e-GRO Nutritional Monitoring

W. Garrett Owen[1]

Brian E. Whipker[2]

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Nutritional Monitoring Series

Heuchera

(*Heuchera hybrida*)

Heuchera or coral bells require low fertility of 50 to 150 ppm N. Overfertilization results in stunted plant growth and necrotic (death) leaf spots and margins. Optimal substrate pH values for coral bells range from 5.8 to 6.2. Coral bells can develop both low and high substrate pH disorders.

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Figure 1. Lower leaves of coral bell (*Heuchera hybrida*) exhibiting lower leaf black spotting due to low substrate pH-induced iron (Fe) and/or manganese toxicity. Photo by: Josh Henry.

Heuchera

Target Nutrition Parameters

pH Category III:
5.8 to 6.2

Fertility Category:
Low to Medium
50 - 150 ppm N

EC Category A - B:
1:2 Extraction:
0.4 to 0.9 mS/cm

SME:
0.9 to 2.0 mS/cm

PourThru:
1.3 to 2.0 mS/cm

[1]University of Kentucky
wgowen@uky.edu

[2]NC State University
bwhipker@ncsu.edu

University of Kentucky

NC STATE UNIVERSITY

Figure 2. Substrate pH below 5.8 during coral bell (*Heuchera hybrida*) production results in stunted plant growth and lower leaf black spotting due to iron (Fe) and/or manganese toxicity. Photo by: Josh Henry.

Fertility Management of Heuchera

Heuchera or coral bells should be grown with a substrate pH range of 5.8 to 6.2. Use recommended 1:2 Extraction, SME, or PourThru methods to determine and monitor substrate pH and soluble salts [referred to as electrical conductivity (EC)] values. Additionally, conduct routine foliar analysis tests to monitor crop nutrient status. Leaf tissue nutrient levels found in leaves of coral bells are provided in Table 1, which can serve as a guideline in diagnosing suspected nutrient disorders. Monitoring substrate pH and nutrient status will enable growers to avoid pH induced nutritional disorders.

Substrate pH below 5.8 causes increase uptake of iron (Fe) and manganese (Mn) to toxic levels which will accumulate in leaf tissue. Plants exhibiting Fe and/or Mn toxicity exhibit lower leaf black spotting (Fig. 1) and stunted plant growth (Fig. 2). Corrective procedures for low substrate pH should begin around 5.6. Substrate pH below 5.4 to 5.6 can inhibit magnesium (Mg) uptake causing lower or older leaves to become Mg-deficient and exhibit interveinal chlorosis (yellowing). Monthly applications of supplemental Mg in the form of magnesium sulfate ($MgSO_4$; Epsom salts) at a rate of 8 oz./100 gal. of water in areas with naturally occurring Mg in the water supply or 16 oz./100 gal. of water in areas lacking Mg in the irrigation water will prevent Mg deficiency and symptomology development.

High substrate pH above 6.2 can inhibit Fe uptake causing newly developed and recently matured leaves to become Fe-deficient. Symptoms of Fe deficiency may be visually challenging to identify because of foliage color and venation. Most often, Fe deficiency will be observed as stunted plant growth (Fig. 3). Corrective procedures for high substrate pH should begin within the range of 6.2 to 6.4.

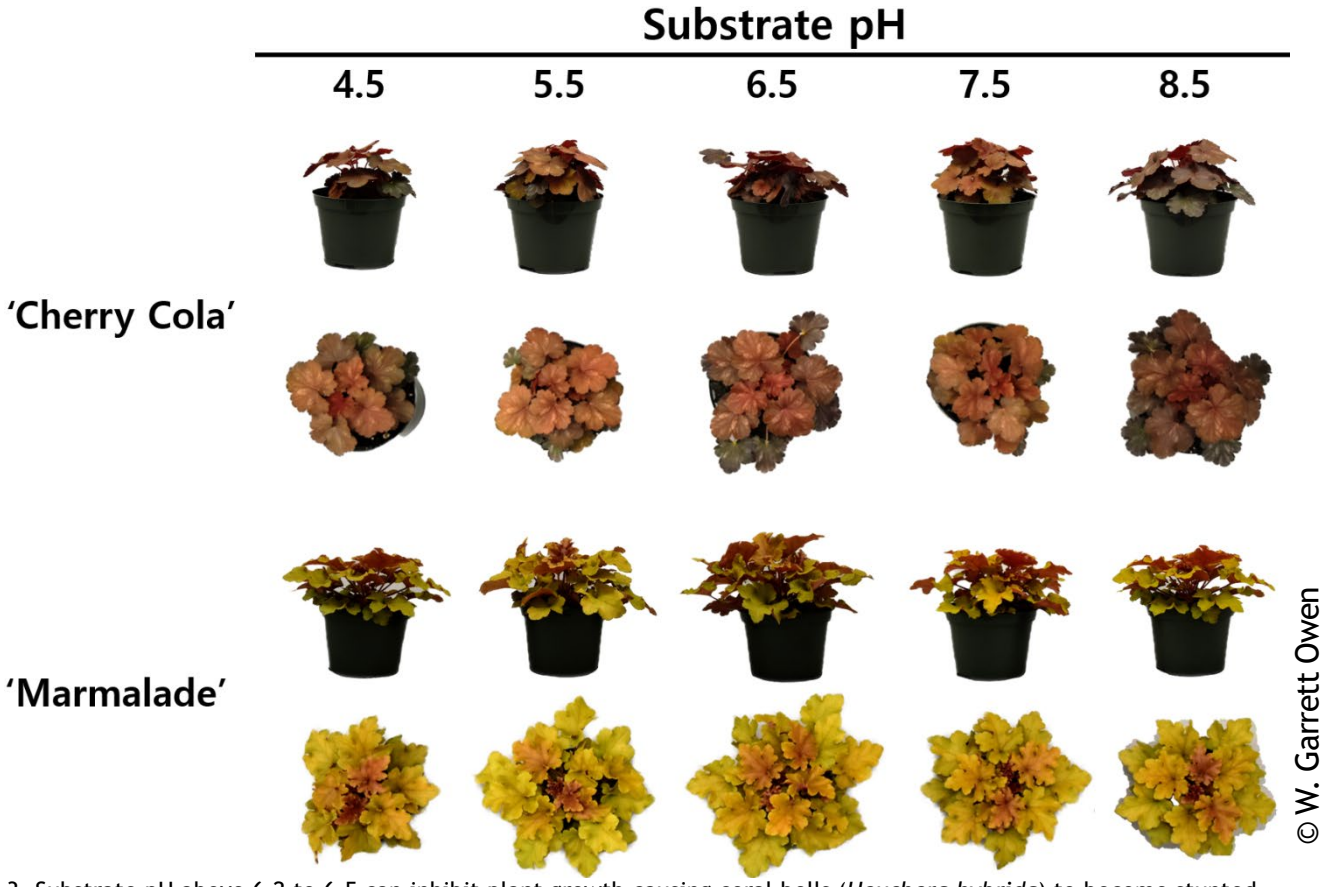

Figure 3. Substrate pH above 6.2 to 6.5 can inhibit plant growth causing coral bells (*Heuchera hybrida*) to become stunted. Photo by: W. Garrett Owen.

During coral bell production, maintain low to medium fertility levels of 50 to 150 ppm N. University of Kentucky research found optimal fertility levels to be 50 to 75 ppm N for four coral bell cultivars (Fig. 4). Insufficient fertility levels (low EC) will often result in lower leaf chlorosis or reddening (Fig. 5). Overfertilization (high EC) results in stunted plant growth (Fig. 6). Plants will also exhibit necrotic leaf spots (Fig. 7) and margins (Fig. 8) because of high substrate EC levels. If EC values become excessive, leach the substrate with clear irrigation water twice before providing fertility. It is best to monitor the crop to avoid excessive EC values than to waste fertilizer by leaching it from the pots.

Summary

Providing low to medium fertility at 100 to 200 ppm N and maintaining a pH of 5.8 to 6.2 will help prevent most nutritional disorders.

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Literature Cited

Owen, W.G. 2019. Leaf tissue nutrient sufficiency ranges of four Heuchera cultivars by chronological age. HortScience 54:1751–1756. https://doi.org/10.21273/HORTSCI14222-19

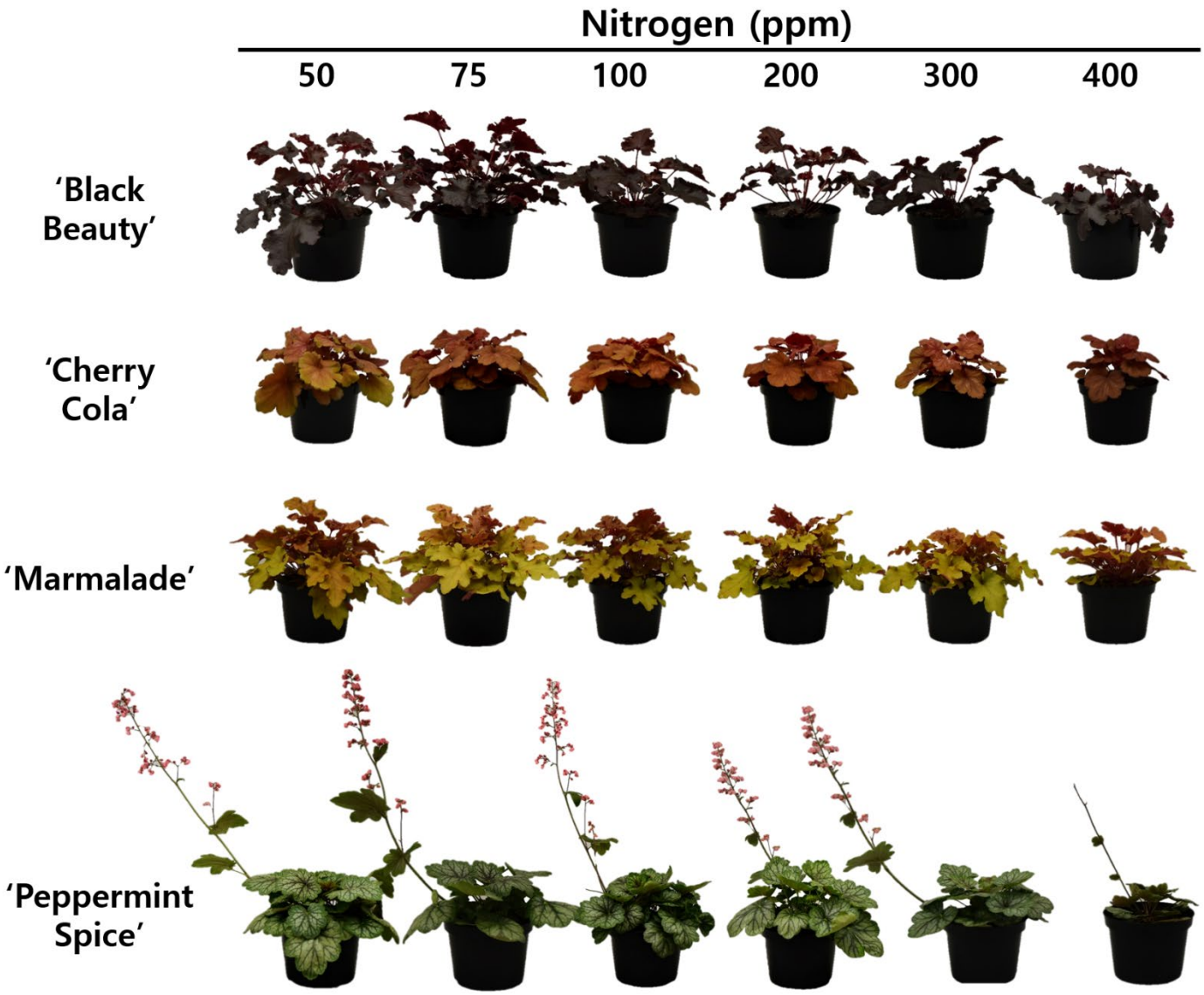

Figure 4. Research found fertility levels for coral bells (*Heuchera hybrida*) 'Black Beauty', 'Cherry Cola', 'Marmalade', and 'Peppermint Spice' to be 50 to 75 ppm N after a 9-week crop cycle. Photo by: W. Garrett Owen.

Figure 5. Providing insufficient fertility [low electrical conductivity (EC)] during coral bells (*Heuchera hybrida*) production can result in lower leaf chlorosis (yellowing or reddening). Photo by: W. Garrett Owen.

Figure 6. Providing excessive fertility [high electrical conductivity (EC)] during coral bell (*Heuchera hybrida*) production can result in stunted plant growth. Photo by: W. Garrett Owen.

Figure 7. Providing excessive fertility [high electrical conductivity (EC)] during coral bell (*Heuchera hybrida*) production can result in necrotic (death) leaf spots. Photo by: Josh Henry.

Figure 8. Providing excessive fertility [high electrical conductivity (EC)] during coral bell (*Heuchera hybrida*) production can result in necrotic (death) leaf margins. Photo by: W. Garrett Owen.

Table 1. Nutrient sufficiency ranges determined at 3 (young growth), 6 (active growth), and 9 (mature growth and/or bloom) weeks after transplant (WAT) for coral bells (*Heuchera hybrida*) 'Black Beauty', 'Cherry Cola', 'Marmalade', and 'Peppermint Spice' grown under 50–75 ppm N supplied by 15N–4P–15K containing 1.9% ammoniacal-N and 13.1% nitrate-N with a constant level of water-soluble micronutrient blend.

Cultivar and weeks after transplant (WAT)	Macronutrients						Micronutrients				
	Total nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulfur	Iron	Manganese	Zinc	Copper	Boron
	(%)						(ppm)				
'Black Beauty'											
3	3.43 - 3.83	0.55 - 0.58	2.40 - 2.68	1.01 - 1.10	0.39 - 0.41	0.38 - 0.39	105.2 - 155.0	61.9 - 72.2	34.9 - 39.4	6.3 - 7.1	28.0 - 28.5
6	3.79 - 4.00	0.72 - 0.75	3.00 - 3.06	1.07 - 1.26	0.37 - 0.40	0.40 - 0.45	128.5 - 189.6	57.2 - 67.5	54.6 - 56.1	7.1 - 7.2	29.9 - 33.5
9	3.45 - 3.63	0.52 - 0.55	2.21 - 2.27	0.88 - 0.95	0.31 - 0.33	0.45 - 0.57	124.2 - 145.5	43.7 - 44.7	56.4 - 59.4	9.7 - 9.8	41.3 - 46.2
'Cherry Cola'											
3	3.82 - 3.96	0.57 - 0.60	2.80 - 3.29	1.14 - 1.34	0.41 - 0.44	0.41 - 0.47	116.6 - 137.1	67.2 - 70.7	38.6 - 41.6	6.0 - 7.9	36.6 - 38.2
6	4.26 - 4.35	0.64 - 0.72	2.87 - 2.92	1.83 - 1.91	0.46 - 0.45	0.47 - 0.56	115.9 - 117.2	58.1 - 68.4	41.6 - 48.9	8.3 - 9.2	48.6 - 55.5
9	3.92 - 4.18	0.64 - 0.68	2.68 - 3.03	1.36 - 1.66	0.35 - 0.37	0.59 - 0.66	106.8 - 111.7	58.4 - 65.7	58.5 - 71.8	9.9 - 10.3	65.3 - 67.5
'Marmalade'											
3	3.24 - 3.27	0.47 - 0.50	1.92 - 2.27	0.70 - 0.72	0.25 - 0.27	0.45 - 0.52	137.5 - 154.2	62.6 - 73.5	41.7 - 47.8	6.4 - 7.1	30.8 - 33.6
6	3.98 - 4.09	0.57 - 0.61	2.60 - 2.66	0.89 - 1.07	0.32 - 0.34	0.47 - 0.48	197.0 - 209.0	62.6 - 73.5	49.2 - 50.8	7.4 - 8.4	34.8 - 36.8
9	2.98 - 3.25	0.37 - 0.39	1.45 - 1.58	0.73 - 0.77	0.23 - 0.24	0.45 - 0.59	146.7 - 203.4	44.3 - 46.0	69.0 - 70.8	10.3 - 10.9	37.8 - 37.9
'Peppermint Spice'											
3	2.87 - 3.15	0.37 - 0.44	1.64 - 1.70	0.89 - 0.94	0.27 - 0.30	0.39 - 0.41	50.3 - 58.4	54.2 - 65.5	35.1 - 35.9	5.5 - 5.8	30.3 - 30.6
6	3.58 - 3.74	0.39 - 0.40	2.01 - 2.15	1.22 - 1.26	0.32 - 0.33	0.35 - 0.43	65.5 - 73.4	48.4 - 50.2	36.1 - 38.8	6.0 - 6.2	34.5 - 34.7
9	2.78 - 3.23	0.22 - 0.30	1.10 - 1.35	1.15 - 1.21	0.29 - 0.33	0.36 - 0.38	51.6 - 65.4	45.5 - 51.6	45.6 - 47.7	6.4 - 8.1	36.1 - 36.4

Source: [1] Owen (2019)

Corrective Procedures for Modifying Substrate pH and Electrical Conductivity (EC)

When the pH or substrate electrical conductivity (EC) drifts into unwanted territory, adjustments must be made. Below are the standard corrective procedures used to modify the substrate pH and EC for greenhouse grown crops in soilless substrates.

1. Low Substrate pH Correction

When Fe and Mn toxicity becomes a problem, adjust (raising) substrate pH to the recommended pH range. Corrective procedures to raise low pH levels are listed below. Switching to a basic fertilizer when the substrate pH is nearing the lower limit will help stabilize the pH. If the pH is below the recommended range, then corrective procedures will need to be implemented. Flowable lime is one option. Using a rate of 2 quarts per 100 gallons of water will typically increase the substrate pH by roughly 0.5 pH units. Two quarts can be used through an injector. Additional applications can be made if needed. Potassium bicarbonate ($KHCO_3$) can also be applied. A rate of 2 pounds per 100 gallons of water will increase the substrate pH by roughly 0.8 pH units. This treatment will also provide excessive potassium (K) and cause a spike in the substrate EC. A leaching irrigation with clear water is required the following day to restore the nutrient balance (the ratio of K:Ca:Mg) and lower the EC. As always, remember to recheck your substrate pH to determine if reapplications are needed.

pH Adjustment Recommendations

Flowable Lime

- Use 1 to 2 quarts per 100 gallons of water.
  Rinse foliage.
- Avoid damage to your injector by using rates of 2 quarts per 100 gallons of water, or less.
- Can split applications.

Hydrated Lime

- Mix 1 pound in 3 to 5 gallons of WARM water. Mix twice. Let settle. Decant liquid and apply through injector at 1:15.
- Caustic (rinse foliage ASAP and avoid skin contact)

Potassium Bicarbonate ($KHCO_3$)

- Use 2 pounds per 100 gallons of water
- Rinse foliage immediately.
- *Provides 933 ppm K.*
- Leach heavily the following day with a complete fertilizer to reduce substrate EC and restore nutrient balance.
- Rates greater than 2 pounds per 100 gallons of water can cause phytotoxicity!

2. High Substrate pH Correction

The target pH for many species is between 5.8 and 6.2. Higher pH values will result in Fe deficiency and lead to the development of interveinal chlorosis on the upper leaves. Check the substrate pH to determine if it is too high. Be careful when lowering the substrate pH, because going too low can be much more problematic and difficult to deal with.

Acid-based Fertilizer
If the substrate pH is just beginning to increase, then first consider switching to an acidic-based fertilizer. These ammoniacal-nitrogen (N) based fertilizers are naturally acidic and plant nitrogen uptake will help moderate the substrate pH over a week or two.

Acid Water Drench
Some growers use this intermediate correction if pH levels are not excessively high, and a quick lower of the substrate pH is desired. Use sulfuric acid to acidify your irrigation water to a pH 4.0 to 4.5. Apply this acid water as a substrate drench providing 5 to 10% excessive leaching of the substrate. Rinse the foliage to avoid phytotoxicity. Results should be visible within 5 days. Retest the substrate pH and repeat if needed.

Iron Drench
If the levels are excessively high, then an Fe chelate application can be made to the substrate.
Below are the options.

Iron Chelate Drench (options)
- Iron-EDDHA: mix 5 ounces in 100 gallons of water
- Iron-DTPA: mix 5 ounces in 100 gallons of water
- Iron sulfate: mix 4-8 ounces in 100 gallons of water

- Apply as a substrate drench with sufficient volume to leach the pot.
- Rinse foliage immediately.
- Avoid use on iron efficient plants (geraniums).

3. Low EC Correction

If low EC problems occur, increase the fertilization rate to 300 ppm N for a few applications before returning to the recommend fertilization rate for the crop.

4. High EC Correction

Excessively high fertilization rates will result in a marginal leaf burn. Check the substrate EC to confirm your diagnosis. Values greater than 6.0 mS/cm based on the PourThru sampling method can be problematic for many plants.

Switch to Clear Water Irrigations
If the substrate EC is just beginning to increase over time, then leach with a few clear water irrigations to lower EC levels by flushing out the salts.

Clear Water Leaching
If the EC values are excessively high, leach the substrate twice with back-to-back clear water irrigations. Then allow the substrate to dry down normally before retesting the EC. If EC levels are still too high, repeat the double leach. Once the substrate EC is back within the normal range, use a balanced fertilizer at a rate of 150 to 200 ppm N.

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CONTRIBUTORS

Dr. Nora Catlin
Floriculture Specialist
Cornell Cooperative Extension
Suffolk County
nora.catlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Greenhouse Horticulture and
Controlled-Environment Agriculture
University of Arkansas
ryand@uark.edu

Thomas Ford
Commercial Horticulture Educator
Penn State Extension
tgf2@psu.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension
Suffolk County
dog1@cornell.edu

Dr. Joyce Latimer
Floriculture Extension & Research
Virginia Tech
jlatime@vt.edu

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rglopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. W. Garrett Owen
Greenhouse Extension & Research
University of Kentucky
wgowen@uky.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Beth Scheckelhoff
Extension Educator - Greenhouse Systems
The Ohio State University
scheckelhoff.11@osu.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Economics
Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research
NC State University
bwhipker@ncsu.edu

Dr. Jean Williams-Woodward
Ornamental Extension Plant Pathologist
University of Georgia
jwoodwar@uga.edu

Cooperating Universities

Cornell CALS College of Agriculture and Life Sciences

Cornell Cooperative Extension Suffolk County

Iowa State University

University of Kentucky

Penn State Extension

Virginia Tech

Michigan State University

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