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ORGANIC FERTILIZERS

Successfully Making the Switch

The webinar will be starting shortly.

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1:05 to 1:30 Eastern

Reasons to Consider Making the Switch & Challenges Along the Way

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KANSAS STATE UNIVERSITY

What is an organic fertilizer?

A fertilizer that is derived from animal or vegetable matter, or from naturally occurring minerals

Examples:

- *manure*
- *blood meal*
- *worm castings*
- *seaweed*
- *hydrolyzed fish*
- *rock phosphate*
- *limestone*

Some organic fertilizer sources

Pre-plant

- Rock phosphate (P)
- Limestone (Ca)
- Dolomitic limestone (Ca, Mg)
- Blood meal (12.5-1.5-0.6)
- Alfalfa meal (2.5-0.5-2.0)
- Bone meal (4-12-0, plus 20% Ca)
- Poultry litter (ex: Perdue 3-2-3, 7-2-2)
- Guano (ex: 10-10-0)

Some organic fertilizer sources

Liquids (applied with irrigation water)

- Fish emulsion (ex: 4-1-1)
- Fish hydrolysate (ex: 3-3-1)
- Seed oil extract (ex: 3-1-1)
- Compost tea

Some of the pre-plant sources noted in the previous slide can be finely ground and suspended in water

- May plug injectors, drip emitters

NOP Standards allow up to 20% of nitrogen from sodium nitrate

Immediately-available and slow-release components

Conventional

- ex. 20-10-20 soluble feed
- Nutrients readily absorbed by plant roots
- ex. Osmocote 15-9-12
- Prill coatings can be compromised at high production temperatures

Organic

- For many, initial charge may release → high EC
- Release nutrients slowly through decomposition and microbial activity
- Microbe-mediated, so temperature, pH, and other factors influences

Organic / Bioorganic Fertilizers Pre-Plant in Root Media

Pre-plant incorporation into root media

Raw Organic Materials

- Feather meal (e.g. 13-0.6-0.2)
- Blood meal (e.g. 14.4-0.6-0.2)
- Bone meal (e.g. 6.4-14.5-1.2)

Engineered Organic Fertilizers

- Hydrolyzed feather meal, fermented sugar beet molasses, bone meal, soybean meal, cocoa shell meal

Anaerobically composted turkey litter

Combination Organic-Mineral Fertilizers

Examples

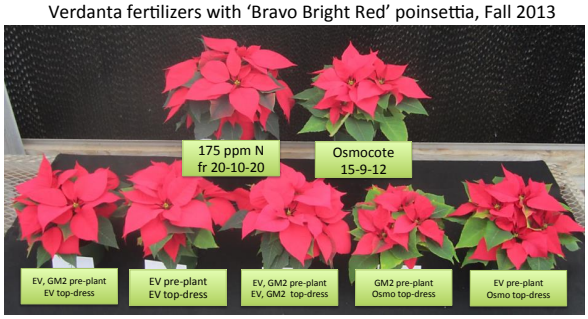
- Verdanta GM-2 (7-6-12 + 2.3% Mg)
  - Hoof & Horn Meal, Fermented Sugar Beet Molasses, Sugar Cane Molasses, Monoammonium Phosphate, Potassium Nitrate, Poultry Manure, Soybean Meal, Cocoa Shell Meal, Urea, Dicalcium Phosphate, & Magnesium Oxide
- Sustane 16-4-8 (120 and 180 day release products)
  - Aerobically composted turkey litter; polymer-coated (Sumicoat) urea, KNO_3, $NH_4H_2PO_4$; feather meal; sulfate of potash
- Nature's Source 10-4-3 Professional Plant Food
  - Oilseed extract & inorganic nutrient salts

Combination Organic-Mineral Fertilizers

- Base fertilizer component is organically derived, but mineral fertilizers are added to enrich the nutrient content
- Why?
  - Environmental benefits of using organic derived components (ex. Keeps by-products out of waste-streams)
  - Can be more cost effective than solely organic
  - Organic-derived materials promote beneficial microbes
  - Blended nutrient release – combination of readily-available and slowly-available nutrient release that may reduce nutrient leaching

Reduced Nutrient Leaching

Verdanta fertilizers with 'Bravo Bright Red' poinsettia, Fall 2013



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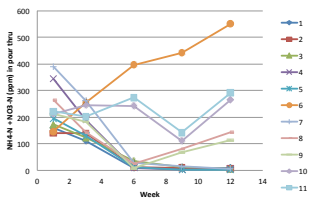
'Bravo Bright Red' Poinsettia, Fall 2013



Description of Treatments as Total lbs product/yd³
Total N applied as slow release = 1.4 lbs/yd³ or 1.2 lbs/yd³ with soluble supplement

Treatment number →	1	2	3	4	5	6	7	8	9	10	11
EcoVita Pre-plant (7-5-10)	5	10	5		4.6			8.5	8.5	8.5	8.5
GM-2 Pre-plant (7-6-12 + 2.3% Mg)	5		5	4.6				8.5	8.5	8.5	8.5
EcoVita Topdress @ mid	10	10	5								
GM-2 Topdress @ mid			5								
Osmocote 15-9-12 (6-mo) Pre-plant				5	5		9.3				
						CLF 175 ppm N fr 20-10-20		CLF 100 ppm N fr 20-10-20, Wk 7	CLF 100 ppm N fr 13-2-13, Wk 7	CLF 100 ppm N fr 20-10-20, Wk 4	CLF 100 ppm N fr 13-2-13, Wk 4

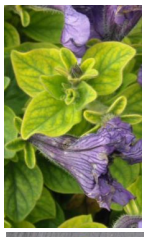
Conditions that favor microbial activity hasten nutrient release from organic fertilizers

Microbial activity favored by:

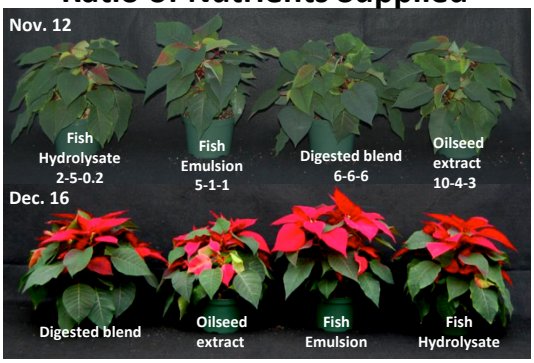
- Source of inoculum (compost or commercial products)
- Food source (compost or other bacteria)
- Warm temperatures
- Substrate that is not water-logged
- pH not too low (greater than 5.5)

Difficulties with organic fertilizers

- Initial high EC
- Slow nutrient release
- Managing pH of the substrate
- Providing comparable levels of nutrients as conventional fertilizers, especially late in the production of heavy feeding crops
- Cost?
- Ratio of nutrients supplied
- Micronutrient supply



Ratio of Nutrients Supplied



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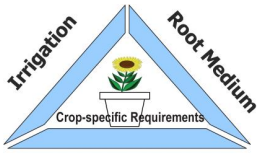
Plants were fertilized with 200 ppm N from each of the fertilizer sources. Photos taken on Nov. 12 (top) and Dec. 16 (bottom).

Bottom Line

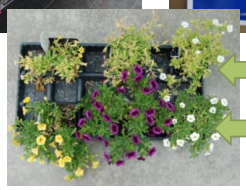
- Though there are potential benefits of using organics, we have not yet found an organic fertilizer that offers the same amount of control and flexibility as conventional fertilizers
- We will give examples of how challenges of using organic fertilizers can be managed by adjusting production systems, including using combinations of products & approaches

What does this mean when making the switch?

- Start by evaluating all aspects of nutrient management--water quality, root medium, and fertilizer program—to ensure that all essential nutrients are provided in appropriate amounts



Learning the hard way…



No iron

Fe chelate 4 oz/100 gal

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What does this mean when making the switch?

- Be prepared to more intensively manage the fertilization program over the course of the production cycle
- pH, EC, ion-specific measurements
- Produce small runs of several cultivars and have current practice as control

What does this mean when making the switch?

- No question, challenges can be overcome to produce healthy, vigorous plants
- Examples from our research of ways to help mitigate or navigate the challenges associated with organic nutrient sources

Length of Cropping Cycle

- Making the switch is easier for short-term crops
- Get an estimate of the fertilizer's release period from the manufacturer
- Pre-plant incorporation works well for many short turn crops (ex. 4 weeks)
- Plan to supplement nutrients for longer-term crops

Basil 'Pluto' 4 week plugs

No Fertilizer | Sustane 8-4-4 8 lbs/yd³ | 20-10-20 100 ppm N 3x/wk

Cornell University Department of Horticulture

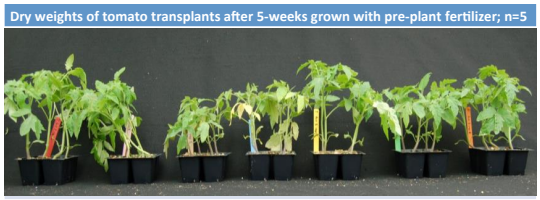
Basil 'Pluto' 4 week plugs

No Fertilizer | Sustane 8-4-4 8 lbs/yd³ | 20-10-20 100 ppm N 3x/wk

Cornell University Department of Horticulture

'Paragon F1' Tomato, 5 week crop

Dry weights of tomato transplants after 5-weeks grown with pre-plant fertilizer; n=5



150 ppm N 20-10-20	Osmo 15-9-12+ 1.2 lb N/yd³	Sustane 8-4-4 0.5 lb N/yd³	Verdanta GM2 7-6-12 0.32 lb N/yd³	Verdanta GM2 7-6-12 0.46 lb N/yd³	Verdanta GM2 7-6-12 0.60 lb N/yd³	Verdanta GM2 7-6-12 0.70 lb N/yd³
	8 lb/yd³	6.5 lb/yd³	4.5 lb/yd³	6.5 lb/yd³	8.5 lb/yd³	10 lb/yd³
1.9	1.1	0.9	1.3	1.5	1.5	1.3

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Length of Cropping Cycle

- Plan to supplement nutrients for longer-term crops
  - Top-dressing
  - Liquid-feed
- Get an estimate of the fertilizer's release period from the manufacturer

15 week Garden Mums 'Gigi Gold'

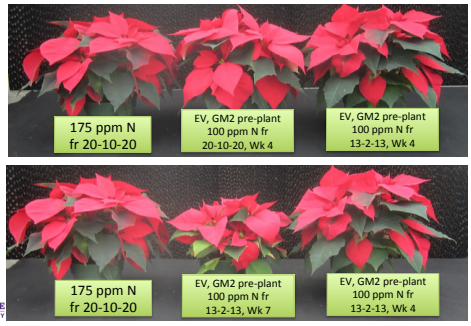
21-5-20 CLF
250 ppm N

EcoVita 7-5-10
8 lbs./yd^3

Cornell University
Department of Horticulture

Pre-plant Organic + Supplemental Conventional Liquid Fertilizer Program

Verdanta fertilizers with 'Bravo Bright Red' poinsettia, Fall 2013



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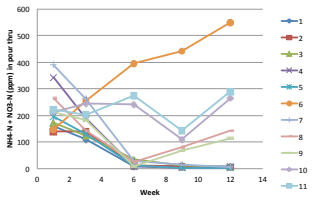
'Bravo Bright Red' Poinsettia, Fall 2013



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Know general amount of quickly-available plant nutrients

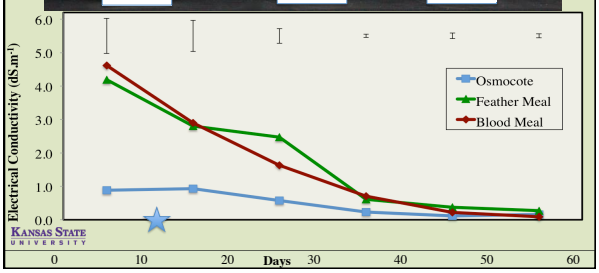
Problem: Initial EC too high

when incorporated at high rates to meet crop nutrient needs for entire production cycle

Pre-plant EC from Pour Thru (dS/m)
- Low: < 2.0
- Normal: 2.0 – 3.5
- High: > 3.5

1 week after potting (units dS/m):
- **Feather Meal: 4.5**
- **Blood Meal: ~4.0**

Solution: Leach before transplant



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Solution: Top-dress at mid-crop

@ 1 week after transplant…

- **Verdanta GM2 (7-6-12): ~10 dS/m**
  NOT RECOMMENDED BY SUPPLIER!
  (17 lbs fert pre-plant)
- **Verdanta GM2 (7-6-12): ~3.5 dS/m**
  (8.5 lbs fert pre-plant + 8.5 lbs topdress at day 45)

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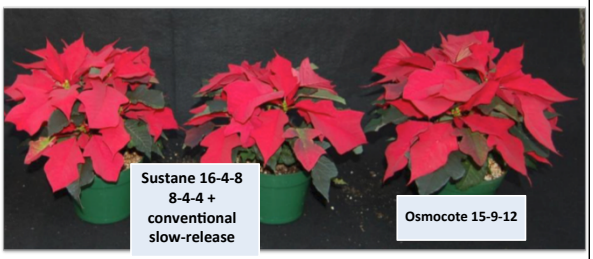
'Prestige Red' Poinsettia;
both treatments provide 1.2 lbs N/yd^3

Solution: Combine organic + inorganic slow-release

- Minimize initial high EC from large doses of some organic sources
- Abate 'dumping' of nutrients from encapsulated prills if high temperatures occur during production
- Provide both ammonium and nitrate N forms
- Help establish diverse and healthy microbial communities in substrate

Solution: Combine organic + inorganic slow-release



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All fertilizer applied pre-plant at a rate of 1.3 lb N/yd³; 8 lbs/yd³

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Disclaimer: Mention of trademarks or brand names is for informational purposes only and does not imply product's approval to the exclusion of other products that may be suitable.

Organic producers should always consult their certification agents before purchasing products

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Getting Specific: Research Results with Organic Fertilizers

Neil Mattson
Greenhouse Research and Extension
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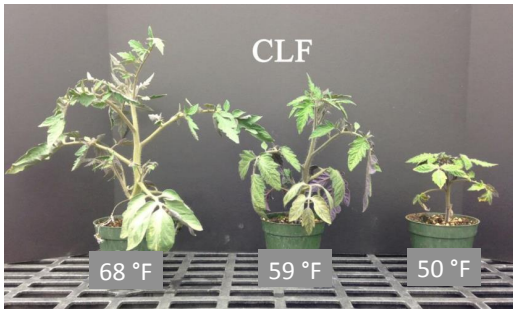
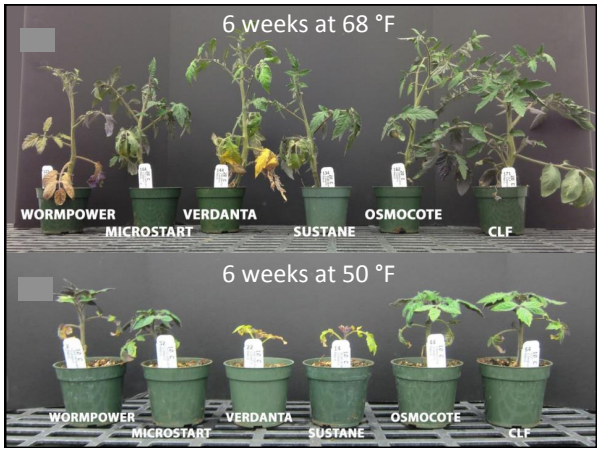
Cornell University

Temperature affects both plant growth and availability of nutrients





Honing in on Recipes and Rates

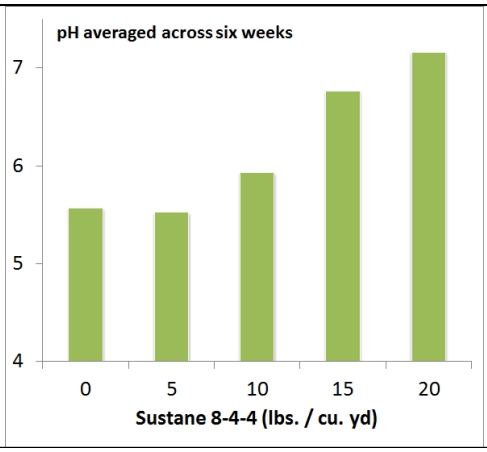
- Conduct your own small-scale trials
- Routine monitoring of pH, EC, shoot and root quality and development

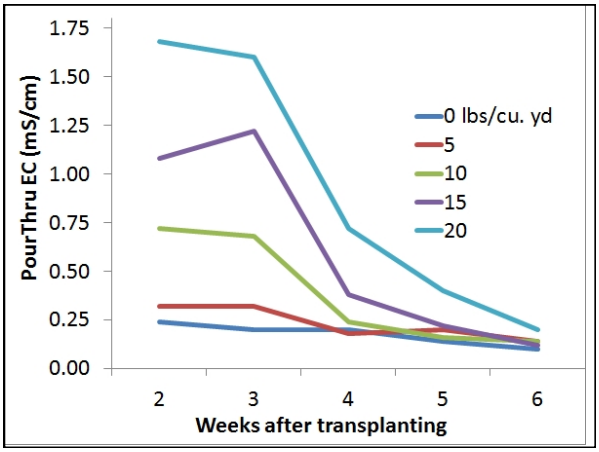
Trial with Sustane 8-4-4 incorporated in potting mix

Pounds per cubic yard Sustane 8-4-4

Tomato

Pounds per cubic yard Sustane 8-4-4





Comparing substrate incorporated fertilizer sources

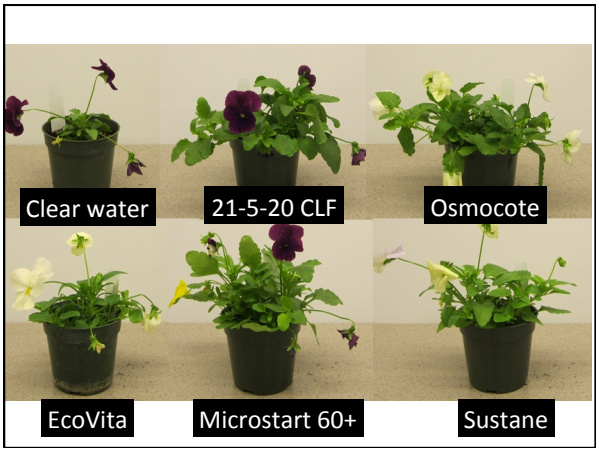
- Materials vary based on % N-P-K and release period

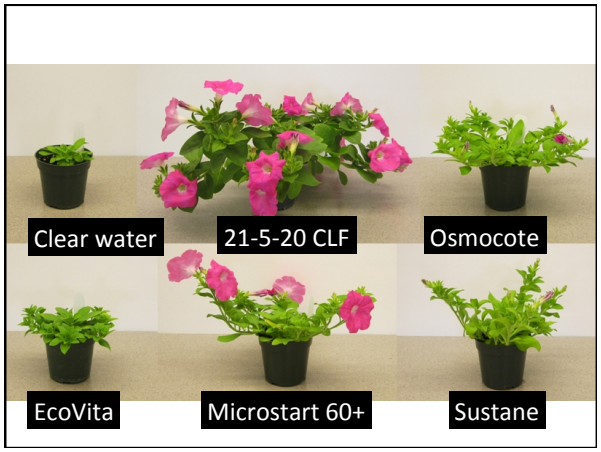
Material	N-P-K	Release period
EcoVita	7-5-10	75-100 d
MicroStart 60 plus	7-7-2	unknown
Sustane	8-4-4	45 d
Osmocote Bloom	12-7-18	60-90 d

Comparing substrate incorporated fertilizer sources

- Comparison on a lbs. Nitrogen per cubic yard
- Application rates – medium 0.42 lbs. N / yd^3

Treatment	Application rate
Clear water	-
Jack's 21-5-20	150 ppm N, weekdays
Osmocote Bloom 12-7-18	3.5 lbs. /cubic yard
EcoVita 7-5-10	6.0 lbs. /cubic yard
MicroStart 60 plus 7-7-2	6.0 lbs. /cubic yard
Sustane 8-4-4	5.25 lbs. /cubic yard





Comparing Vermicompost Sources for Tomato Transplant Production

Dr. Neil Mattson

Stephanie Beeks

Cornell University
Department of Horticulture

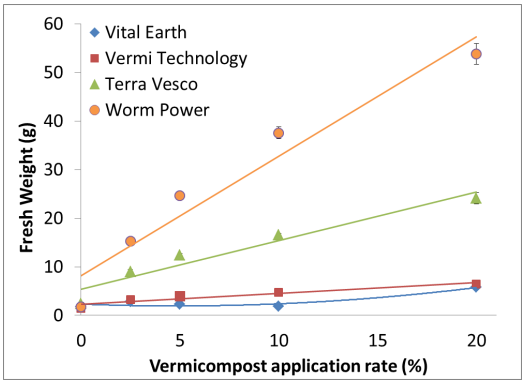
Comparing Vermicomposts as the sole fertilizer source

- Vital Earth- Mega Worm
- Vermi Technology-Black Castings (OMRI)
- Terra Vesco- Sonoma Valley Worm Farm (OMRI)
- Worm Power (OMRI)
- 75 :25 Peat perlite base substrate
- Vermicompost added to displace peat at 0, 2.5, 5, 10, 20% v/v
- Seedling germination and 4-inch containers
  - 'Celebrity' tomato
  - Lady Bell' pepper

Nutrient Comparison (dry weight basis)

Parameter	Units	Vital Earth	Vermi Technology	Terra Vesco	Worm Power
pH	std	4.1	7.4	7.6	7.1
Soluble Salts	mmhos/cm	2.2	1.8	9.0	16.2
Nitrogen (total)	%	1.50	1.10	2.50	3.90
Phosphorous	%	0.17	0.18	0.97	1.45
Potassium	%	0.09	0.10	2.07	3.09
Ammonium N	mg/kg	5.0	<4.9	<5.0	132
Nitrate N	mg/kg	590	504	2,378	4,896

Tomato 4-inch containers FW (g)



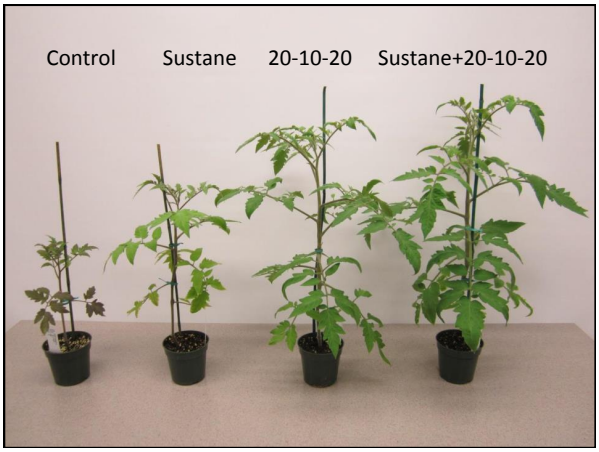
Conclusions – VC comparison

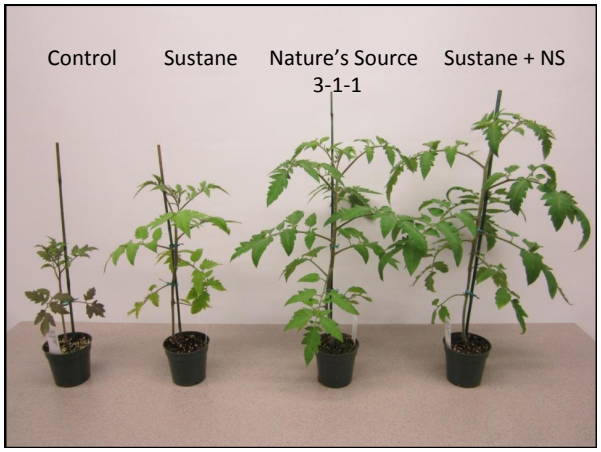
- The dairy-solids based VCs were suitable as primary fertilizer source for tomatoes/pepper
- To achieve suitable size:
  - 2.5-5% Worm Power
  - 10-20% Terra Vesco
- Black Castings and Mega Worm VC were not suitable as a fertilizer source for tomatoes and peppers
  - Are suitable as a substrate amendment
- Selection of VC source has a great effect on suitability for germination and transplant use

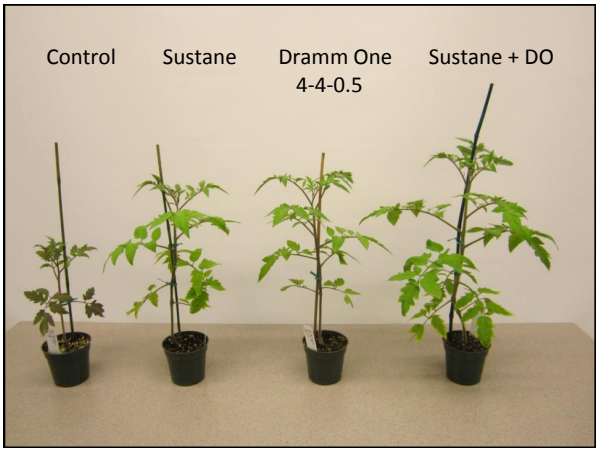
Combining Granular and Liquid Materials

Combining Sustane 8-4-4 with liquid feed

- Tomatoes in 4-inch containers, 5 weeks
- Fertility
  - Sustane 8-4-4 @ 8 lbs/yd^3
  - Liquid fertilizer @ 100 ppm N 3x/week
  - Both

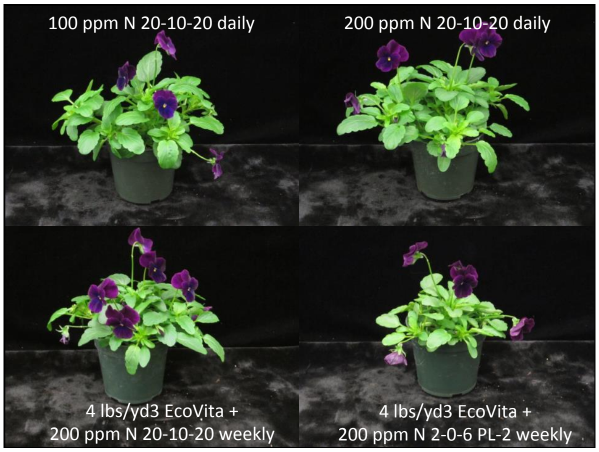


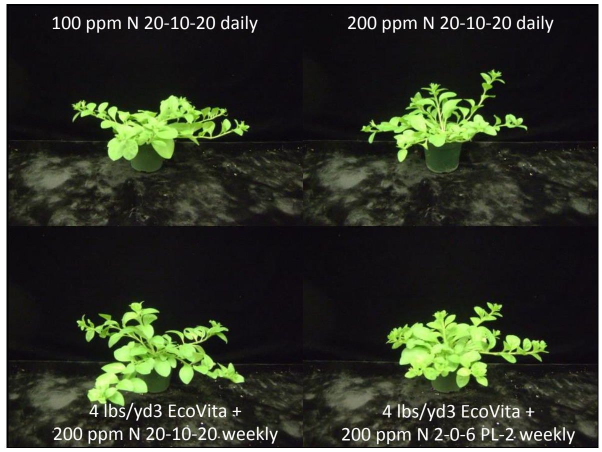


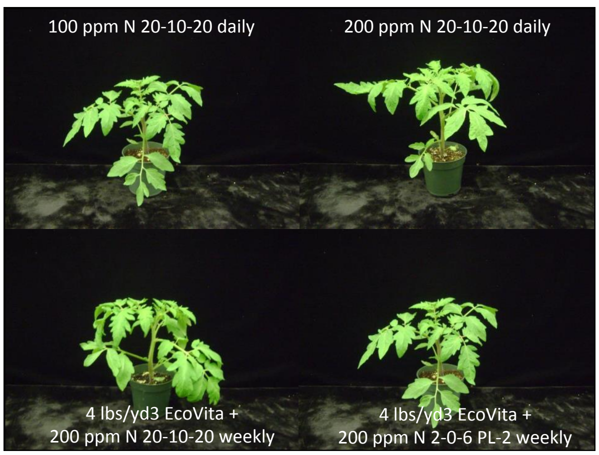


EcoVita and Liquid Feed

- Spring bedding plants and vegetable transplants – 6 week crops
- Constant liquid feed vs.
- Base feed: EcoVita 7-5-10 incorporated at 4 lbs/yd^3, supplemented with
  - 20-10-20 at 200 ppm N 1x/week; or
  - PL-2 2-0-6 (liquid organic) at 200 ppm N 1x/week







Organic Lavender

Control Unfertilized | EcoVita 6#/yd3 | EcoVita + PL-2 100 ppm 2x/wk

Summary of What Works

- Many different approaches work!
- Need to consider the system as a whole
  - How does crop period match nutrient availability?
- Many organic growers begin with substrate incorporated as the base feed and amend from there
- Conventional growers may see benefits, too
  - Organic granular as an controlled release alternative
  - Combo organic/mineral to increase microbial activity and reduce nutrient leaching

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Questions and Answers

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