Fall is for Rooting!!

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No, I am not going to write about rooting for your favorite football team. This article is not even about propagation! The topic is root growth of container grown nursery crops; and the question is do roots grow more in the Fall than in the Summer or Spring? (See Answers Below!)

With marketing programs such as FALL IS FOR PLANTING, most green industry professionals are pre-conditioned to believe that roots grow in the Fall. This belief was brought into question by a well known university researcher last year during a nursery industry conference. A by-stander ask me, you got any proof that roots *do grow* in containers during fall when tops are going dormant. I said, Yeah.

Actually, there are not an over-whelming number of university research studies that provide direct comparisons of root growth between seasons. Most container studies are focused on effects of water, specific elemental nutrients or rates of fertilizer applied or potting substrate components. Studies are initiated and conducted for specific periods of time, such as a growing season and then terminated to determine top and possibly root growth. Few studies have multiple harvest dates. An exception might be use of preemergence herbicides, but results are of multiple harvests are usually attributed to effects of the products applied.

At N.C. State, we have conducted several studies with cotoneaster and other evergreen shrub crops that focused on water, nutrients or substrates with multiple harvest dates and results have included seasonal root growth data.

The first study (Bilderback, T.E., S.L. Warren, and J.H. Daniels. 1999. Managing Irrigation by Electrical Conductivity. Acta. Hort. 481:403-408) evaluated the effect of EC on top and root growth with plant harvests conducted in August (89 Days After Initiation; [DAI]) and October (129 DAI) (Table A). The study was initiated on May 30. If you look at root growth presented in the table, the % increase in root growth between the two dates is astounding! The increase depending on fertilizer rate applied ranged from 295% to 616% increase in root dry weight from August 29 to October 29.

In a second study (Owens, James S. Jr. 2006. Clay amended soilless substrates: Increasing water and nutrient efficiency in containerized crop production. Ph.D. Thesis. North Carolina State University) the effect of amendment rates of clay to pine bark is presents with three harvest dates. Cotoneaster root growth from 124 days to 208 days increased 3 to 6 fold depending on the clay amendment rate. Root growth declined between 208 days and 314, possibly due to translocation of nutrients and growth substances and death of ephemeral roots since the first spring flush proceeded the harvest.

A third study, (Ivy, R. Lee, Ted E. Bilderback and Stuart L. Warren. 2002. Potting date and rate of fertilization affects plant growth, nutrient content and substrate EC. J. Environ. Hort. 20:104-109.) showed similar increases in root mass of Compact holly (*Ilex crenata* Thunb. 'Compacta') and Chindo viburnum (*Viburnum awabuki* K. Koch. 'Chindo') for fall and winter harvests.

I did not conduct an exhaustive literature review for further evidence ,but I did find two studies conducted with red maples and crabapple that provided comparable results to N.C. State studies. The first of these studies was published in 1999 by Mary Ann Rose and Barbara Biernacka, "Seasonal Patterns of Nutrient and Dry Weight Accumulation in Freeman Maple",(HortScience 34:91-95). This study showed that deciduous trees had increased root growth in October through June compared to root dry weight in July and September. Data presented showed increased concentrations of nitrogen, phosphorus and potassium in October through June compared to September. In a second study "Fertilizer Concentration and Moisture Tension Affect Growth and Foliar N,P and K contents of Two Woody Ornamentals" by Mary Ann Rose, Mark Rose and Hao Wang (HortScience 34:246-250. 1999.) studied the effects of irrigation effects on top and root growth. Regardless of irrigation practices, root dry weight increased with increasing fertilizer concentrations in Fall compared to Summer harvests in Freeman Maple and crapapple (*Malus x zumi*).

In conclusion, Fall is for Rooting. When the tops of plants stop growing, the roots get growing.

Table A.Fertilizer rate effects on shoot and root dry weights of cotoneaster, 89 and 152 days after initiation (DAI) of the study.

Fertilizer Rate g N / pot	Shoot dry weight (g) 89 DAI	152 DAI	**% Inc**	Root dry weight (g) 89 DAI	152 DAI	**% Inc**
5.00	45.8	78.8	**73**	5.8	23.0	**295**
4.25	45.3	72.8	**60**	5.9	20.9	**252**
3.50	32.7	63.4	**94**	4.3	23.9	**462**
2.75	26.0	60.9	**133**	3.9	16.7	**330**
2.00	16.8	44.9	**169**	2.5	18.0	**616**
Significance						
Linear	**	**		**	NS	
Quadratic	NS	NS		NS	NS	

Table B . The effect of 0.25 to 0.85 mm Georgiana interstratified palygorskite bentonite industrial mineral aggregate amendment rate in pine bark substrate on root and top dry mass (n = 3) of Skoghom cotoneaster harvested 124, 208, and 314 days after experiment initiation.

Mineral amendment rate	124 DAI (30 Sept.)			208 DAI (23 Dec.)			314 DAI (6Apr.)		
	Root (g)	Top (g)	Root:topz (g)	Root	Top	Root:top	Root	Top	Root:top
0	27	225	0.12 cy	141	371	0.38 a	89	449	0.20 b
8	29	263	0.11 c	147	460	0.32 a	95	530	0.18 b
12	34	297	0.13 c	103	407	0.25 a	98	542	0.18 b
16	33	282	0.15 b	115	400	0.29 a	92	548	0.17 b
20	28	253	0.12 c	118	439	0.27 a	101	549	0.18 b
Linear	NS	NS	NS	*	NS	***	NS	***	NS
Quadratic	NS	**	NS	NS	NS	NS	NS	*	NS

NS, *,**, ***Nonsignificant or significant at $P \leq 0.10, 0.05, 0.01$, respectively.
zRoot : top = root dry weight ÷ top dry weight.
yAny means within a row for root : top ratio not followed by the same letter are significantly different as determined by Fishers LSD, P = 0.05.