipal wastes to be reclaimed as useful products. The municipal wastes most commonly recycled by composting are yard wastes (trimmings from trees and shrubs, grass clippings, and leaves), biosolids (sewage sludge), and municipal solid waste (garbage) (Roe, 1998). Changes in regulations governing waste disposal and rising costs associated with traditional disposal methods have made the commercial production of compost a potentially profitable business. Because of the high-value crops and need to replace the root-growth medium after each production cycle, growers of container-nursery and greenhouse crops are considered an attractive market for compost products (Fitzpatrick et al., 1998).

Research has shown that container crops can be successfully grown in composts (Rosen et al., 1993; Fitzpatrick, 2001). But growers are cautioned to proceed carefully in adopting composts as growing media in their operations because of concerns with compost quality, uniformity, and consistency (Roe, 1998; Fitzpatrick, 2001). Container-grown plants require high quality, uniform composts with consistent chemical and physical characteristics. Compost manufacturers who manage their operations to produce these consistent quality composts could turn the growers of container plants into enthusiastic customers. An informal survey of commercial growing media suppliers in Pierce County, Washington, indicated that prices for yard trimmings compost (YTC) were from 80% to 87% lower than the price of a standard peat-perlite bagged growing medium.

The potential cost savings and the environmental benefits of using a recycled product are good reasons to consider using YTC in container media. However, as Gouin (1998) has indicated "the ultimate test of horticultural value is whether the compost can be used for growing plants". A greenhouse study was conducted to determine the suitability of using YTC in container media for chrysanthemum and fuchsia plants. The objectives of this research were to (1) evaluate the rate at which YTC could be substituted for peat-perlite in the growing media and (2) to determine the need for macronutrient fertilization in the YTC amended media.

MATERIALS AND METHODS

A commercially formulated, bagged, peat-perlite mix (PP) and YTC obtained from a commercial composting facility near Puyallup, Washington, were used as components of the growing media in this study. The YTC was mostly woody yard trimmings that were ground and composted using the aerated turned pile method then screened to pass an 11 mm (7/16 inch) screen. The initial electrical conductivity (EC), pH, and percent air space (AS) of the YTC were 1.63 $dS \cdot m^{-1}$, 6.6, and 19%, respectively. The PP had an initial EC of 1.25 $dS \cdot m^{-1}$, pH of 6.2, and 14% AS. Measurement of EC was done by the pour-through method, also known as the Virginia Tech Extraction Method (Wright, 1986). The method described by Ingram et al. (1990) was used to measure AS.

In mid-May rooted cuttings of hardy fuchsia, *Fuchsia magellanica* var. molinae (syn. *F. magellanica* var. *alba*)., and chrysanthemum, *Chrysanthemum* 'Davis' (syn. *Dendranthema* ×*grandiflorum* Ramat. 'Davis') were transplanted into 1.1-liter (1.2-qt.) containers filled with one of the following growing media: YTC : PP (1 : 4, v/v); YTC : PP (1 : 1, v/v); YTC : PP (4 : 1, v/v); and a control growing medium consisting of PP. All media were amended with Micromax micronutrient mix at the rate of 1038 $g \cdot m^{-3}$ (1.75 lb per yd^3) and dolomite at 4745 $g \cdot m^{-3}$ (8 lb per yd^3). Containers were 12 cm (4.7 inches) deep with a bottom inside diameter of 9 cm (3.5 inches) and a top inside diameter of 12 cm (4.7 inches).

All plants were fertilized weekly with a soluble 20-8-20 (20N-3.5P-16.6K) fertilizer at a concentration of 100 ppm (100 $mg \cdot liter^{-1}$) nitrogen. A polymer-coated, slow-release fertilizer, POLYON NPK™ 17-5-11 (17N-2.2P-9.1K) (Pursell Industries, Inc. of Sylacauga, Alabama) was applied by topdressing at rates of 0, 2, and 4 g (0, 0.07, and 0.14 oz) per container. The growing media and slow-release fertilizer treatments were applied in factorial combination for a total of 12 treatments. There were 10 single-plant chrysanthemum and 7 single-plant fuchsia replicates per treatment. Plants were arranged on greenhouse benches in a randomized complete block design and grown under standard greenhouse conditions using overhead sprinkler irrigation.

Eleven weeks after transplanting, the growth response of plants to growing media and fertilizer treatments was determined by measuring shoot height, canopy width, and fresh and dry weights. From the height and width data, a shoot growth index (SGI) was calculated [SGI = (height + width)/2]. A separate analysis of variance (ANOVA) was performed for each species. When the two-factor interaction was significant, data were analyzed by one-way ANOVA. The orthogonal polynomial trend comparisons procedure (Gomez and Gomez, 1984) was used to evaluate the effects of compost amendment and slow-release fertilizer rate on plant growth.

RESULTS AND DISCUSSION

Results of 2-way ANOVAs indicated there were significant interactions between slow-release fertilizer rate and growing medium for dry weight and SGI of both chrysanthemum and fuchsia. Shoot fresh weight data is not presented because of similarity to dry weight measurements. One-way ANOVAs were used to determine the effect of slow-release fertilizer rates within a growing medium treatment and the effect of compost-amended growing media within a fertilizer treatment. Results for chrysanthemum indicated that dry weight and SGI of plants grown in the PP, YTC : PP (1 : 4, v/v), YTC : PP (1 : 1, v/v) growing media increased when the slow-release fertilizer rate increased (Table 1). In the YTC : PP (4 : 1, v/v) medium, chrysanthemum growth was not improved by the addition of fertilizer; however, plants receiving slow-release fertilizer had slightly darker green leaves.

The addition of YTC to the growing media significantly improved chrysanthemum dry weight in all slow-release fertilizer treatments (Table 1). Chrysanthemum SGI increased with the addition of YTC in the 0- and 2-g fertilizer treatments. At the 4-g fertilizer rate, SGI was not influenced by the growing medium. As expected, the greatest growth increase from the addition of YTC occurred in the 0-g fertilizer treatment. Chrysanthemum plants in the 0 g fertilizer, YTC : PP (4 : 1, v/v) treatment were similar in size to those receiving 2 or 4 g of fertilizer in the YTC amended media.

Fuchsia dry weight and SGI increased with increasing slow-release fertilizer rate in all of the growing media (Table 2). The 4 g fertilizer rate produced the largest fuchsia plants. Addition of YTC to the growing medium produced larger fuchsia in the 0 and 2 g fertilizer treatments. At the 4 g fertilizer rate, there was no significant increase in fuchsia dry weight or SGI when YTC was incorporated into the growing medium.

Table 1. Effect of fertilizer rate and growing medium on shoot dry weight and shoot growth index (SGI) of chrysanthemum.

	Dry weight (g)				SGI[1]			
	Fertilizer rate				Fertilizer rate			
Growing medium	0	2	4		0	2	4	
100% PP	1.9	8.7	8.9	L[2]	20	33	38	L[2]
20% YTC:80% PP	10.0	14.0	15.3	L	29	39	39	L
50% YTC:50% PP	10.7	15.8	16.0	L	32	42	43	L
80% YTC:20% PP	16.8	16.9	14.8	NS	39	39	40	NS
Significance of growing medium[3]								
Linear	***	***	**		***	**	NS	
Quadratic	***	**	NS		***	NS	NS	

[1] SGI = (height + width)/2.

[2] L or NS indicates a significant linear (at P<0.05) or nonsignificant response to fertilizer rate.

[3] NS, *, **, *** = nonsignificant and significant at P<0.05, 0.01, or 0.001 level, respectively.

Hartz et al. (1996) produced tomato and marigold plants in the greenhouse under varying levels of fertigation (0, 50, or 100 mg·liter^{-1} N as 15N-13P-12K constant feed with each watering) and found that plant growth in the YTC : PP (1 : 1, v/v) potting mix was equivalent or superior to growth in peat and perlite (1 : 1, v/v) medium. They measured plant tissue concentration of N, P, and K and concluded that YTC contributed to crop macronutrient nutrition, but that the highest fertigation rate was required for optimum growth.

In the present study where all plants were fertigated with 100 mg·liter^{-1} N weekly, the growth increase from adding YTC to the container medium was likely due to macronutrients in the compost. However, growth of fuchsia in all growing media increased with increasing rates of slow-release fertilizer thus indicating that the YTC was supplying only a part of the nutrients needed for optimum growth. For chrysanthemum, a growth increase in response to added slow-release fertilizer was observed in all but the 80% YTC medium where added fertilizer did not influence growth. Klock-Moore (1999) found increasing N, P, and K concentrations as well as growth increases in impatiens plants as the amount of a biosolids/yard waste compost in the growing medium was increased from 0 to 100%. A 100% fishwaste-compost medium supplied sufficient N to produce drip-irrigated marigold and geranium crops (Hummel at al., 2000).

Results of this research indicated chrysanthemum and fuchsia growth was enhanced by the addition of YTC to the container medium. Based on current prices for the YTC and PP media used in this research, growers could expect to save 16%, 40%, and 64% on their media raw material cost by using YTC at the 20%, 50%, and 80% substitution rates, respectively. However, the decision to use compost as a growing medium component should not be based on cost alone but must also take into consideration the quality and consistency of available compost products, the plant species being grown and other management practices of the individual grower.

Table 2. Effect of fertilizer rate and growing medium on shoot dry weight and shoot growth index (SGI) of fuchsia.

	Dry weight (g)				SGI[1]			
	Fertilizer rate				Fertilizer rate			
Growing medium	0	2	4		0	2	4	
100% PP	4.5	7.5	11.9	L[2]	22	38	43	L[2]
20% YTC:80% PP	5.4	13.0	16.5	L	31	44	48	L
50% YTC:50% PP	7.1	13.4	14.0	L	34	42	49	L
80% YTC:20% PP	9.4	10.6	14.6	L	38	45	49	L
Significance of growing medium[3]								
Linear	NS	***	NS		**	NS	NS	
Quadratic	*	NS	NS		**	*	NS	

[1] SGI = (height + width)/2.

[2] L or NS indicates a significant linear (at P<0.05) or nonsignificant response to fertilizer rate.

[3] NS, *, **, *** = nonsignificant and significant at P<0.05, 0.01, or 0.001 level, respectively.

LITERATURE CITED

Fitzpatrick. G.E. 2001. Compost utilization in ornamental and nursery crop production systems, pp. 135-150. In: P.J. Stoffella and B.A. Kahn (eds.). Compost utilization in horticultural cropping systems. Lewis Publishers, Boca Raton, Florida.

Fitzpatrick, G.E., E.R. Duke, and **K.A. Klock-Moore.** 1998. Use of compost products for ornamental crop production: Research and grower experiences. HortScience 33:941-944.

Gomez, K.A. and **A.A. Gomez.** 1984. Statistical procedures for agricultural research. 2nd ed. John Wiley & Sons, New York.

Gouin, F.R. 1998. Commercial composting systems. HortScience 33:932-933.

Hartz, T.K., F.J. Costa, and **W.L. Schrader.** 1996. Suitability of composted green waste for horticultural uses. HortScience 31:961-964.

Hummel, R.L., S. Kuo, D. Winters, and **E.J. Jellum.** 2000. Fishwaste compost medium improves growth and quality of container-grown marigolds and geraniums without leaching. J. Environ. Hort. 18:93-98.

Ingram, D.L., R.W. Henley, and **T. H. Yeager.** 1990. Diagnostic and monitoring procedures for nursery crops. Univ. of Fla. Coop. Extn. Serv. Circ. 556.

Klock-Moore, K. 1999. Growth of impatiens 'Accent Orange' in two compost products. Compost Sci. Utilization. 7:58-62.

Roe, N.E. 1998. Municipal waste compost production and utilization for horticultural crops: Introduction to the colloquium. HortScience 33:931.

Rosen, C.J., T.R. Halbach, and **B.T. Swanson.** 1993. Horticultural used of municipal solid waste composts. HortTechnol. 3:167-173.

Wright, R.D. 1986. The pour-through nutrient extraction procedure. HortScience 21:227-229.