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Composted Dairy Manure as a Component of Potting Media for Greenhouse Crop Production

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What Are Potting Media?

Potting media: substrates formulated by mixing organic materials with other ingredients in different proportions used for growing nursery and greenhouse crops

Organic Materials		Other Ingredients	
Composted materials		Dolomite	√
Coconut coir dust		Fertilizers	
Peat moss	√	Foam beads	
Pine bark	√	Perlite	√
Rice hulls		Sand	
Wood residues		Soil	
		Vermiculite	√

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Commercial Media Formulations

Ratio by Volume	Components
1:1	Peat: Pine bark
1:1	Peat: Perlite
2:1:1	Peat: Perlite: Vermiculite
2:1:1	Peat: Pine bark: Sand
2:1:1	Peat: Pine bark: Perlite
3:1:1	Peat: Perlite: Vermiculite
3:1:1	Peat: Pine bark: Sand
6:3:1	Pine bark: Florida peat: Sand

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Why Composted Dairy Manure?

- Composting dairy manure reduces nutrient pollution
- Florida is the second largest state consuming potting media
- Peat is a major component of potting media, peat mining has been restricted, and the price has been increasing
- Creating a win-win situation for both the greenhouse and the dairy industries

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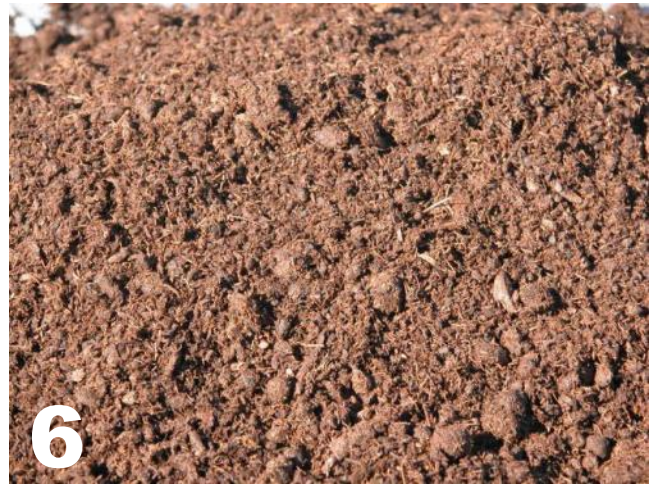
How Dairy Manure is Composted



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Physical Properties of Composted Dairy Manure

Component	Bulk density (g/cm^3)	Total porosity (%)	Air space (%)	Water holding capacity (%)	EC (dS/m)	pH	CEC (cmol/kg)
Canadian peat	0.16	74.6	10.5	64.1	0.32	3.9	35.89
Cowpeat	0.26	74.3	23.1	51.2	4.64	6.9	27.31
Florida peat	0.39	61.7	17.4	44.3	0.31	6.9	16.24

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Chemical Properties of Composted Dairy Manure

Component	C/N ratio	C	N	P	K	Ca	Mg	S
		(%)						
Canadian peat	56.82	46.60	0.82	0.03	0.05	0.24	0.16	0.15
Cowpeat	15.06	25.00	1.66	0.59	0.57	1.21	0.33	0.73
Florida peat	18.26	29.40	1.61	0.03	0.02	0.73	0.06	0.17

Component	B	Cu	Fe	Mn	Mo	Zn	Na
	(mg/kg)						
Canadian peat	n.d.	2.3	1375.0	66.8	n.d.	17.7	212.0
Cowpeat	17.3	36.2	14338.0	105.0	1.6	188.0	2058.0
Florida peat	n.d.	5.4	1300.0	13.2	n.d.	5.4	133.0

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More Questions

- How to use the composted dairy manure to formulate potting media?
- Will the formulated media have an increased amount of N and P leaching?
- Will the high concentration of Fe and Na cause phytotoxicity to plants?

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Potting Media Components

(1) Canadian peat (Fafard, Inc.)

(2) Cowpeat (Agrigy)

(3) Florida peat (Reliable Peat, Co.)

(4) Vermiculite (Fafard, Inc.)

(5) Perlite (Fafard, Inc.)

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Formulation of Potting Media

-Percentages of Components

Potting media	Canadian peat (%)	Florida peat (%)	Cowpeat (%)	Perlite (%)	Vermiculite (%)
1	60	0	0	20	20
2	50	0	10	20	20
3	40	0	20	20	20
4	30	0	30	20	20
5	20	0	40	20	20
6	10	0	50	20	20
7	0	0	60	20	20
8	0	60	0	20	20
9	0	50	10	20	20
10	0	40	20	20	20
11	0	30	30	20	20
12	0	20	40	20	20
13	0	10	50	20	20
14	20	20	20	20	20

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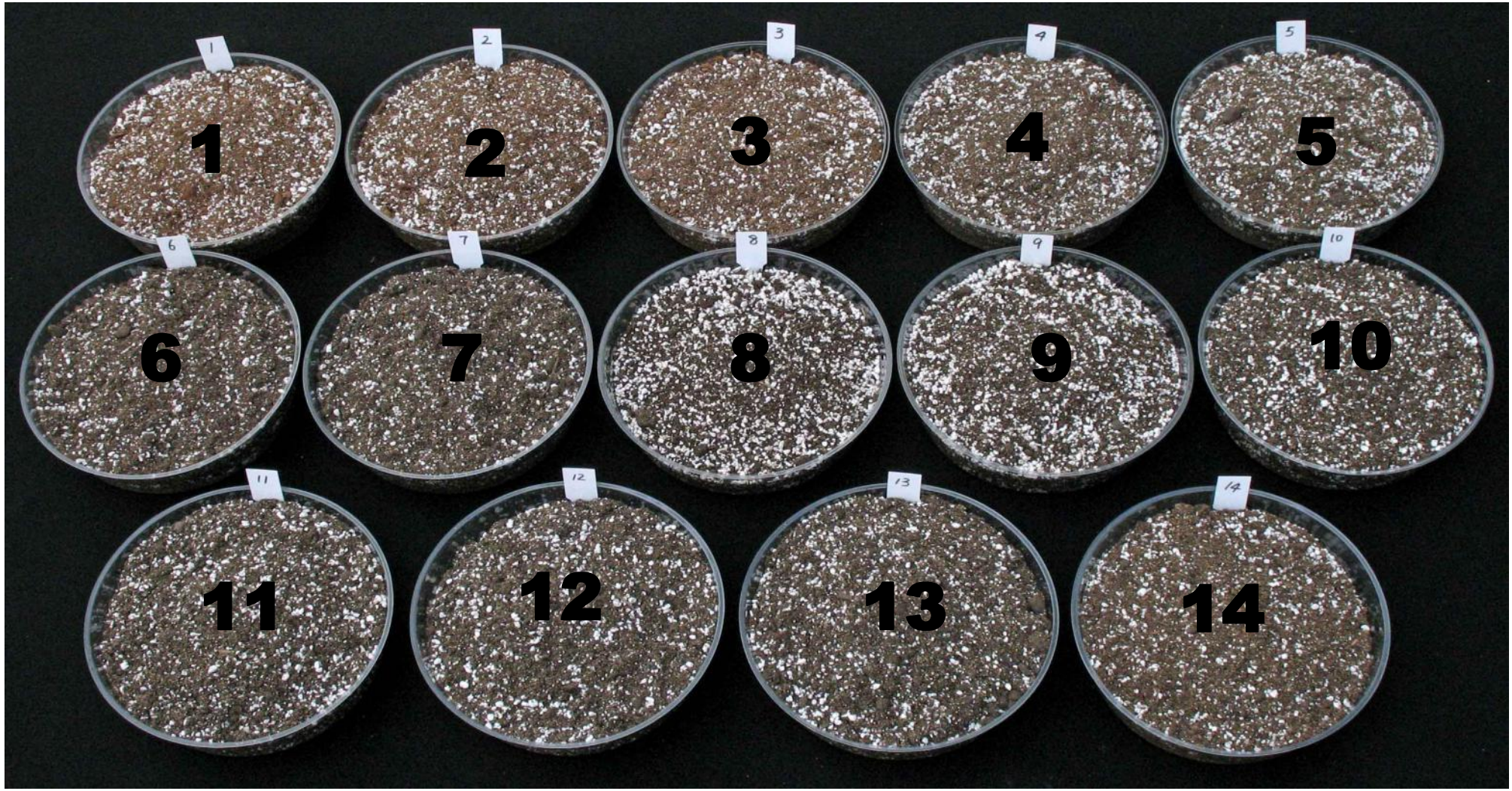
Formulated 14 Media



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Properties of the 14 Media - Summary

- The 14 media had both physical and chemical properties suitable for propagation and production of greenhouse crops
- Increased percentages of dairy manure resulted in increased concentrations of nutrients
- Extractable N was lower in composted dairy manure-based media
- Extractable P was moderate in composted dairy manure-based media
- Total and extractable heavy metals were extremely low; but Fe and Na concentrations were higher than peat-based media

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Germination of *Asparagus*, *Chlorophytum* and *Schefflera* Seeds

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Rooting of ‘Golden Pothos’

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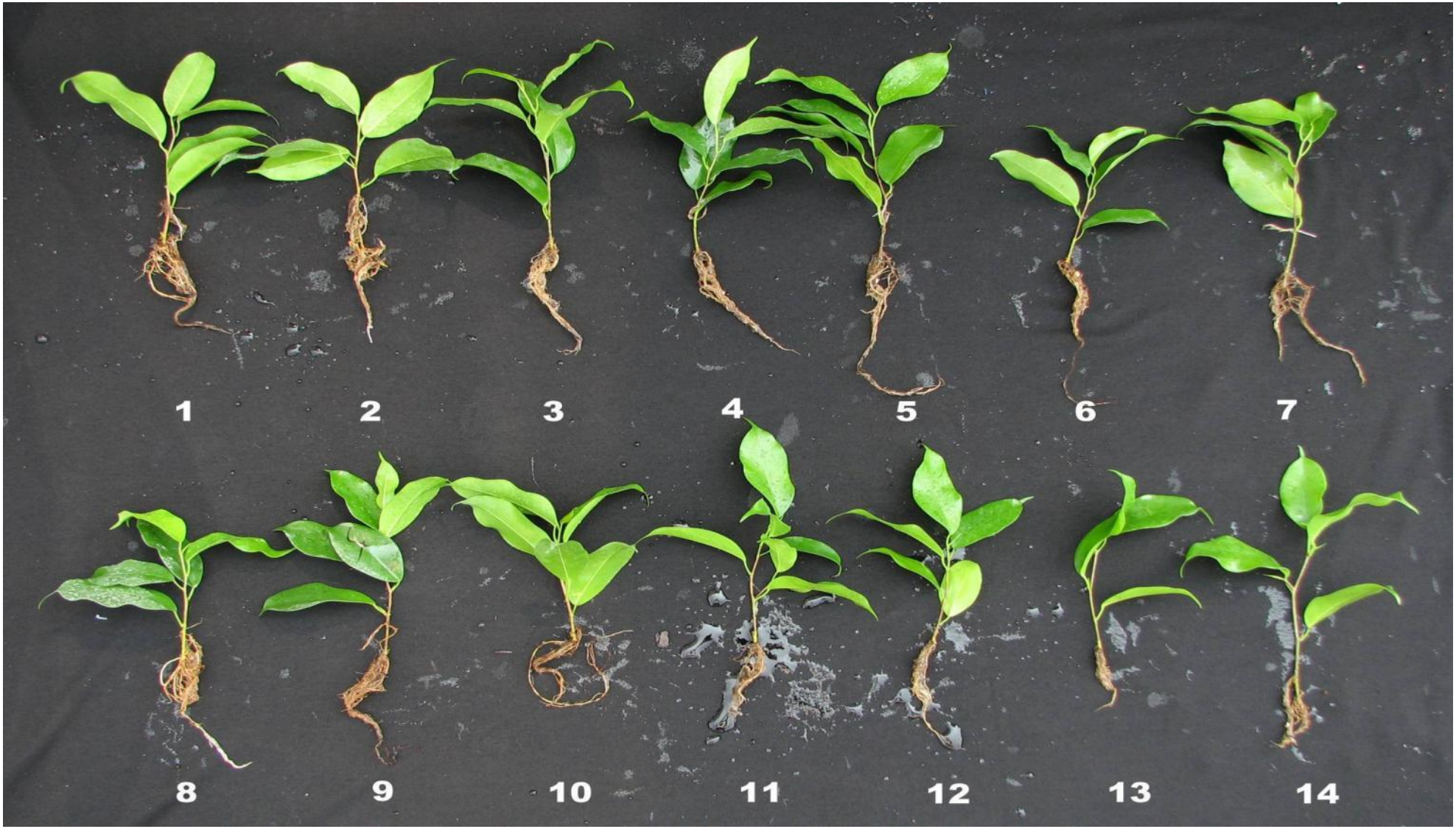
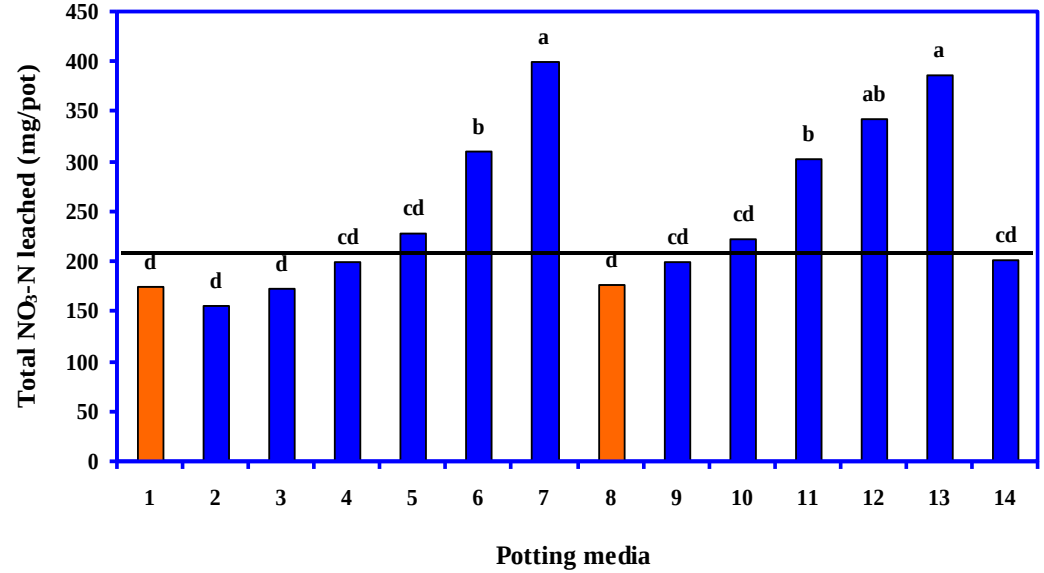
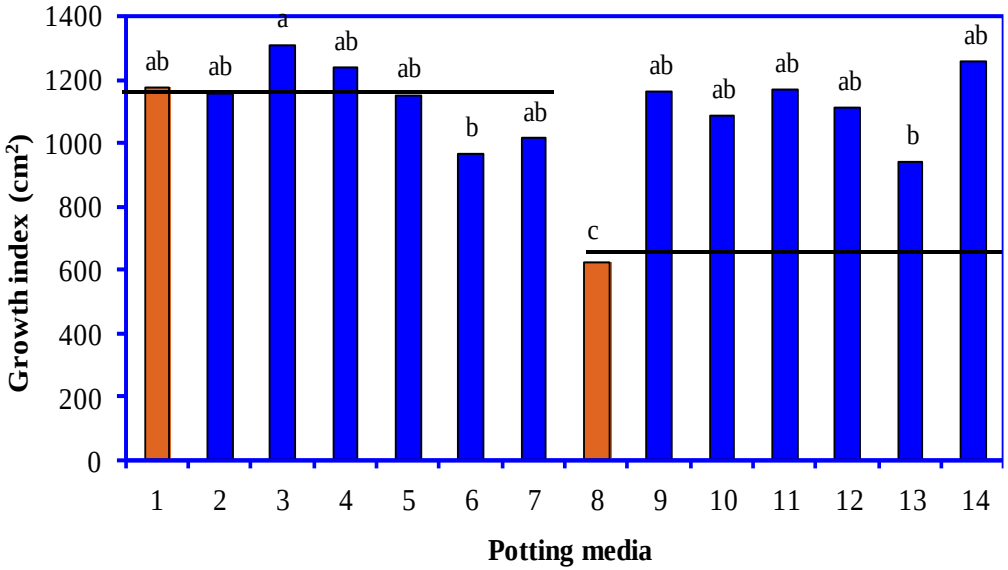
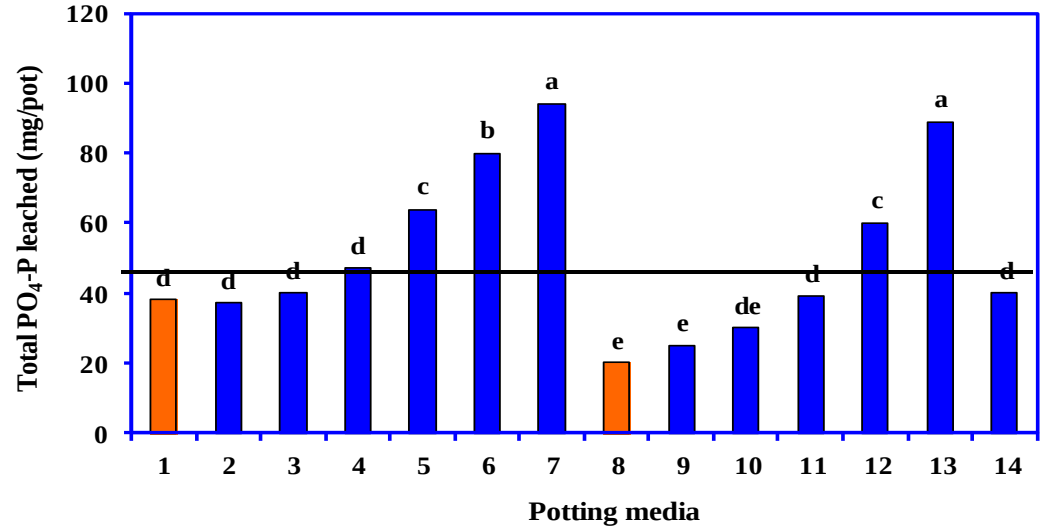
Rooting of ‘Weeping Fig’



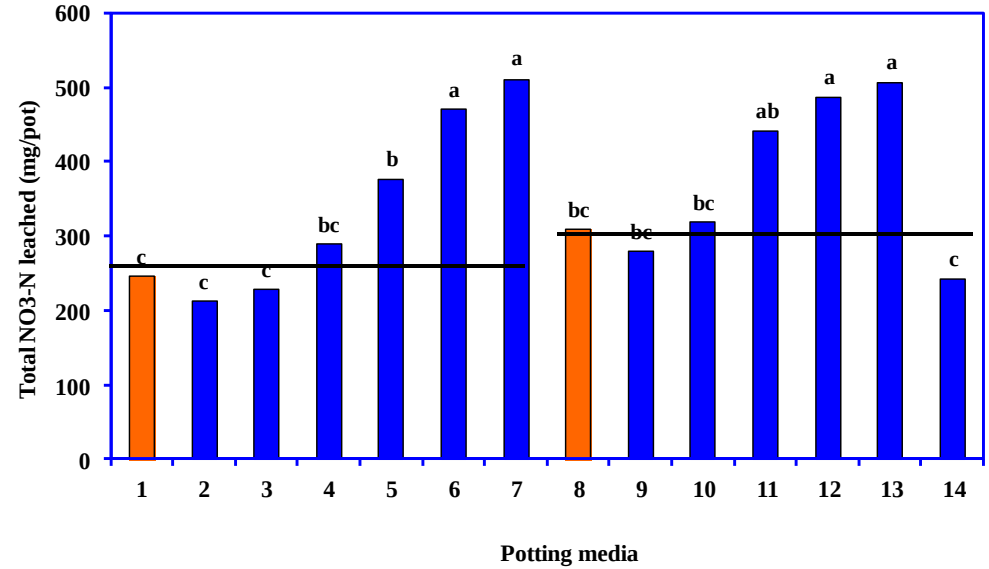
Production of *Dieffenbachia* ‘Star Bright’

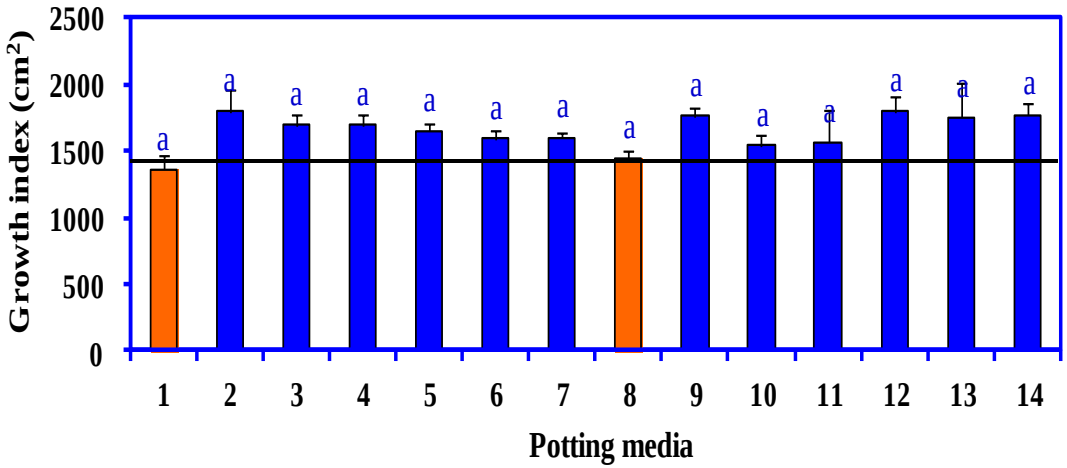


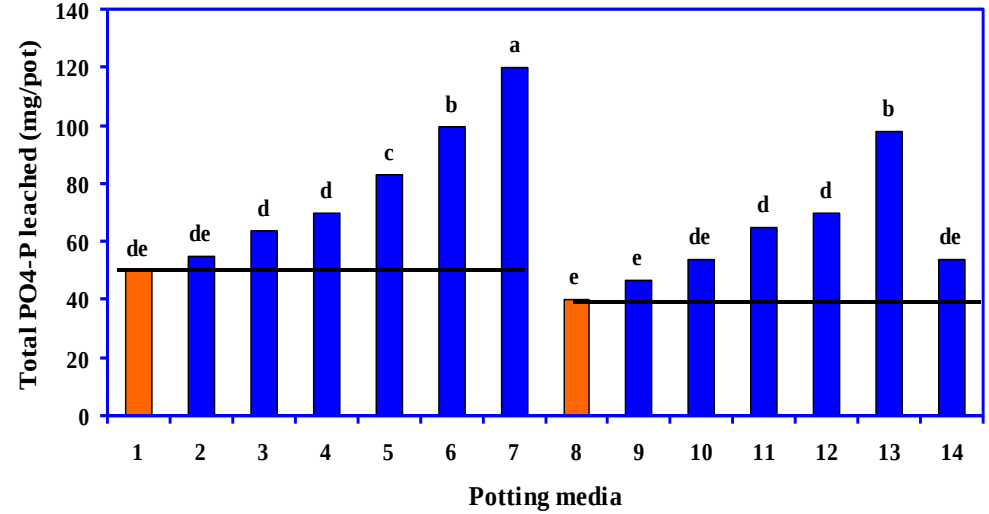




Production of *Epipremnum aureum* 'Golden Pothos'







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Crop Propagation and Production - Summary

- Composted dairy manure can replace up to 60% of peat with few detrimental effects on seed germination, rooting of cuttings and plant growth

- With increased percentages of composted dairy manure, the amount of NO_3-N and PO_4-P leaching increased

- The safeguard for less NO_3-N and PO_4-P leaching is to replace Canadian peat or Florida peat with composted dairy manure up to 20% by volume

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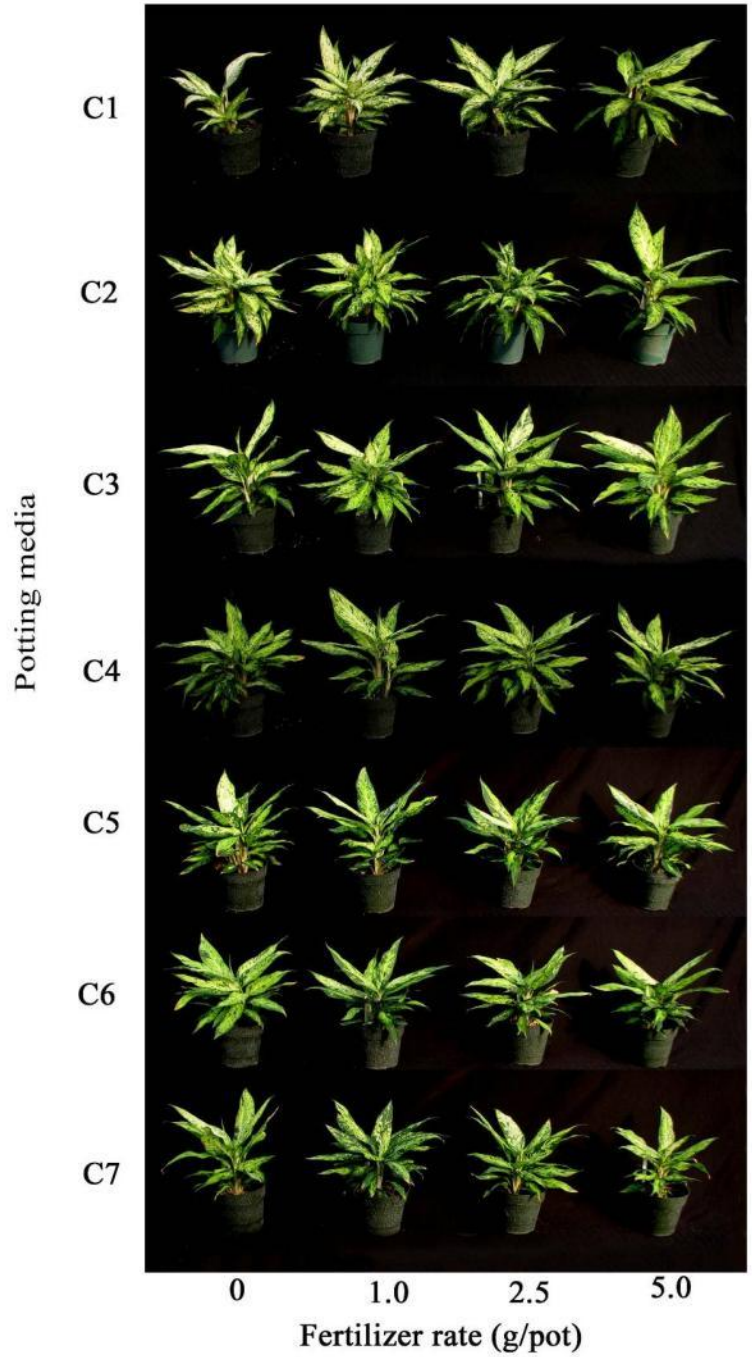
Any Room for Improvement?

Is there any way of reducing N and P leaching?

- **Plant production with reduced fertilizer application**

Production of *Dieffenbachia* ‘Star Bright’



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Shoot Dry Weight (g/pot) at the End of 'Star Bright' Production

Media	Fertilizer rate (g/pot)			
	0	1	2.5	5
C1 (Control)	5.7	7.1	9.0	10.0
C2 (10%)	10.7	10.8	11.2	10.7
C3 (20%)	11.8	11.3	10.5	10.8
C4 (30%)	12.9 a	12.1	10.2	9.9
C5 (40%)	10.6	9.4	8.5	7.4
C6 (50%)	9.3	8.9	7.8	7.2
C7 (60%)	8.3	7.5	7.1	6.7

Total Amount of NO_3-N Leached (mg/pot) during 'Star Bright' Production

Media	Fertilizer rate (g/pot)			
	0	1	2.5	5
C1 (Control)	0	6	20	108
C2 (10%)	5	9	29	128
C3 (20%)	68	94	146	211
C4 (30%)	122	202	234	355
C5 (40%)	239	297	363	421
C6 (50%)	261	311	441	467
C7 (60%)	354	356	454	523

Total Amount of PO_4-P Leached (mg/pot) during 'Star Bright' Production

Media	Fertilizer rate (g/pot)			
	0	1	2.5	5
C1 (Control)	2	6	18	38
C2 (10%)	6	14	20	40
C3 (20%)	27	28	33	55
C4 (30%)	43	58	68	76
C5 (40%)	59	69	101	97
C6 (50%)	69	71	105	103
C7 (60%)	85	93	100	114

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Reduced Fertilizer Application - Summary

- High quality ‘Star Bright’ plants were produced from composted dairy manure-based media without the addition of fertilizers
- Potting media with composted dairy manure at a volume from 10 to 30% produced ‘Star Bright’ with the greatest growth indices, the highest dry matter (shoot and root) accumulation, and the highest overall quality grading (4.0-4.5) without chemical fertilizer application
- The amounts of NO_3-N and PO_4-P leaching from media with composted dairy manure at 10 to 30% replacement of peat were equal to or much less than those of the control media fertilized with the commercial standard rate

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Conclusion

The safeguard for better plant growth and less NO_3-N and PO_4-P leaching is to:

- **replace Canadian peat or Florida peat with composted dairy manure at 20% by volume with standard fertilizer application**

or

- **replace Canadian peat or Florida peat with composted dairy manure at 30% by volume with reduced fertilizer application**

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Economic/Environmental Impacts

- No need for dolomite to neutralize pH, a saving of $200/acre/year
- A 30% substitution by volume reduces peat use by 50% or a reduction of peat use by 240 cubic yard/acre/year, a saving of $3,000-4,000/acre/year
- Potting media containing 10-30% composted dairy manure require no or reduced fertilizer application, a saving of $2,000 to $4,500 per acre/year

Total saving $5,200 to 8,700/acre/year

- Plants produced from 10-30% composted dairy manure-based media are larger and reach marketable size at least 15 days earlier than peat-based media produced with chemical fertilizers, which reduces labor cost and water use
- Composting dairy manures significantly reduces the environmental problems and converts the manures into useful organic materials and potential income to dairy producers