Plant, Solution, & Media Testing for Nursery Production

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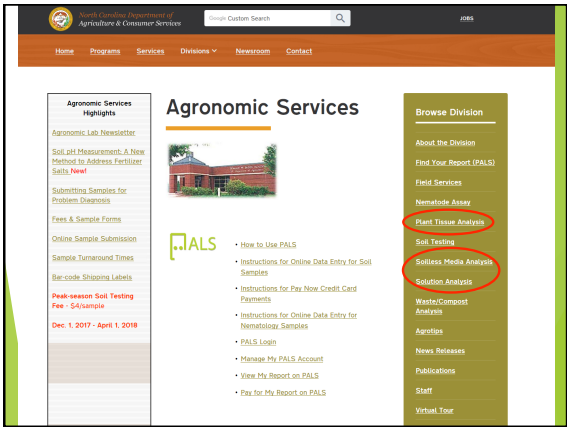


Water & Solution Testing

Why Test Your Water?

- Mineral composition varies depending on
  1. Source. Ponds, wells, streams,& municipal water differ statewide
  2. Time of year.
- Pour-through helps to monitor plant available nutrients *in situ*

SOLUTION USE CODES *(select the code that fits the intended use of the sample)*

Aquaculture		General Water Quality		Nutrient Solution		Irrigation Water		Solution Source Water	
AS	Source Water	QG	Ground Water	NS	General (indicate target conc. in comments)	IW	General	SP	Pesticide Solution
AP	Pond Water	QH	Household (nonpotable)	NT	Tobacco	IO	Overhead	SH	Hydroponic Nutrient
AO	Other *	QS	Surface Water	NL	Pour-thru Leachate	IT	Trickle	SF	Floriculture Production
Farm Pond		QO	Other *	NO	Other *	**Hydroponic Solution**		ST	Tobacco Transplant Production
FP	Fish Production/Recreation	**Poultry Water**		**Livestock Water**		HT	Tomato	SV	Vegetable Transplant Production
		PC	Chicken	LC	Cattle	HC	Cucumber	SO	Other *
		PD	Duck	LH	Horse	HL	Lettuce		
		PT	Turkey	LS	Swine	HH	Herb		
		PO	Other *	LO	Other *	HO	Other *		

* Indicate type of sample and use under Sample Description / Comments.

Solution Analysis

- Essential plant nutrients
  - NH_4-N, NO_3-N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, B
- Na (sodium) and Cl (chloride)
- Soluble Salts (EC)
- Sodium Adsorption Ratio (SAR)
- pH, Total Alkalinity, Acid req.
- Hardness
- Now available by request: Molybdenum $2 (Mo)

Common Problems: Fe

- Micronutrients more available. Can have too much uptake. Fe and Mn toxicity at low pH
- Iron (Fe) accumulation
  - Concentrations as low as 0.5 ppm can cause brownish red staining.
  - Concentrations as low as 0.3 ppm can clog emitters with a red-brown-yellow, jelly-like substance.
  - Accumulation on foliage can cause stunting and darkened leaves

Common Problems: High Alkalinity

- Alkalinity (TA)is the measure of waters ability to resist changes in pH
- Increases substrate pH
- High pH interferes with micronutrient uptake leading to nutrient deficiencies in the plant
- High alkalinity can clog emitters and causes buildup of white deposits.
- Acid injection – Lowers alkalinity and pH levels and reduces white precipitate

Nutrient Measurements													Other Results	
N (ppm)		P (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	S (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)	B (ppm)	Mo (ppm)	Na (ppm)	Cl (ppm)
Inorganic N	0.91	0.04	2.18	92.4	3.29	0.22	1.09	0.08	0.00	0.00	0.06		24.5	32.9
NH4-N	0.63													
NO3-N	0.08	Other Results (continued)												
Organic N		SS (10^{-5} S/cm)	EC (mS/cm)	pH	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR				
Urea	0.41	62	0.82	7.30	0	5.14	257	5.85	244	0.88				

Common Problems: Sodium (Na) & Chloride (Cl)

- Both are toxic at high levels to roots and leaves.
- Can be directly taken up by leaves so overhead irrigation can burn leaves
- Interfere with water uptake (physiological drought)
- Some crops are more sensitive than others
  - >70 ppm Na or Cl
- Sodium Adsorption Ratio (Ratio of Na to Ca + Mg) Predicts the salt hazard to the plant. The higher the ratio the greater the risk of detrimental effects. >4-10

Nutrient Measurements													Other Results	
N (ppm)		P (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	S (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)	B (ppm)	Mo (ppm)	Na (ppm)	Cl (ppm)
Inorganic N	127	3.24	25.5	103	13.4	16.2	0.01	0	0.01	0.03	0.07		828	970
NH4-N	0.29													
NO3-N	127	Other Results (continued)												
Organic N		SS (10^{-5} S/cm)	EC (mS/cm)	pH	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR				
Urea	0	455	4.55	8.18	0	2.72	136	2.99	313	20.3				

How to Take a Solution Sample

- Please No Glass!
- Clean plastic container
  - Beverage container - soda, water, etc.
  - No glass
  - No detergent
  - Rinsed with same water as sample
- Quantity - 16 oz.
- How often? Depends on the water source and purpose
- Tell us the purpose for the sample, e.g. floriculture production.

Irrigation Water

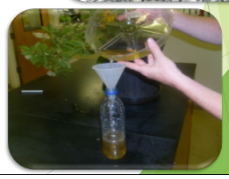
- Can collect directly from tap or irrigation head. Let the water run for ~5 minutes before collecting the sample.

Pour-through Method

- Collect 30 min to 2 hrs after irrigation/fertigation.
- Media moisture should be at "container capacity."
- Use a saucer or tray as a collection device.
- Pour ½ cup of water gently and evenly over the surface of a 1-gallon pot; for a 3-gallon pot, use 1½ cups of water, etc.
- For a small block, use 3-5 pots. For a larger block, use 5-15 pots.

Pour-Through Method (cont.)

- Allow water to drain through the bottom and collect in a saucer or tray
- Use a funnel to pour the collected leachate into a clean soda or water bottle
- Combine multiple *subsamples* for each sample area into the bottle
- Collect at least 8-16 oz.



Soilless Media Testing

Why Test Soilless Media ?

- Pre-plant
  - Check pH, EC & nutrient levels

- Post-plant
  - Identify nutrient and pH problems before plant expresses symptoms
  - Determine if problem is nutrient related
  - Adjust fertilization program

Media Analysis by SME

Nitrate-N (NO_3-N)	Calcium (Ca)	Chloride (Cl)
Ammonium-N (NH_4-N)	Magnesium (Mg)	Aluminum (Al)
Phosphorus (P)	Sulfur (S)	pH
Potassium (K)	Sodium (Na)	EC (10^{-5} S/cm)

Results reported in parts per million (ppm) or milligrams per liter (mg/L) except EC and pH

- Also micronutrients: Fe, Mn, Zn, Cu, B
- And nutrient balances
- Now available with media analysis & by request: Molybdenum $2 (Mo) & Bulk Density $10

Nutrient Recommendations

Greenhouse Floriculture (GHF)

Laboratory result	Greenhouse Floriculture Pre-Plant	Greenhouse Floriculture Post-Plant
pH	5.0-6.5	5.0-6.5
EC (10^{-5} S/cm)	<75	75-350
EC (mS/cm)	<0.75	0.75-3.5
IN-N (ppm)	<50	40-200
P (ppm)	<20	3-10
K (ppm)	<50	60-250
Ca (ppm)	<50	80-400
Mg (ppm)	<25	30-140
%NO3-N	--	8-10%
%NH4-N	--	<3%
%K	--	11-13%
%Ca	--	14-16%
%Mg	--	4-6%
%Cl	--	<10%
%Na	--	<10%

Nursery Crop (NUR)

Laboratory result	Nursery Crop Pre-Plant	Nursery Crop Post-Plant
pH	4.0-4.5 (unlimed) 5.0-6.5 (limed)	5.0-6.5
EC (10^{-5} S/cm)	<25	70-150
EC (mS/cm)	<0.25	0.7-1.5
IN-N (ppm)	< 5	40-100
P (ppm)	< 5	3-12
K (ppm)	<25	10-40
Ca (ppm)	<25	15-40
Mg (ppm)	<5	10-20
%NO3-N	--	8-10%
%NH4-N	--	<3%
%K	--	11-13%
%Ca	--	14-16%
%Mg	--	4-6%
%Cl	--	<10%
%Na	--	<10%

SOILLESS MEDIA SAMPLE INFORMATION

NCDA&CS Agronomic Division Plant/Waste/Solution/Media Section
Mailing Address: 1040 Mail Service Center, Raleigh NC 27699-1040
Physical Address (UPS/FedEx): 4300 Reedy Creek Road, Raleigh NC 27607
Phone: (919) 733-2655 Web Address: www.ncagr.gov/agronomi

SAMPLE TYPE (check one / see instructions) — Predictive ($5) Diagnostic ($5) Research ($12) Out of State ($25)

FOR OFFICE USE ONLY — REPORT # — DATE REC'D — INITIAL

Key & Codes: *Recommendations can be more specific when this information is provided.*

[1] Media Production System Code	[2] Media Type	[3] Fertilizer Type	[4] Sample Type
GHF = GH Floriculture	PMB = Peat Moss Based	LIQ = Liquid or Fertigation	PRE = Preplant
GHV = GH Vegetable	PBB = Pine Bark Based	CRF = Controlled Release	POST = Postplant
NUR = Nursery Crop	PER = Perlite Based	NON = None	[5] Planting date or time since potting (d, wk, mo)
TOB = Tobacco Transplants	OTH = Other	OTH = Other	
OTH = Other	UNK = Unknown	UNK = Unknown	

For each sample, please collect 1-2 quarts of media in a 1-gallon plastic bag.

LAB NUMBER (leave blank)	SAMPLE ID	MEDIA CODE [1]	MEDIA TYPE [2]	FERT TYPE [3]	SAMPLE TYPE [4]	CROP (scientific or common name)	PLANTING DATE [5]	CORRESPONDING SAMPLE ID Solution	CORRESPONDING SAMPLE ID Plant	COMMENTS (fertilizer details, crop appearance)
1	Pojn1	GHF	PMB	CRF	PRE					Add Mo
2	GH1									
3	GH2									Add BD
4										
5										
6										

Additional Comments or Information

Thank you for using agronomic services to manage nutrients and safeguard environmental quality. — Steve Troxler, Commissioner of Agriculture

Soilless Media Sampling Pre-plant

- Subsamples are collected from around the pile or bag then mixed to obtain a representative composite sample.
- Moisten pre-plant samples.
  - Activates lime; provides a better indication of pH for plant growth

Soilless Media Sampling Post-plant

Destructive sampling

- Plugs and seedlings
- Remove plug from tray and shake or rub substrate away from plant roots.
- Make a composite of “subsamples” from 5-15 pots.

Soilless Media Sampling Post-plant

Non-destructive sampling

- Small Pots
  - Remove root mass from container; then pinch or grab a wedge of substrate from center of root mass.
- Large Pots
  - Brush aside top one inch of media and use a probe or trowel to collect substrate from center of pot. Don’t collect from top or bottom one inch.

Plant Tissue Testing

Why tissue sample?

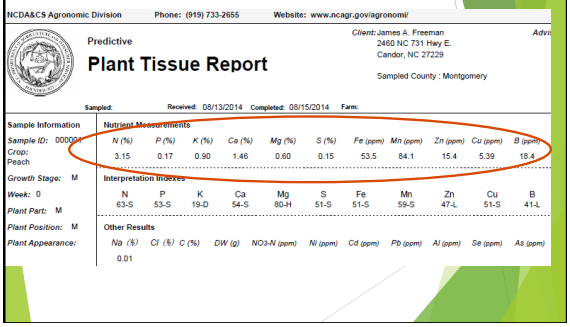
- Very important in high-value crops
- Determine if abnormal color/growth is related to nutrition
- Verify that nutrients are within recommended ranges
- Predict hidden hunger prior to visual symptoms
- Fine-tune fertility programs

Micronutrient Deficiency in Poinsettia

Why Sample Plant Tissue?

- Complementary to solution and media testing
- Get the most accurate info by doing them together
- Plant tissue test tells you how much is being taken up
- Tissue tests measures the concentrations of nutrients in the plant leaves and compares them to researched sufficiency ranges and ratios

Reports the concentrations of nutrients in the plant leaves



NCDA&CS Agronomic Division Phone: (919) 733-2655 Website: www.ncagr.gov/agronomi/

Predictive

Plant Tissue Report

Client: James A. Freeman
2460 NC 731 Hwy E.
Candor, NC 27229

Sampled County : Montgomery

Sampled: Received: 08/13/2014 Completed: 08/15/2014 Farm:

Sample Information
Sample ID: 000004
Crop: Peach
Growth Stage: M
Week: 0
Plant Part: M
Plant Position: M
Plant Appearance:

Nutrient Measurements

N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)	B (ppm)
3.15	0.17	0.90	1.46	0.60	0.15	53.5	84.1	15.4	5.39	18.4

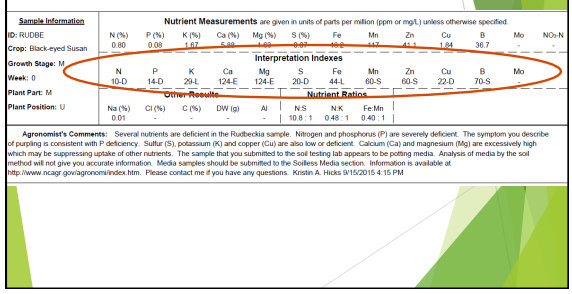
Interpretation Indexes

N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B
63-S	53-S	19-D	54-S	80-H	51-S	51-S	58-S	47-L	51-S	41-L

Other Results

Na (%)	Cl (%)	C (%)	DW (g)	NO3-N (ppm)	Ni (ppm)	Cd (ppm)	Pb (ppm)	Al (ppm)	Se (ppm)	As (ppm)
0.01										

Reports tissue nutrient levels in terms of the degree of effect on growth:



Sample Information
ID: RUDBE
Crop: Black-eyed Susan
Growth Stage: M
Week: 0
Plant Part: M
Plant Position: U

Nutrient Measurements are given in units of parts per million (ppm or mg/L) unless otherwise specified.

N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)	Fe	Mn	Zn	Cu	B	Mo	NO3-N
0.80	0.08	1.67	5.88	1.69	0.67	49.2	14.7	41.1	1.84	36.7	-	-

Interpretation Indexes

N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
10-D	14-D	29-L	124-E	124-E	20-D	44-L	60-S	60-S	22-D	70-S	-

Other Results

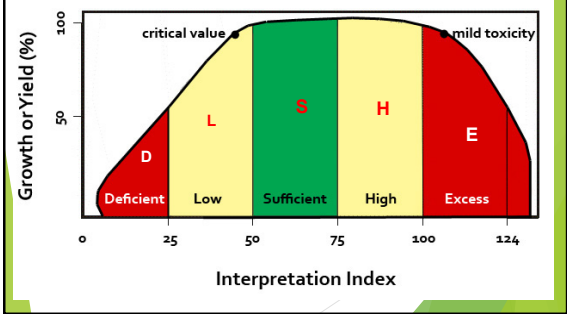
Na (%)	Cl (%)	C (%)	DW (g)	Al
0.01	-	-	-	-

Nutrient Ratios

N:S	N:K	Fe:Mn
10.8 : 1	0.48 : 1	0.40 : 1

Agronomist's Comments: Several nutrients are deficient in the Rudbeckia sample. Nitrogen and phosphorus (P) are severely deficient. The symptom you describe of purpling is consistent with P deficiency. Sulfur (S), potassium (K) and copper (Cu) are also low or deficient. Calcium (Ca) and magnesium (Mg) are excessively high which may be suppressing uptake of other nutrients. The sample that you submitted to the soil testing lab appears to be potting media. Analysis of media by the soil method will not give you accurate information. Media samples should be submitted to the Soilless Media section. Information is available at http://www.ncagr.gov/agronomi/index.htm. Please contact me if you have any questions. Kristin A. Hicks 9/15/2015 4:15 PM

Translates each nutrient concentration into an Index Deficient, Low, Sufficient, High, or Excessive



How to tissue sample

- Collect most recently mature leaves (MRML)
- MRML should be full-sized and dark green; they are usually located 3-5 leaves back from the tip
- Sample from multiple pots
- Couple handfuls of leaves
- Place the sample in a paper bag or envelope

Submitting the sample

- Place the sample in a paper bag or envelope
- Do not combine varieties
- Collect tissue for each sample from a uniform area

Get the sample to the lab within 24-48 hours!!!!

Tips

- Fill out the form fully
- Use courier service, UPS or FedEx
- Refer to website for detailed information:

Plant:
http://www.ncagr.gov/agronomi/uyrplant.htm

Solutions:

http://www.ncagr.gov/agronomi/uyrsoln.htm

Media:

http://www.ncagr.gov/agronomi/uyrmedia.htm

- Be Consistent!!!