

# Plant Nutrients and Fertilizers



## Soil & Nutrient Management in Vegetable Gardens

### Module II

**Matt Jones**

Horticulture Extension Agent

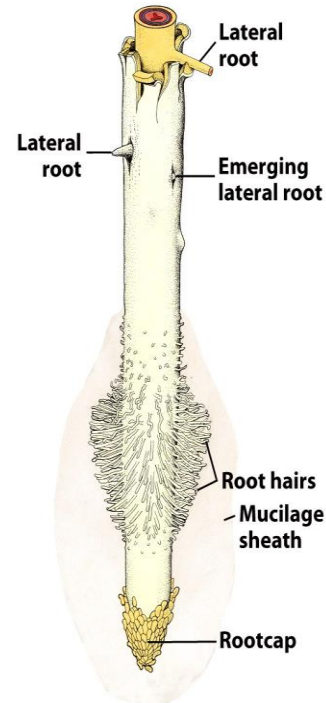
NC Cooperative Extension - Chatham County Center

- What is “plant food” ?
- Nutrients are chemicals necessary for an organism's biochemistry
- Nutrients help a plant *make* food



# How do Plants Absorb Nutrients?

- Roots absorb water and nutrients dissolved in water
- Cannot absorb solid pellets!
- What happens when the soil is dry?
- Roots must be healthy to absorb nutrients



Raven et al. *Biology of Plants* 7th ed. 2005



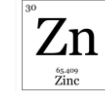
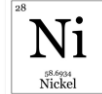
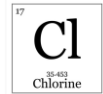
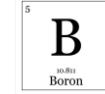
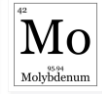
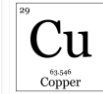
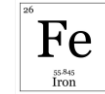
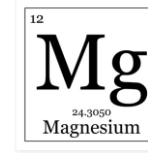
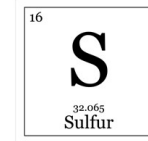
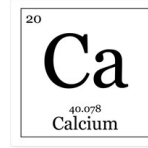
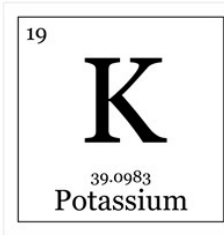
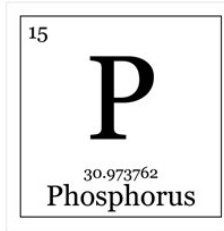
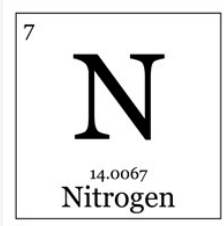
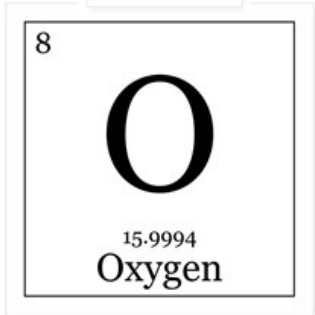
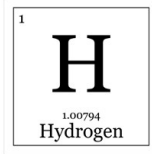
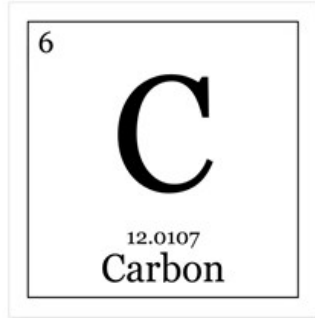
Univ. of Maryland



Utah State Univ.

# The Macro- and Micronutrients

Obtained from  
the atmosphere



Obtained from soil

# Nutrient Deficiencies

Some nutrient deficiencies (and toxicities) are symptomatic in leaves

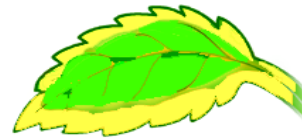
## Symptoms

- Chlorosis or necrosis
- Entire leaf, margin, or interveinal
- Older vs. younger leaves

Requires tissue analysis for confirmation

- NCDA (\$3)
- <http://www.ncagr.gov/agronomi/uyrplant.htm>

Univ. of Arizona



Marginal Chlorosis



Interveinal Chlorosis



**Immobile nutrient**  
Deficiency on younger leaves



**Mobile nutrient**  
Deficiency on older leaves



# Macronutrient Deficiency Symptoms



Readily leaches from soil  
if not used by plants



Rare (ag/urban)  
Too much, excess runs-off



Adsorbed by clay soils  
Can leach in organic soils



Readily leaches



Rarely a *soil* deficiency



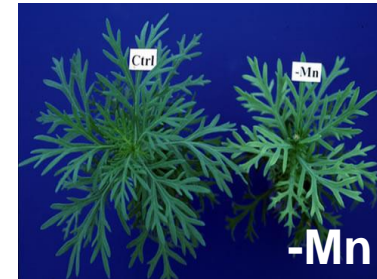
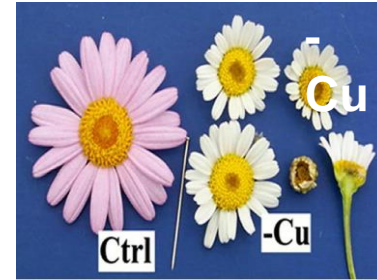
Rare

-S

Ctrl

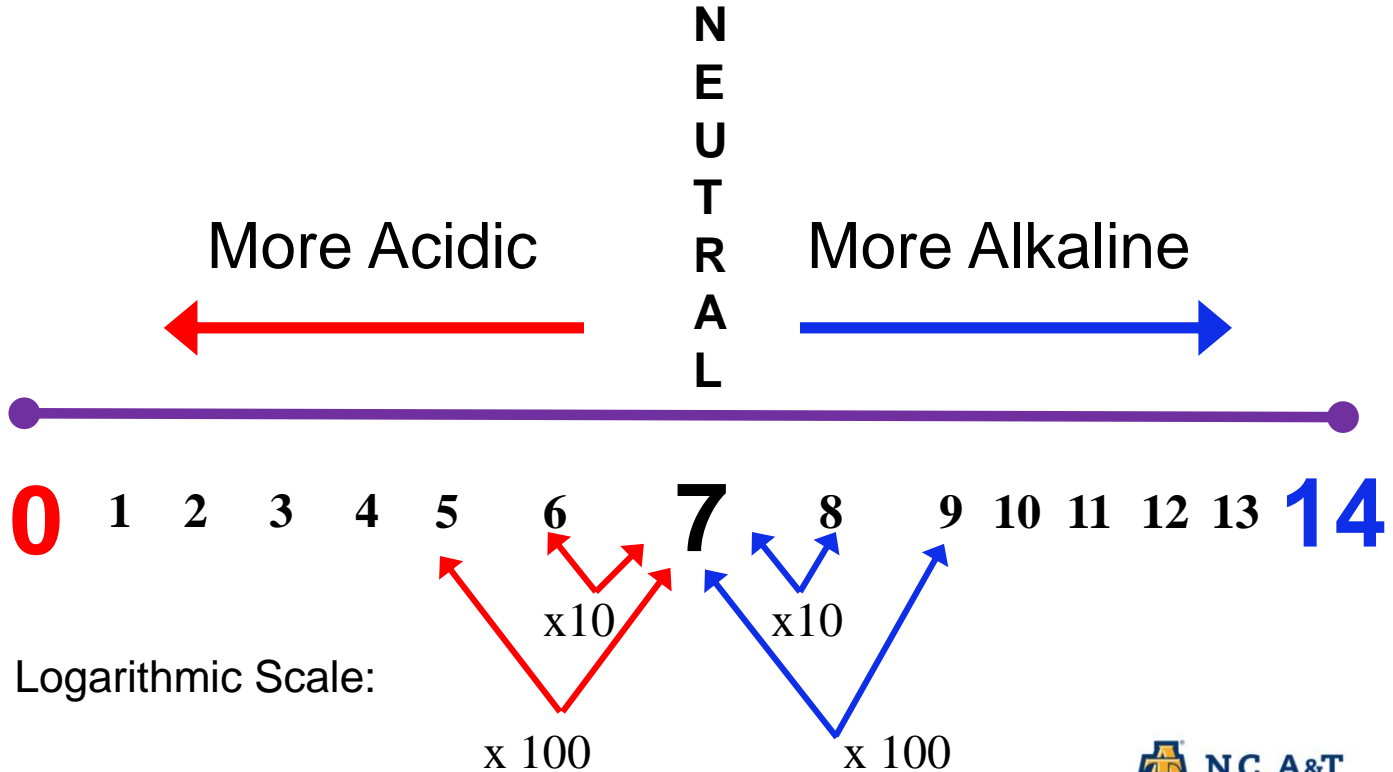
-S

# Micronutrient Deficiency Symptoms



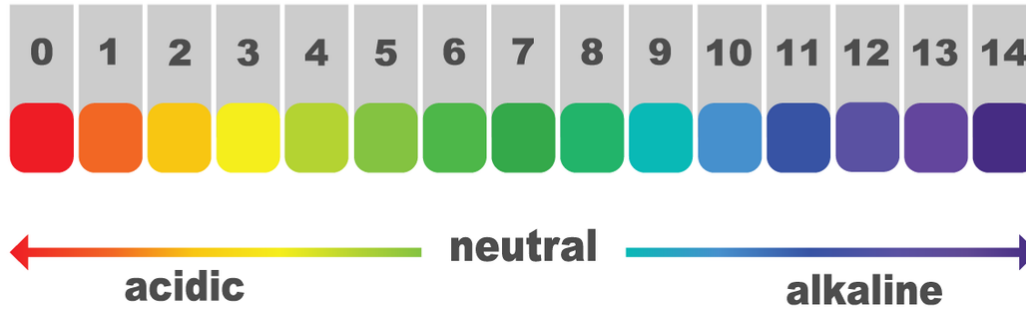
# pH Scale

Measure of Soil Reaction





# pH scale



## Examples of pH Conditions



**pH 2**  
gastric  
juices



**pH 4**  
tomato  
juice



**pH 5**  
human  
urine



**pH 7**  
pure  
water



**pH 7.4**  
human  
blood

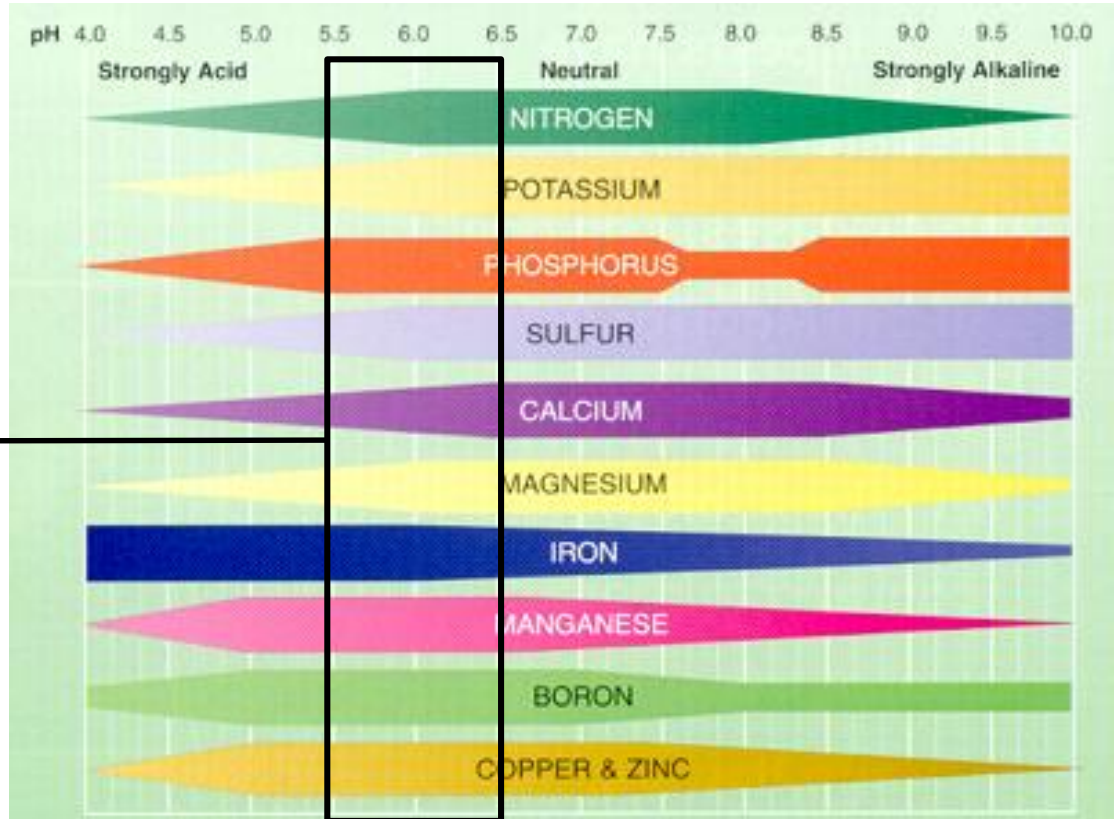


**pH 10**  
hand  
soap



**pH 12**  
household  
bleach

# How pH Affects Nutrient Availability



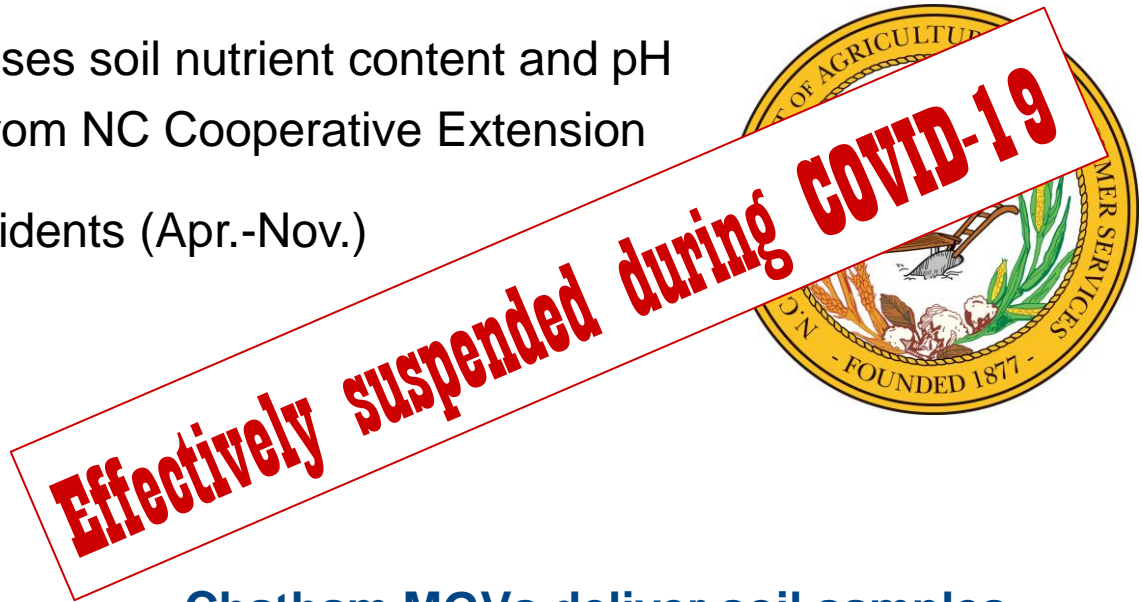
**Many plants  
favor pH 5.5-6.5**

**How do you determine the nutrient  
and pH status of your soil?**

# How to determine nutrient & pH status?

## Soil Testing from the NCDA!

- Only reliable method to assess soil nutrient content and pH
- Boxes & forms available from NC Cooperative Extension
- Analysis is *free* for NC residents (Apr.-Nov.)
  - \$4/sample: Dec-Mar



**NC STATE** EXTENSION

Master Gardener | Chatham County

**Chatham MGVs deliver soil samples  
monthly during the free period!**



# How to Sample Soil

- Use clean equipment
- Shovel or soil probe
- Plastic bucket for mixing subsamples



# How to Sample Soil

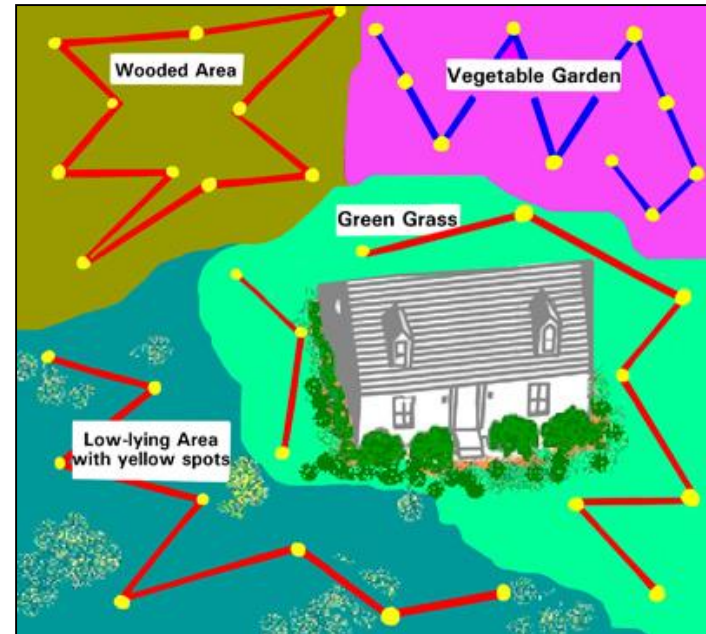
## Sample different areas separately

- Plants/Crops
- Topography
- Soil texture
- Plant health

## Avoid areas that will skew results

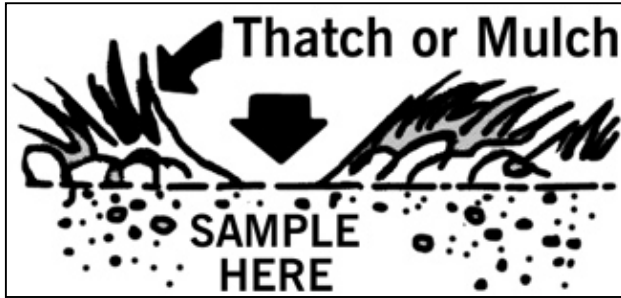
- Compost piles
- Burn piles
- Animal 'minefields'

## Take 10 subsamples per area



# How to Sample Soil

1



**Remove thatch, mulch, and debris**

2



## **Dig Hole**

- **Veg/Flower Gardens:** 6-8 in.
- **Trees/Shrubs:** 6 in.
- **Lawns:** 2-4 in.

# How to Sample

3



Virginia Tech

## Take a slice on the side

With your shovel or trowel remove a 1 inch thick slice from the smooth side of the open hole.

4



Virginia Tech

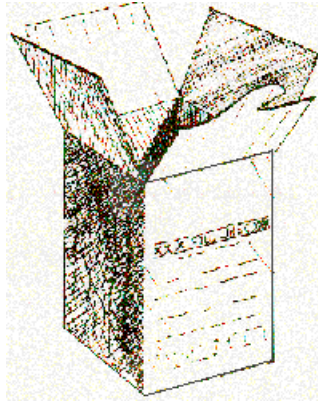
## Mix subsamples in a bucket

Remove any rocks, twigs, other debris



# How to Sample Soil

5



## Fill box with portion of composite sample

- Fill box to fill line
- Do not submit wet samples
- Do not tape box shut
- Do not store boxes in plastic bags

6

Form 16-1 (November 2015)

**SOIL SAMPLE INFORMATION — N.C. Soil Only**

NCDA&CS Agronomic Division Soil Testing Section  
 Mailing Address: 1950 Mail Service Center, Raleigh, NC 27619-1049  
 Physical Address (IF DIFFERENT): 4300 Sandy Creek Road, Raleigh, NC 27617  
 Phone: (919) 733-2633 Website: www.ncagr.gov/agronomi

**ROUTINE SAMPLES**  
 Earth Movement:  No  
 Construction Activity:  No

SAMPLE INFORMATION	PAYMENT	CLIENT INFORMATION (please print legibly)	CONSULTANT/OTHER RECIPIENT
TIME (to nearest hour)	CASH/ CHECK	CLIENT NAME	CLIENT NAME
SAMPLE DATE (to nearest hour)	DATE/TIME METHOD OF PAYMENT (circle amount over before)	ADDRESS (do not include phone numbers)	ADDRESS
NO. COUNTY (do not use abbrev.)	STATE	CITY	CITY
NUMBER OF SAMPLES	ZIP	STATE	STATE
	PHONE	PHONE	PHONE
	FAX/AL ADDRESS <input type="checkbox"/> NO. FIELDS IN SAMPLES NUMBER	E-MAIL ADDRESS <input type="checkbox"/> NO. FIELDS IN SAMPLES NUMBER	

*By submitting this form to the NCDA&CS Agronomic Division, I attest that the accompanying samples were collected in North Carolina.*

LAB NUMBER (same as label)	SAMPLE IDENTIFICATION	LAB DATE/TIME MONTH			THIS FIELD SAMPLES A GOOD OPPORTUNITY TO NUMBER A REPRESENTATIVE SOIL PROFILE WITH GPS			
		Year	Month	Year	POINT GROUP	ZONE	SECTION GROUP	ZONE
1								
2								

## Complete form & submit sample

- Name and contact information
- Sample ID and Crop Code
- Deliver to NCCE Chatham

# Where to Find Sample Results

<http://www.ncagr.gov/agronomi/pals/>

**PALS**  
Agronomic Services Division

Agronomic Home PALS Home Utilities Help Login

**PALS** is the Public Access Laboratory-information-management System that provides access to recent soil test, plant tissue, waste, solution, soilless media and nematode assay reports.

**Report Quick Search**

Search

You may enter last name(comma) first name, business name, or report number

[Show My Reports](#)

Estimated Processing Time for Samples Received on 2/28/2016

Lab	ProcessTime
Soil	1 to 2 Weeks
Nematode	4-5 weeks
Nematode(Problem)	3 to 5 days
Plant	2 days
Waste	7 to 10 days
Media	3 to 4 days
Solution	3 to 4 days

**We will help  
interpret the soil  
test report!**

**Once deficiencies are known,  
how do you make corrections?**

# Fertilizers vs. Amendments

## Fertilizers

Compounds containing nutrients added to the soil to improve plant health

### Fertilizers vary by:

- Source
- Release time
- Application method

## Amendments

Compounds that improve soil structure or physical condition

Natural fertilizers such as manure can be both a **fertilizer** and an **amendment**



Number on the bag represent % of:

**N**



Nitrogen

**P**



Phosphorus

**K**



Potassium

For a 100 pound bag of fertilizer:

**10 – 5 – 15**

= 10 lbs. N, + 5 lbs. P, + 15 lbs. K, + 70 lbs. filler

<u>Analysis</u>	<u>Ratio</u>
<b>10 - 10 - 10</b>	<b>1 : 1 : 1</b>
<b>5 - 10 - 5</b>	<b>1 : 2 : 1</b>

**Fertilizers with the same ratio are substitutable,  
but must change application rate.**

**For example:**

- 5 lbs. of 10-20-10 is equal to 10 lbs. of 5-10-5
- 10 lbs. of 5-10-10 is equal to 5 lbs. of 10-20-20

# Natural Fertilizers

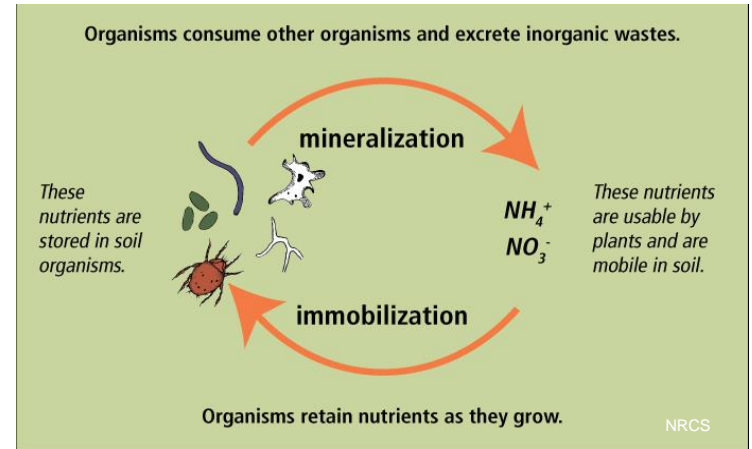
## Types of Fertilizers

### Derived from natural sources

- Composts and manures
- Mined minerals
- Animal byproducts

### Nutrient content

- Required on label if sold as fertilizer
- Depend on soil microbial activity for mineralization



# Common Natural Fertilizers

## Dried Blood Meal ~10-0-0

- Rapid release rate
- Excellent for side-dressing

## Feather Meal 11-0-0

- Slow release rate

## Fish Emulsion 10-6-2

- Trace micronutrients

## Poultry Manure 4-4-2

- **MUST BE COMPOSTED**
- Rapid release rate

## Bone Meal 3-15-0

- Medium release rate

## Wood Ash 0-2-6, 25% Ca

- Raises pH (50% lime equivalent)

Table 17-2. Organic fertilizers<sup>abc</sup>.

Items below are generally acceptable under the NOP for commercial organic farmers, unless otherwise noted.

Fertilizer	Primary Benefit	Average Analysis	Notes
Alfalfa meal	Organic matter	5-1-2	Contains triacontanol, a natural fatty acid growth stimulant, and trace minerals.
Algae	Organic matter	N/A	Includes photosynthetic organisms of the Kingdom Protista typically found in aquatic or shoreline environments. Algae do not have true roots, stems, or leaves. Organic Materials Review Institute (OMRI) approved.
Amino acid (nonsynthetic)	Chelating agent	N/A	A chelating agent improves plant uptake of a nutrient. Also used as a plant growth regulator.
Ash	Liming effect, source of calcium, micronutrients	25% calcium carbonate, 9% potash	Ash from plant or animal sources only. Ashes from burning minerals, manure, or other substances are prohibited.
Basalt dust	Micronutrients	N/A	Improves cation exchange capacity.
Blood meal (dried)	Nitrogen	10-0-0	Dried blood collected from slaughtered animals. One of the highest non-synthetic forms of nitrogen. Over-application can burn plants with too much ammonia.
Bone meal (steamed)	Phosphate	3-15-0; 20% total phosphate; 24% calcium	Ground animal bones that have been steamed under pressure, heated, or rendered sterile. Bone meal phosphorus is only plant-available in soils lower than pH 7. Widely available at feed stores.
Borax	Trace minerals	10% boron	Also known as sodium tetraborate.
Calclitic limestone	Calcium	65-80% calcium carbonate	Mined calcium carbonate.
Coffee grounds	Nitrogen	2-0.3-0.2	Acid-forming soil amendment. Needs limestone supplement.
Colloidal phosphate	Phosphate	0-2-2	
Compost (commercial or homemade)	Organic matter	Varies with components added	The product of a managed process through which microorganisms break down plant and animal materials into plant-available soil nutrients. Composted materials produced in vessels or static aerated piles must be maintained at a temperature between 131° F to 170° F for 3 days. Windrow systems must maintain at the above temperature for 15 days and turned at least 5 times. NCDA&CS waste analysis recommended if fertilizer content unknown.

See: [Table 17-2 of the Organic Gardening chapter of the NC Extension Gardener Handbook](#)

[Organic & Natural Fertilizers for the Home Ground & Garden \(Univ. of New Hampshire Extension\)](#)

### Derived from industrial sources

- Less expensive
- High energy input

### Nutrient content

- Precisely known, measured and labeled
- Many formulations

### Purified, mixed and blended

- Skips the microbial mineralization process
- Can be absorbed by plants immediately unless in slow release coating
- Quick release more prone to over-application and run-off



Sharon Luxton

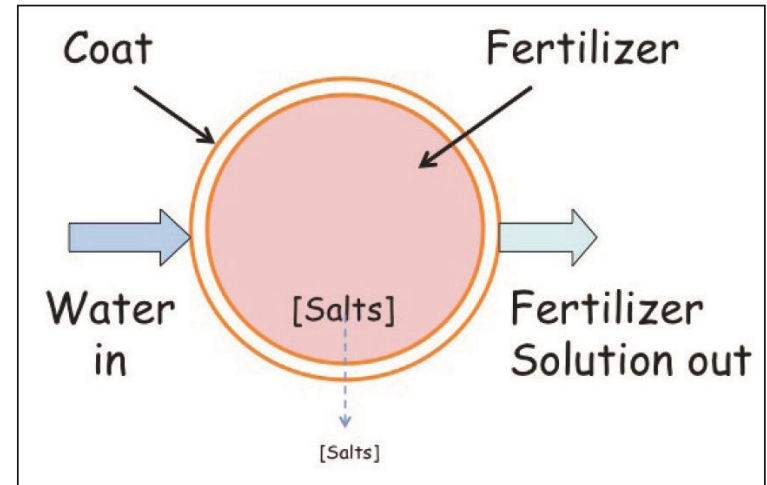
Professional Lawn Fertilizer	
24-2-12	
Guaranteed Analysis	
Total Nitrogen (N)	24%
1.5% Ammoniacal Nitrogen	
7.5% Urea Nitrogen	
10% Other Water Soluble Nitrogen*	
5% Water Insoluble Nitrogen**	
Available Phosphate (P <sub>2</sub> O <sub>5</sub> )	2%
Soluble Potash (K <sub>2</sub> O)	12%
Calcium (Ca)	1%
Magnesium (Mg) Total	0.5%
0.5% water soluble Magnesium (Mg)	
Sulfur (S)	4%
4% combined Sulfur (S)	
Boron (B)	0.02%
0.01% water soluble Boron (B)	
Copper (Cu)	0.05%
0.02% water soluble Copper (Cu)	
Iron (Fe)	1.0%
1.0% water soluble Iron (Fe)	
Manganese (Mn)	0.05%
0.01% water soluble Manganese (Mn)	
Molybdenum (Mo)	0.0009%
Zinc (Zn)	0.07%
0.04% water soluble Zinc (Zn)	

Derived from: Dicyandiamide Diurea, Urea-formaldehyde, Sulfur coated urea, Urea, Ammonium sulfate, Ammonium phosphate, Potassium sulfate, Sulfate of potash-magnesia, Murate of potash, Calcitic limestone, Calcium sodium borate, Copper oxy sulfate, Iron oxy sulfate, Iron sulfate, Manganese oxy sulfate, Ammonium molybdate, Zinc oxy sulfate.

\*Contains 1.25% Slowly Available Nitrogen from Urea-

# Slow & Controlled Release Fertilizers

- Released into soil over a longer period of time
- Used more efficiently by plants
- Natural fertilizer release rate depends on microbial activity
- More expensive





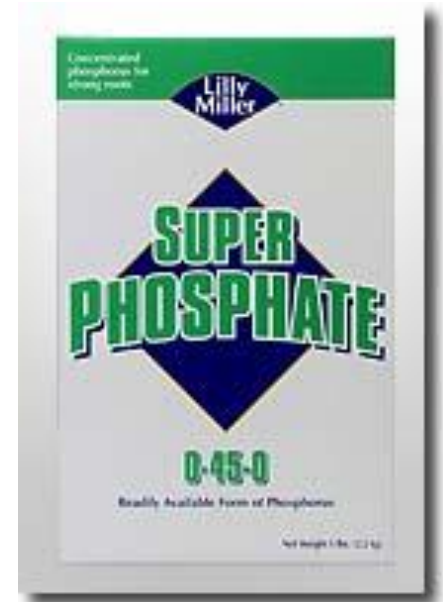
# Quick Release Fertilizers

- Available for immediate root uptake
  - Granulated
  - Liquid
- More like to leach from soil
  - Waste
  - Pollution
- More likely over apply and cause 'burning'
- Less expensive



# Common Synthetic Fertilizers

- Ammonium Sulfate 21-0-0
- Ammonium Nitrate 33-0-0
- Epsom Salts (Magnesium Sulfate)
- Muriate of Potash 0-0-60
- Nitrate of Soda 16-0-0
- Triple Superphosphate 0-46-0, Superphosphate 0-20-0
- Urea 45-0-0



# How Much Fertilizer to Apply?

## Follow test report recommendations!



Predictive Home & Garden

### Soil Report

Mehlich-3 Extraction

Client: Harnett County EMGV  
126 Alexander Dr  
Lillington, NC 27546

Advisor:

Sampled County : Harnett

Client ID: 493494

Advisor ID:

Sampled: 09/19/2019 Received: 10/11/2019 Completed: 10/21/2019 Farm:

Sample ID: VEGE1

Lime History:

Crop 1- Vegetable garden  
Crop 2-

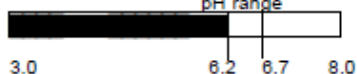
Lime Recommendations

40.0 lb per 1,000 sq ft  
0.0 lb per 1,000 sq ft

Test Results:

pH = 6.2

Optimum  
pH range



N-P-K Fertilizer Recommendations \*

10 lbs per 1,000 sq ft 10-10-10 Group A

Phosphorus Index (P-I) =39



Potassium Index (K-I) =27



Below Optimum Optimum Above Optimum

Additional Test Results:

Soil Class	HM%	W/V	CEC	Mn-I	Zn-I	Cu-I	S-I
Mineral	0.56	1.14 g/cm <sup>3</sup>	8.3 meq/100 cm <sup>3</sup>	185	137	92	34

*\*If you cannot find the fertilizer recommended here, choose one from the same Group (A, B, C or D) listed on the last page of this report.  
Note: This soil test does not measure nitrogen (N) levels. N fertilizer recommendations are based only on needs of the designated crop.*

# Applying Fertilizer

**Fertilize based on soil test recommendations**  
**Incorporate in top few inches before planting**

- **Row gardens:** 2/3 broadcast, remainder banded
- **Raised beds:** broadcast, scratch or rake in
- Make sure fertilizer is watered-in before planting



Banding Fertilizer

# Side Dressing

## Cabbage, peppers, potatoes, squash

Apply 1 Tbsp. high N fertilizer per plant halfway through growing season (NCSU) **OR**  
0.5-1 lb. N/1000 ft<sup>2</sup> one month after emergence or transplanting (NCDA)

## Okra

0.5-1 lb. N/1000 ft<sup>2</sup> when 2 ft. high (NCDA)

## Tomatoes

0.5-1 lb. N/1000 ft<sup>2</sup> 4 & 8 weeks after first bloom (NCDA)

## Potatoes, Sweet Corn

1.5 -2 lb. N/1000 ft<sup>2</sup> one month after emergence or transplanting (NCDA)



# Adding Lime to Raise Soil pH

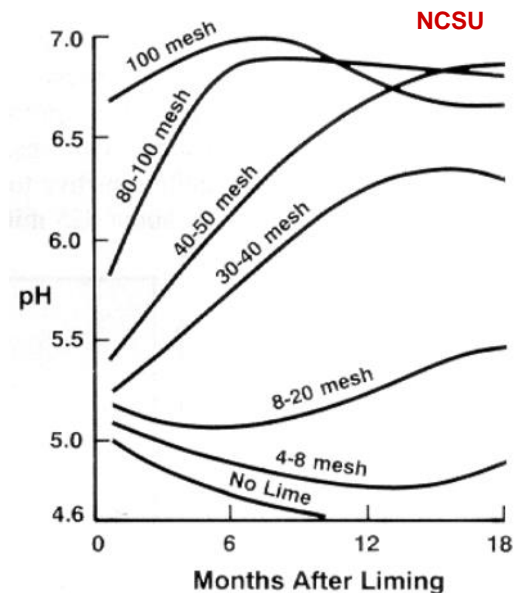
**Only add lime based on soil test results!**

## Lime Materials

- Calcitic lime ( $\text{CaCO}_3$ ,  $\text{Ca(OH)}_2$ ,  $\text{CaO}$ )
- Dolomitic Lime ( $\text{MgCO}_3$ )

## Finer grains, faster reaction

- Most agricultural lime is 8-20 mesh
- 4-6 months to react & raise pH



*Soil Acidity & Liming: Basic Information for Farmers and Gardeners*

<https://content.ces.ncsu.edu/soil-acidity-and-liming-basic-information-for-farmers-and-gardeners>



## For acid loving plants

- *Rhododendron* spp., blueberries

## Elemental Sulfur

- Biological reaction (slow)
- Potent

## Aluminum Sulfate

- Chemical reaction (fast)
- Less potent

## Acidifying Fertilizers

- Ammonium sulfate,  $(\text{NH}_4)_2 \text{SO}_4$  (21-0-0)
- Sulfur-Coated Urea

### Changing the pH of Your Soil

The soil pH value is a measure of soil acidity or alkalinity. Soil pH directly affects nutrient availability. The pH scale ranges from 0 to 14, with 7 as neutral. Numbers less than 7 indicate acidity while numbers greater than 7 indicate alkalinity.

The pH value of soil is one of a number of environmental conditions that affects the quality of plant growth. The soil pH value directly affects nutrient availability. Plants thrive best in different soil pH ranges. Azaleas, rhododendrons, blueberries and conifers thrive best in acid soils (pH 5.0 to 5.5). Vegetables, grasses and most ornamentals do best in slightly acidic soils (pH 5.8 to 6.5). Soil pH values above or below these ranges may result in less vigorous growth and nutrient deficiencies.

Nutrients for healthy plant growth are divided into three categories: primary, secondary and micronutrients. Nitrogen (N), phosphorus (P) and potassium (K) are primary nutrients which are needed in fairly large quantities compared to the other plant nutrients. Calcium (Ca), magnesium (Mg) and sulfur (S) are secondary nutrients which are required by the plant in lesser quantities but are no less essential for good plant growth than the primary nutrients. Zinc (Zn) and manganese (Mn) are micronutrients, which are required by the plant in very small amounts. Most secondary and micronutrient deficiencies are easily corrected by keeping the soil at the optimum pH value.

The major impact that extremes in pH have on plant growth is related to the availability of plant nutrients or the soil concentration of plant-toxic minerals. In highly acid soils, aluminum and manganese can become more available and more toxic to the plant. Also at low pH values, calcium, phosphorus and magnesium are less available to the plant. At pH values of 6.5 and above, phosphorus

and most of the micronutrients become less available.

**Factors Affecting Soil pH**  
The pH value of a soil is influenced by the kinds of parent materials from which the soil was formed. Soils developed from basic rocks generally have higher pH values than those formed from acid rocks.

Rainfall also affects soil pH. Water passing through the soil leaches basic nutrients such as calcium and magnesium from the soil. They are replaced by acidic elements such as aluminum and iron. For this reason, soils formed under high rainfall conditions are more acidic than those formed under arid (dry) conditions.

Application of fertilizers containing ammonium or urea speeds up the rate at which acidity develops. The decomposition of organic matter also adds to soil acidity.

#### Increasing the Soil pH

To make soils less acidic, the common practice is to apply a material that contains some form of lime. Ground agricultural limestone is most frequently used. The finer the limestone particles, the more rapidly it becomes effective. Different soils will require a different amount of lime to adjust the soil pH value. The texture of the soil, organic matter content and the plants to be grown are all factors to consider in adjusting the pH value. For example, soils low in clay require less lime than soils high in clay to make the same pH change.

**Selecting a Liming Material:** Homeowners can choose from four types of ground limestone products: pulverized, granular, pelletized and hydrated. Pulverized lime is finely ground. Granular and pelletized lime are less likely to clog when

# Adding Sulfur to Reduce pH

## Elemental Sulfur

**Pounds of Sulfur per 10 square feet to Lower the Soil pH to the Recommended Level**

Present pH	Desired pH				
	6.5	6.0	5.5	5.0	4.5
8.0	0.3	0.4	0.5	0.6	0.7
7.5	0.2	0.3	0.4	0.5	0.6
7.0	0.1	0.2	0.3	0.4	0.5
6.5		0.1	0.2	0.3	0.4
6.0			0.1	0.2	0.3

## Aluminum Sulfate

**Pounds of Aluminum Sulfate per 10 square feet to Lower the pH to the Recommended Level**

Present pH	Desired pH				
	6.5	6.0	5.5	5.0	4.5
8.0	1.8	2.4	3.3	4.2	4.8
7.5	1.2	2.1	2.7	3.6	4.2
7.0	0.6	1.2	2.1	3.0	3.6
6.5		0.6	1.5	2.4	2.7
6.0			0.6	1.5	2.1

# Interpreting the Soil Test Report



Predictive Home & Garden

## Soil Report

Mehlich-3 Extraction

**Client:** Harnett County EMGV  
126 Alexander Dr  
Lillington, NC 27546

**Advisor:**

Sampled County : Harnett

**Client ID:** 493494

**Advisor ID:**

Sampled: 09/19/2019 Received: 10/11/2019 Completed: 10/21/2019 Farm:

**Sample ID:** VEGE1

[Links to Helpful Information](#)

**Lime History:**

Crop 1- Vegetable garden  
Crop 2

### Lime Recommendations

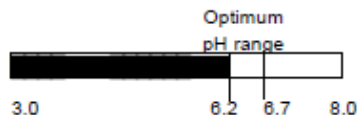
40.0 lb per 1,000 sq ft  
0.0 lb per 1,000 sq ft

### N-P-K Fertilizer Recommendations \*

10 lbs per 1,000 sq ft 10-10-10 Group A

### Test Results:

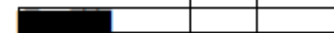
pH = 6.2



Phosphorus Index (P-I) =39



Potassium Index (K-I) =27



Below Optimum Optimum Above Optimum

Additional Test Results:

Soil Class	HM%	W/V	CEC	Mn-I	Zn-I	Cu-I	S-I
Mineral	0.56	1.14 g/cm <sup>3</sup>	8.3 meq/100 cm <sup>3</sup>	185	137	92	34

*\*If you cannot find the fertilizer recommended here, choose one from the same Group (A, B, C or D) listed on the last page of this report.  
Note: This soil test does not measure nitrogen (N) levels. N fertilizer recommendations are based only on needs of the designated crop.*

**Sample ID** – What you named your sample

**Crop 1** – What you plan to grow

# Lime Recommendation



Predictive Home & Garden

## Soil Report

Mehlich-3 Extraction

Client: Harnett County EMGV  
126 Alexander Dr  
Lillington, NC 27548

Advisor:

Sampled County : Harnett

[Links to Helpful Information](#)

Client ID: 493494

Advisor ID:

Sampled: 09/19/2019 Received: 10/11/2019 Completed: 10/21/2019 Farm:

Sample ID: VEGE1

Lime History:

Crop 1- Vegetable garden  
Crop 2-

**Lime Recommendations**

40.0 lb per 1,000 sq ft  
0.0 lb per 1,000 sq ft

**N-P-K Fertilizer Recommendations \***

10 lbs per 1,000 sq ft 10-10-10 Group A

**Test Results:**

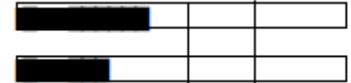
pH = 6.2

3.0 6.2 6.7 8.0

Optimum  
pH range

Phosphorus Index (P-I) =39

Potassium Index (K-I) =27



Below Optimum Optimum Above Optimum

Additional Test Results:

Soil Class	HM%	W/V	CEC	Mn-I	Zn-I	Cu-I	S-I
Mineral	0.56	1.14 g/cm <sup>3</sup>	8.3 meq/100 cm <sup>3</sup>	185	137	92	34

*\*If you cannot find the fertilizer recommended here, choose one from the same Group (A, B, C or D) listed on the last page of this report.*

*Note: This soil test does not measure nitrogen (N) levels. N fertilizer recommendations are based only on needs of the designated crop.*

**pH level** – gives number and shows where your pH is in comparison to target range

**Lime recommendation** – for dolomitic or agricultural/garden lime, pounds per 1000 ft.<sup>2</sup>

# Fertilizer Recommendation



Predictive Home & Garden

## Soil Report

Mehlich-3 Extraction

[Links to Helpful Information](#)

Sampled: 09/19/2019 Received: 10/11/2019 Completed: 10/21/2019 Farm:

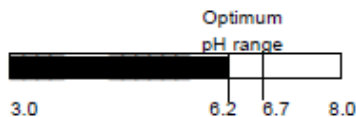
Sample ID: VEGE1

Lime History:

Test Results:

Crop 1- Vegetable garden  
Crop 2-

pH = 6.2



Lime Recommendations

40.0 lb per 1,000 sq ft  
0.0 lb per 1,000 sq ft

Additional Test Results:

Soil Class	HM%	W/V	CEC	Mn-I	Zn-I	Cu-I	S-I
Mineral	0.56	1.14 g/cm <sup>3</sup>	8.3 meq/100 cm <sup>3</sup>	185	137	92	34

Client: Harnett County EMGV  
126 Alexander Dr  
Lillington, NC 27548

Advisor:

Sampled County : Harnett

Client ID: 493494

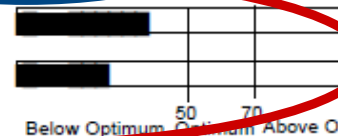
Advisor ID:

N-P-K Fertilizer Recommendations \*

10 lbs per 1,000 sq ft 10-10-10 Group A

Phosphorus Index (P-I) =39

Potassium Index (K-I) =27



*\*If you cannot find the fertilizer recommended here, choose one from the same Group (A, B, C or D) listed on the last page of this report.*

*Note: This soil test does not measure nitrogen (N) levels. N fertilizer recommendations are based only on needs of the designated crop.*

**Phosphorous and Potassium Index** – between 50 and 70 is ideal, lower than 50 will recommend fertilizer

**Fertilizer Recommendation** – in pounds per 1000 ft.<sup>2</sup>

# How Much Fertilizer to Apply?

- For fertilizers containing more than one nutrient, nitrogen usually used to calculate application rate
- Most recommendations are for 1 lb. of actual N per 1000 ft.<sup>2</sup>
- This is the amount of 'actual nitrogen' applied

**How many pounds of 10-5-10 fertilizer is needed to get 1 lb. of actual nitrogen per 1000 ft<sup>2</sup>?**

**Actual N / Nutrient % = Amount Needed**

$$1 / 10\% = 10$$

$$1 / 0.1 = 10$$



# Example Fertilizer Calculation

Sample ID: VRB15

Lime History:

Crop 1- Vegetable garden  
Crop 2-

Lime Recommendations

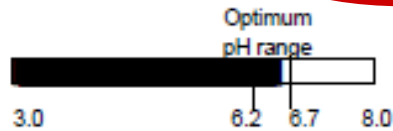
0.0 lb per 1,000 sq ft  
0.0 lb per 1,000 sq ft

N-P-K Fertilizer Recommendations \*

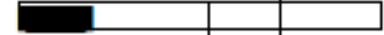
20 lbs per 1,000 sq ft 5-10-5 Group B

Test Results:

pH = 6.6



Phosphorus Index (P-I) = 18



Potassium Index (K-I) = 62



Below Optimum    Optimum    Above Optimum

Additional Test Results:

Soil Class	HM%	W/V	CEC	Mn-I	Zn-I	Cu-I	S-I
Mineral	0.09	0.79 g/cm <sup>3</sup>	6.6 meq/100 cm <sup>3</sup>	152	38	32	155

*\*If you cannot find the fertilizer recommended here, choose one from the same Group (A, B, C or D) listed on the last page of this report.  
Note: This soil test does not measure nitrogen (N) levels. N fertilizer recommendations are based only on needs of the designated crop.*

**pH = 6.6**  
**No need to apply lime!**

# Example Fertilizer Calculation

Sample ID: VRB15

Lime History:

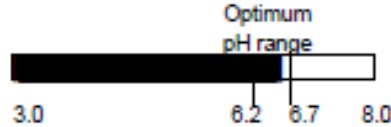
Crop 1- Vegetable garden  
Crop 2-

Lime Recommendations

0.0 lb per 1,000 sq ft  
0.0 lb per 1,000 sq ft

Test Results:

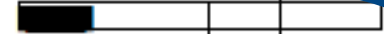
pH = 6.6



N-P-K Fertilizer Recommendations \*

20 lbs per 1,000 sq ft 5-10-5 Group B

Phosphorus Index (P-I) = 18



Potassium Index (K-I) = 62



Below Optimum Optimum Above Optimum

Additional Test Results:

Soil Class	HM%	W/V	CEC	Mn-I	Zn-I	Cu-I	S-I
Mineral	0.09	0.79 g/cm <sup>3</sup>	6.6 meq/100 cm <sup>3</sup>	152	38	32	155

\*If you cannot find the fertilizer recommended here, choose one from the same Group (A, B, C or D) listed on the last page of this report.  
Note: This soil test does not measure nitrogen (N) levels. N fertilizer recommendations are based only on needs of the designated crop.

**P is low**

**K is adequate**

**Recommendation: 20 lbs. 5-10-5 per 1000 ft<sup>2</sup>**

# Example Fertilizer Calculation

**Recommendation: 20 lbs. 5-10-5 per 1000 ft<sup>2</sup>**

Calculate equivalent for your area

$$4 \text{ ft.} \times 12 \text{ ft.} = 48 \text{ ft.}^2$$

$$\frac{20 \text{ lbs.}}{1000 \text{ ft}^2} = \frac{x \text{ lbs.}}{48 \text{ ft}^2}$$

$x = 0.96$  lbs. of 5-10-5 fertilizer for your 48 ft.<sup>2</sup> bed

# How Much Fertilizer to Apply?

## Fertilizer Calculators

- Purdue: <https://turf.purdue.edu/fertilizer-calculator/>
- UGA: <http://aesl.ces.uga.edu/soil/fertcalc/>
- TAMU: <http://soiltesting.tamu.edu/webpages/calculator.html>

# Need help interpreting soil report?

**Matt Jones**

matt\_jones@ncsu.edu

919-542-8243

**Questions from this class?**

**Need help interpreting soil report?**

**Matt Jones**

matt\_jones@ncsu.edu

919-542-8243



# Other gardening questions?

**NC STATE**

**EXTENSION**

Master Gardener | Chatham County

Plant Clinic: MW 1:00-4:00, F 9:00-12:00

**[chathamemgv@gmail.com](mailto:chathamemgv@gmail.com)**

919-545-2715 (Except during COVID-19)

**NC STATE**

**EXTENSION**

## **Vegetable Gardening Resources**

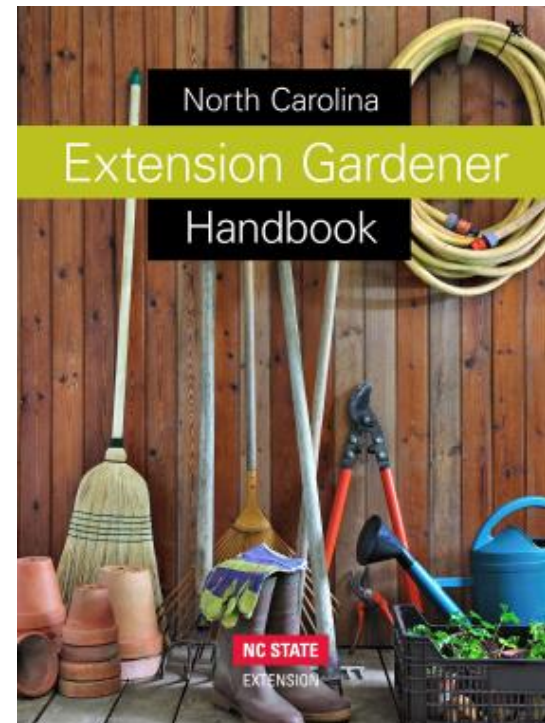
- **For this class:** <https://go.ncsu.edu/chathamveggies>
- **Gardening Portal:** <https://gardening.ces.ncsu.edu/>
- **Extension Gardener Portal:**  
<https://extensiongardener.ces.ncsu.edu/>

## Subscribe to the Chatham Gardener Newsletter

- Sustainable gardening information
- Monthly articles written by Master Gardener<sup>SM</sup> Volunteers
- Upcoming classes and events
- **To subscribe:** <http://go.ncsu.edu/subscribecg>

# Extension Gardener Handbook

- Available online for FREE  
<https://content.ces.ncsu.edu/extension-gardener-handbook>
- Full-color, hardback copy available from UNC Press (\$60)



# Please Complete the Evaluation!

<https://go.ncsu.edu/veggie-evaluation1>