

Fall Vegetable Gardening in Containers

Matt Jones

Horticulture Extension Agent
NCCE Chatham County Center

Extension Master Gardener Volunteers
of Chatham County

NC STATE EXTENSION

Master Gardener | Chatham County



Workshop Overview

Lecture – Matt Jones

- Container selection
- Properties and selection of media
- Nutrient and Water Management
- Planting Calendars

Hands-on Demonstration – Master Gardener VolunteersSM

Workshop Resources

On Tuesday, go.ncsu.edu/chathamfallveggies will be updated to include:

- PowerPoint Slides
- Links to PDFs of Handouts
- Links to other Extension Resources
- Information on Extension Gardener and Master Gardener Volunteer Training Classes in 2019!

Why garden in containers?



Grow Food in Small Spaces



Flexibility & Accessibility



Avoid Soil Problems

Other Considerations

- More frequent watering
- More frequent fertilization
- Don't use native soil



Choosing Containers



RHS

Containers can be made of many different materials

Containers must be able to:

- 1) Hold soil media
- 2) Drain water



Mrs. Northfarm

Add drainage holes if needed

Container Materials



Porous

- Clay
- Terracotta
- Unglazed ceramic



Semi-porous

- Wood
- Pressed fiber



Non-porous

- Plastic
- Metal
- Fiberglass
- Glazed ceramic

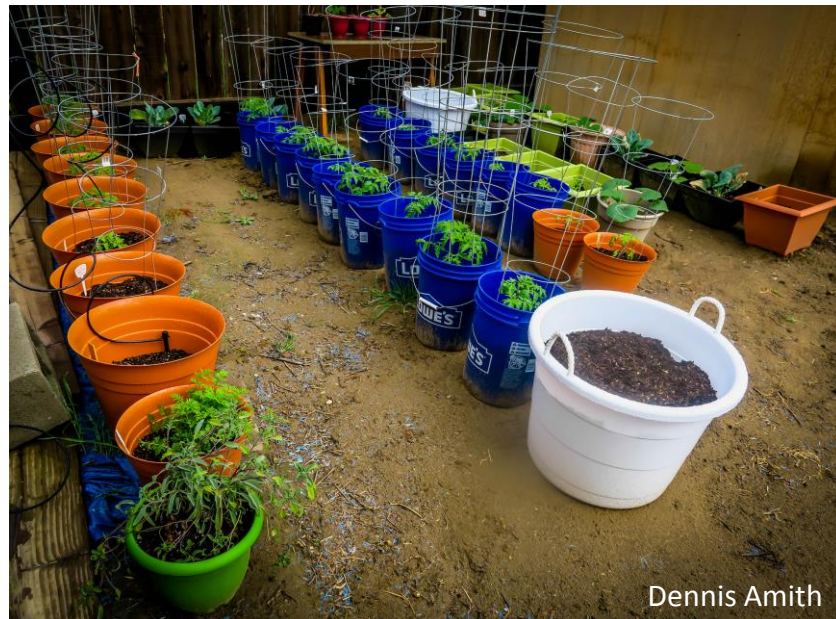
Container Materials

Heat Absorption

- Dark colors absorb more heat
- Metals better conduct heat

Weight

- Top-heaviness of crops
- Wind
- Need to move?



Dennis Amith

Container Size

- Need space for roots
- **Shallow rooted veg. crops:**
Min. 4-8 in. depth
- **Root or fruit crops:**
Min. 10-12 in. depth
- Larger = better moisture retention
- Penn State Extension Study
 - 14”- 20” diameter

Vegetable	Minimum Size Container	Spacing	Minimum Container Depth
Beans	2 gallon	2-3 inches	8-10 inches
Beets	2 quart	2-3 inches	8 inches
Bok choy	1 gallon	6 inches	20 inches
Carrots	2 quart	2-3 inches	10 inches
Collards	3 gallon	12 inches	12 inches
Cucumbers	1 gallon	1 plant per container or 12-16 inches	8 inches
Eggplant	5 gallon	1 plant per container	12-16 inches
Green garlic	2 quart	4 inches	4-6 inches
Kale	3 gallon	6 inches	8 inches
Lettuce	2 quart	4-5 inches	6-8 inches
Mustard greens	3 gallon	6 inches	4-6 inches
Peas	2 gallon	2-3 inches	12 inches
Peppers	2 gallon	1 plant per container or 14-18 inches	12-16 inches
Potatoes	30 gallon	5-6 inches	
Radishes	2 quart	2-3 inches	4-6 inches
Scallions	2 quart	2-3 inches	6 inches
Spinach	1 gallon	2-3 inches	4-6 inches
Squash	2 gallon	1 plant per container	12-24 inches
Swiss chard	2 quart	4-5 inches	8 inches
Tomatoes	5 gallon	1 plant per container	12-24 inches

Table 18.1 *NC Extension Gardener Handbook*
<https://content.ces.ncsu.edu/extension-gardener-handbook>

Potting Media (“Soil”)

- Don't use soil from the garden
- Poor drainage kills roots
 - Lack of O₂
 - Pathogens
- Instead, use soilless substrates
a.k.a. potting mixes



Healthy



Nope!

Qualities of Good Container Media

Large particles

- Drainage of water
- Aeration for roots

Small particles & organic matter

- Water holding capacity
- Nutrient-holding capacity

Other Features

- Light weight
- Free of pests, pathogens, & weeds
- Contain or add nutrients

Common Container Media Components

- Forestry “waste” product
- Large particles great for drainage and aeration
- Moderate water retention
- Sustainably produced
- In mixes or purchased in bulk
- Generally favored for woody crops?



Aged Pine Bark

Common Container Media Components

- Excellent water and nutrient holding capacities
- Common ingredient in mixes
- Differ in extent of decomposition
- Not sustainably produced?
- Active research on more sustainable alternatives



Peat Moss

Common Container Media Components

- “Waste” product of coconut production
- Good alternative to peat moss
 - But lots of processing, shipping
- Excellent drainage, good N holding capacity
 - Less so other nutrients
- More expensive



Coconut Coir

Common Container Media Components

- Decomposed plant materials
- Good water and nutrient-holding capacities
- Quality depends on source material
- UMD studies suggest annuals & veggies in 50% compost perform well, but most recommend lower %

<https://composting.ces.ncsu.edu/>



Compost

Common Container Media Components

- Heated igneous rock
- Improves drainage & aeration
- Chemically inert
- Does not hold water or nutrients



Perlite

Common Container Media Components

- Heated mica
- Improves water and nutrient retention
- Fine-grade used for propagation and seed starting mixes



Vermiculite

Common Container Media Components

- 'Waste' hulls from rice
- Unprocessed, excellent replacement for perlite
- Composting PBH improves water-holding capacity
- Lightweight



Parboiled Rice Hulls

Common Container Media Components

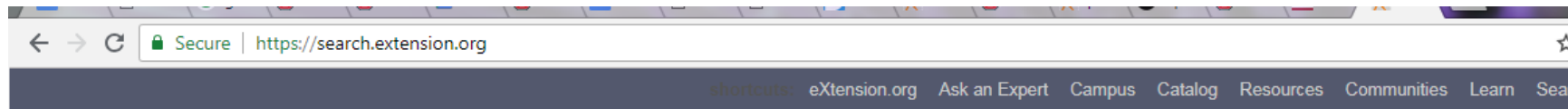
- Improves drainage
- Little nutrient or water holding capacity
- Heavy – can use as ballast
- Typically $\leq 10\%$ of media



Coarse Sand

Media Recipes

- 60% Peat or Coir 20% Perlite 20%, Vermiculite
- 60% Pine Bark, 20% Peat, 20% Sand
- 50% Compost, 50% soilless mix (peat, perlite, vermiculite)
- 60% Pine Bark, 40% PBR
- 50% Peat or Coir. 25% Pine Bark, 25% vermiculite
- 40% Pine Bark, 20% perlite, 40% vermiculite
- Etc.



One Search
Hundreds of Cooperative Extension Sites
Easy search access to resources provided by your Land-Grant institutions

<https://search.extension.org/>

Commercial Container Media

- Many variants available
- Combination of peat moss, perlite, vermiculite
- Easy to find and purchase
- Look for 'Mix' or 'Media
- Avoid “topsoil”, “potting soil” “garden soil” etc.
- May contain fertilizers – not enough!



Tips for Adding Media to Pots

- 1) Moisten before potting, especially peat moss
- 2) Maintain the substrate line with transplants
- 3) Leave a reservoir for watering 1-3 inches
- 4) Do not pack media



Leave a reservoir for water

Adding Gravel to the Bottom of Pots?

- Does not improve drainage
- Creates a perched water table
- Fill entire container with uniform media



The wettest soil is at the bottom.



Gravel moves the wettest soil up in the pot, closer to the roots, which can lead to rot.

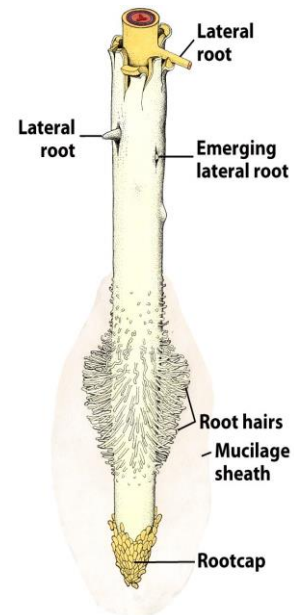
Plant Nutrients

- What is the difference between a food and a nutrient?
- What is “plant food” ?
- Nutrients are chemicals necessary for an organism's biochemistry
- Nutrients help a plant make food

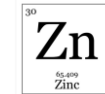
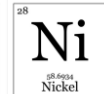
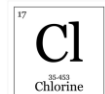
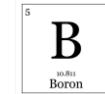
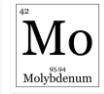
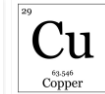
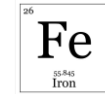
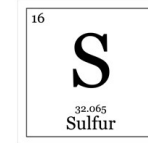
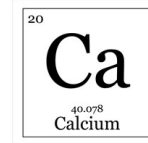
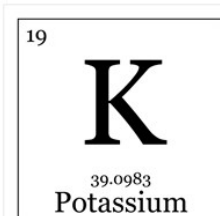
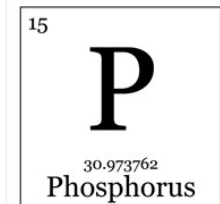
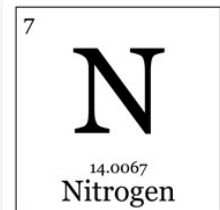
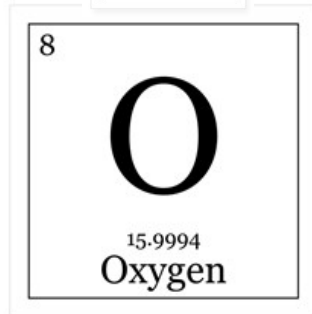
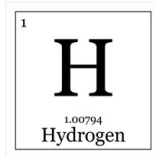
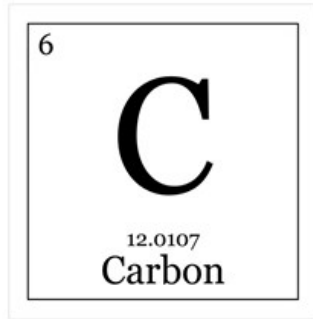


How do Plants Absorb Nutrients?

- 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



The Macro- and Micronutrients



Obtained mostly from soil

Nutrient Deficiencies

Some nutrient deficiencies (and toxicities) are symptomatic in leaves

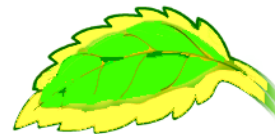
Generally distributed evenly throughout the plant

- Not on one stem
- Not in circular spots

Consider

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

Univ. of Arizona



Marginal Chlorosis



Interveinal Chlorosis

Mobile nutrient:

Deficiency on older leaves



Immobile nutrient:

Deficiency on younger leaves

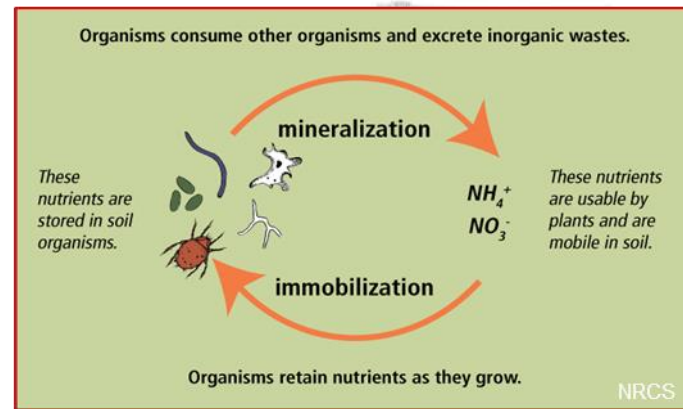
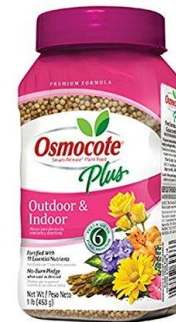
Fertilizers

Synthetic Fertilizers

- Derived from industrial processes
- Quick, Slow, & Controlled release

Natural Fertilizers

- Derived from natural sources
- All slow release



At a chemical level, plants cannot tell the difference

Fertilizer Nutrient Analysis

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

Fertilizers

Liquid (quick release)

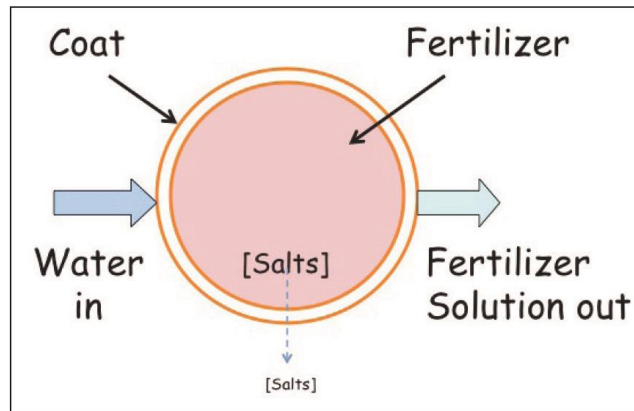
- Concentrated, immediate uptake
- Easily leach

Slow Release

- Less prone to leaching
- May be inadequate for fast-growing crops
- Affected by moisture, microbes, temperature, particle size

Controlled Release

- Coated in materials for steady release
- Release increases with temperature



Fertilizers for Container Veggies

Synthetic

Incorporate controlled release at labeled rate at planting

- Again in 8-10 weeks, or liquid half strength
- Penn State study for fruiting veggies:
 - Liquid 1-1.5-3 (N-P-K ratio) + micronutrients weekly

Organic

Incorporate at planting at labeled rate. Supplement:

- Transplants: 3 weeks after planting
- Seeds: after plants have first true leaves
- Penn State: fish emulsion, green sand, kelp meal, bone meal

What Factors Affect Watering Frequency?

- Light
- Temperature
- Humidity
- Container Size
- Media Composition

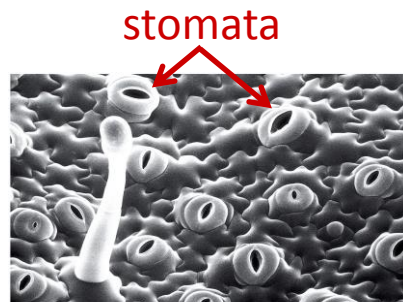
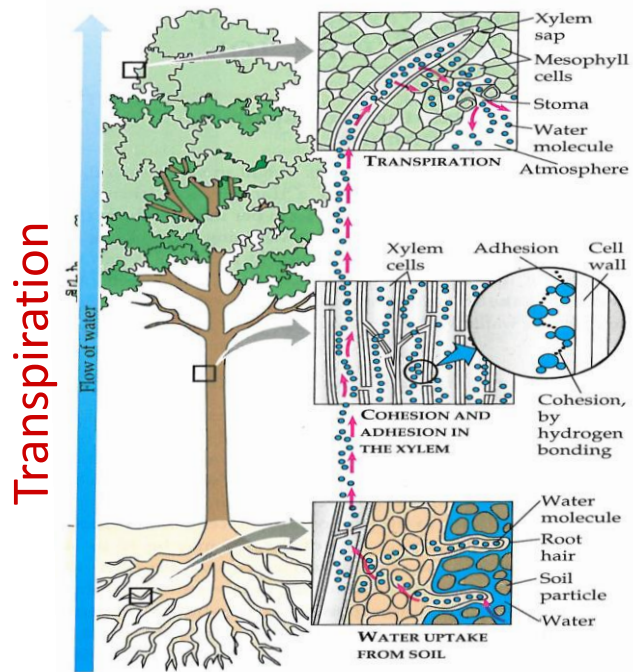


Figure 7-11
From Biology of Plants, Eighth Edition
© 2001 by Sinauer Associates, Inc.



ERIKA SAALAU
IOWA STATE UNIVERSITY
PLANT & INSECT DIAGNOSTIC CLINIC

When do you water?

- When you need to!
- When top few inches of media are dry
- Water until water comes out of container
- Use mulch
 - 1 in deep, 1 in. away from plants
 - Reduce weeds



Container Watering Methods

Watering Can

- Cheap & Easy
- Heavy to carry
- Wets foliage

Garden Hose

- Cheap & Easy
- Lightweight-ish
- Wets Foliage

Drip Irrigation

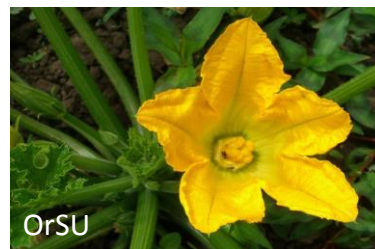
- Convenient
- Lower volume reduces runoff
- Does not wet foliage
- More expensive
- Maintenance



Light Requirements

Hours of Direct Sun Per Day

8-10



Fruits

6-8



**Leaves
Stems
Roots**

Planting Seasons

Cool season:

- Plant **July-Sept** for fall crop
- **Feb-April** for spring crop

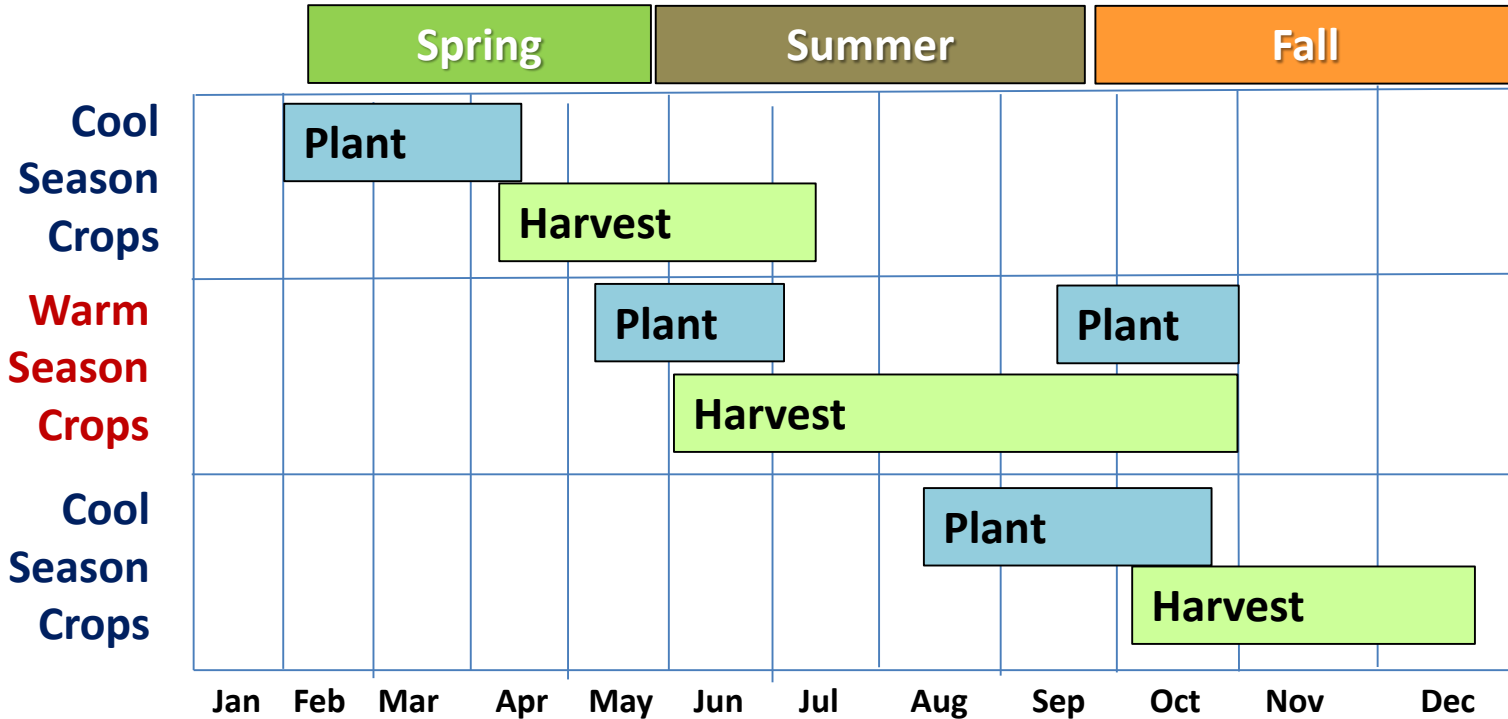
Warm season:

- Plant after average last spring frost date, **April 15**
- See “Central NC Planting Calendar” for specific dates



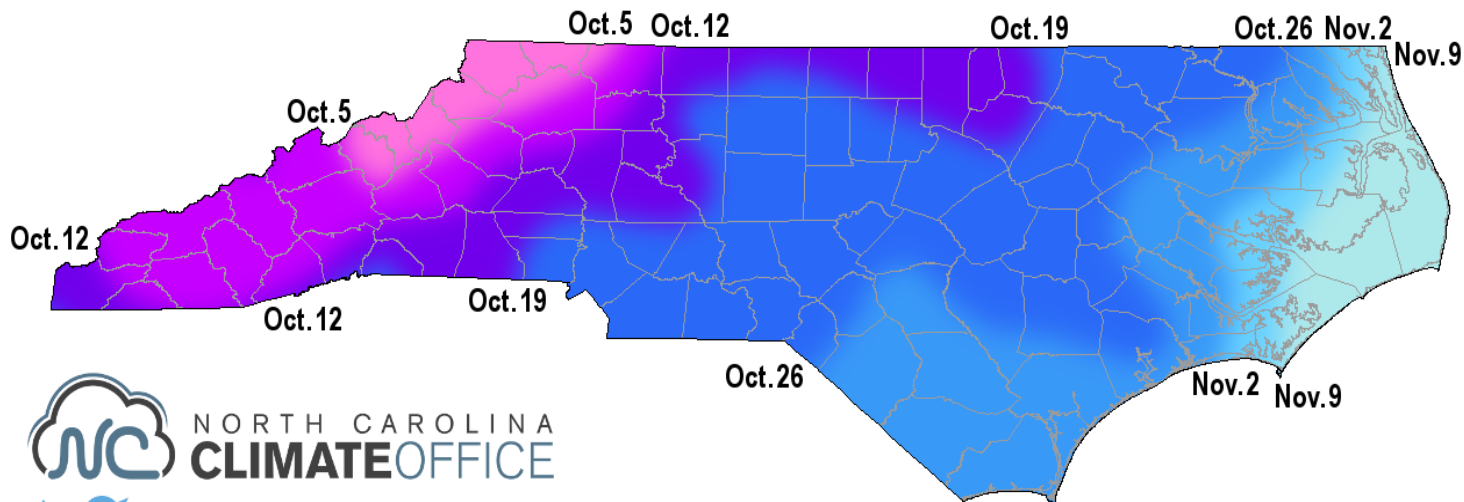
Not the same as the produce aisle!

Planting Seasons



Average First Frost Dates (1981-2010)

First day with minimum temperatures $\leq 36^{\circ}\text{F}$



Cool Season Crops



Cold-hardy and planted in early spring or early fall, temperatures < 70° F

NC State Extension Planting Calendars

Container Garden Planting Calendar for Vegetables in the N.C. Piedmont

Vegetables	Days to Harvest	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
		1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15
Beans, lima - bush	65-80									S	S	S													
Beans, lima - pole	75-95									S	S	S													
Beans, snap - bush	50-55								S	S	S	S	S	S											
Beans, snap - pole	65-70								S	S	S	S	S												
Beets	55-60			S	S											S	S								
Bok choy	45-60					T												T	T						
Carrots	75-80		S	S											S	S									
Collards	90-120														ST	ST									
Cucumber	60-65								ST	ST						ST									
Eggplant	80-85									T	T	T													
Endive	80-90		S	S	S												S	S							
Green garlic	30-35						B	B	B	B															
Kale	50-60			ST	ST	ST											S	S							
Leeks	70-100								T	T									T	T					
Lettuce, head	75-85			ST	ST	ST											ST								
Lettuce, leaf	45-50			ST	ST	ST	ST										ST	ST							
Mustard greens	30-45			ST	ST	ST	ST									S	S	S							
Peas, garden	65-70		S	S																					
Peas, snap	65-70		S	S																					
Peas, snow	65-70		S	S																					
Peppers	75-80									T	T														
Potatoes	100-120					T	T	T	T	T															
Radish	20-25		S	S	S	S	S									S	S	S							
Scallions	60-80		B	B	B														B	B	B				
Spinach	45-50		S	S	S												S	S							
Squash, summer	50-60								T	T															
Squash, winter	85-95									S	S					S									
Swiss chard	60-70					ST	ST	ST																	
Tomatoes	75-85								T	T	T	T	T												

B = Bulbs S = Seeds T = Transplants

Container Garden Planting Calendar for Edibles in the Piedmont

<https://content.ces.ncsu.edu/container-garden-planting-calendar-for-edibles-in-the-piedmont>

*Plants Grown in Containers – Chapter 18 of the **NC State Extension Gardener Handbook***

<https://content.ces.ncsu.edu/extension-gardener-handbook/18-plants-grown-in-containers#planting>

A Few Easy Fall Vegetables for Containers

Lettuce

Lactuca sativa (Asteraceae)

- Native to Eurasia
- Sunflower family
- Consume basal rosette leaves
- Leaves become bitter in warm weather
- Warm weather causes ‘bolting’



Pl. 109. Lactue virgine. *Lactuca virosa* L.



Types of Lettuce



Loose Leaf Varieties

- Numerous
 - ‘Simpson Elite’
 - ‘Red Sails’
 - ‘Prizeleaf’
 - ‘Oak Leaf’



Romaine a.k.a. Cos

- Upright, tighter heads
- Leaf bases more flavorful



Butterhead a.k.a. Bibb

- Attractive yellow-green leaves
- Good flavor
- ‘Tom Thumb’ miniature and grows quickly

Planting Lettuce

- Feb-Mar., Aug.-September; survives to 30 F
- Plant densely 2-3" apart in containers
 - Romaine and buttercrisp – 8" spacing
- Seed: ¼ in. deep
- Use fresh seed – does not store well
- Even watering critical

Loose Leaf Varieties

Cut with scissors (1" above soil) in about 30 days

- Should be about 5-6 in. tall
- 2-3 successive cuttings possible
- Plant every 2-3 weeks for continuous supply until frost



Common Problems of Lettuce

- No tolerance for hot weather
- Poor competitor against weeds
- Tip burn
 - Physiological disorder
 - Ca deficiency from rapid growth and water stress
- **Insects:**
 - Cabbage looper and other caterpillars (B.t., hand pick)
 - Aphids (Insecticidal soap)
- **Diseases:**
 - Stem and root rots, leaf gray molds

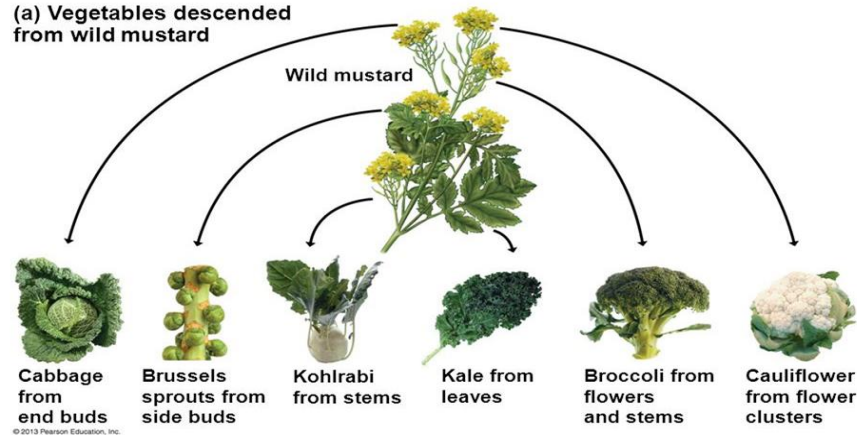


Kale

Brassica oleracea (Brassicaceae)

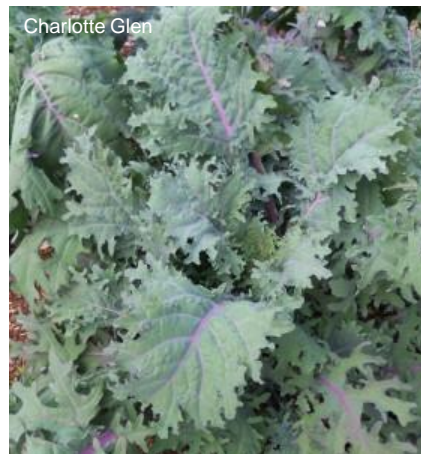
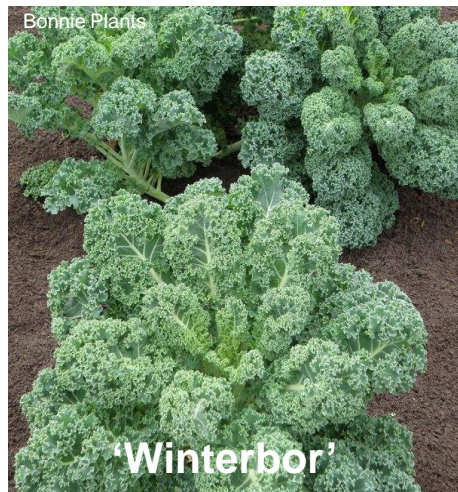
- Native to Eurasia
- Doesn't form heads like cabbage, no edible buds like broccoli
- Consume leaves
 - Cooked
 - Fresh
- Rich in vitamins, higher protein content than other crucifers

(a) Vegetables descended from wild mustard



Types of Kale

More flavorful but less cold-hardy varieties



Classic cold-hardy varieties



- Frost improves flavor in most varieties
- Leaves may be damaged in extreme cold, but plants recover

Kale

Planting and Care

- Late Aug - mid Oct. (Autumn)
- Mid Feb. to June (Spring)
- Grow as baby green or to mature leaf size
- Seeds: 1-2" apart; ½" deep (or scatter!)
 - Seeds mature in 40-60 days
 - Re-sow every 2-4 weeks
 - Harvest when 4-6" tall
- Transplants: 6" spacing



Caterpillar Pests of Cole Crops



B.t.– *Bacillus thuringiensis*

- Naturally occurring soil bacteria
- Sporulate and produce toxin
- Must be ingested
- Stop feeding within a few hours, slow death
- Spray in evening
 - Toxin breaks down in sunlight
- Separate strain for Colorado potato beetle control



Radish

Raphanus raphanistrum (Brassicaceae)

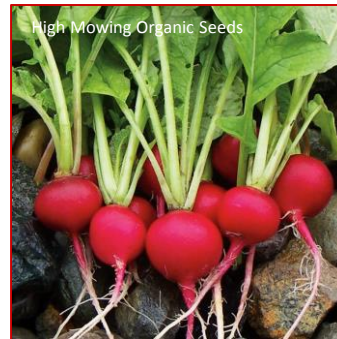
- Native to Eurasia, annual or biennial
- Consume fleshy, sugar rich roots
- Flavor comes from defense chemicals

European or Spring Radishes

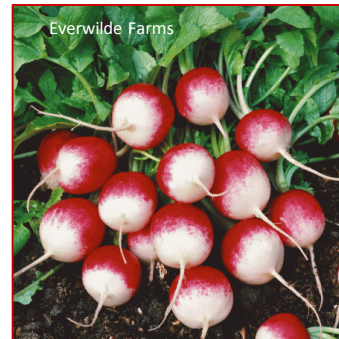
- Ideal for containers
- Red, bright red skins, white flesh

Winter and Asian Radishes

- Much larger, longer
- Store well



'Cherry Belle'



'Sparkler White Top'



'Long Black Spanish'



'April Cross'

Planting and Harvesting Radishes

- Plant seeds Aug-Sept.
- Space $\frac{3}{4}$ " (Euro) – 2-4" (daikon)
- 20-25 days to harvest
- Great for testing compost!
- **Pests and Diseases**
- Cabbage looper complex; aphids
- Damping-off diseases



Harvest

- Roots are just visible
- 0.5-1.5" diameter

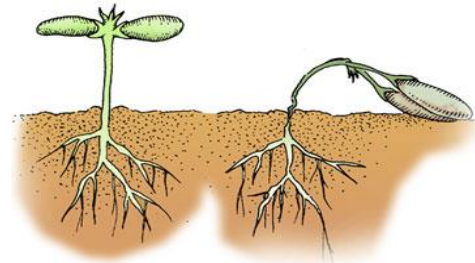
Damping-off Diseases

Symptoms

- Germination failure
- Dark, constricted hypocotyl
- Soft, mushy seeds
- Soil sticks to seeds
- Wilting, rotting seedlings

Control

- Avoid compaction & over-watering of growth media
- Use clean seeds, media, containers, and tools
- Fungicides (Captan) may help if caught early



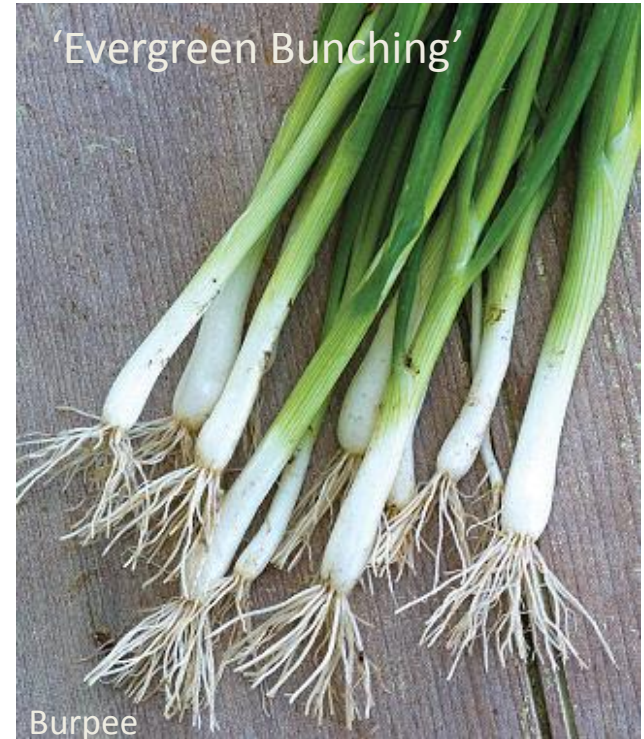
Univ. of Missouri



Scallions/Green Onions

Allium cepa (Amaryllidaceae)

- 500+ species of *Allium*, hundreds of cultivars
- Unknown, ancient cultivated origin
- Consume leaves
 - Above and below ground!
- Scallions and green onions are immature onions



Any onion variety can be harvested as green onions, some are bred to be scallions.

Planting and Harvesting Onions

- Late Aug- Mid Sept.
- Seeds 1-2" apart, 1/2" deep, thin to 2-3"
- 60-80 days to maturity
- Harvest when 6-8" tall



Other Container Crops for Fall

Herbs

- Bay (T)
- Chervil (S)
- Dill (S)
- Parsley (T)

• Veggies

- Bok Choy (T)
- Carrots (S)
- Collards (S/T)
- Endive (S)
- Mustard Greens (S)
- Spinach (S)

Know Your Enemy ?



Resources on Container Gardening



Container Garden Planting Calendar for Edibles in the N.C. Piedmont

You can grow and harvest vegetables, fruits, and herbs in the piedmont of North Carolina practically year-round. Container gardening offers flexibility over traditional gardening because the containers can be raised or lowered for easier accessibility, placed in a sunny or shady spot, moved to a sheltered area for extreme weather (low temperatures, snow, or tropical storms), and protected from wildlife (squirrels, voles, rabbits, or deer) that may damage plants or try to eat your harvest. By choosing the appropriate varieties and planting at the right time of year, you can enjoy the many benefits of gardening and create a beautiful space just outside your door.

Benefits

People grow vegetables, fruits, and herbs for many reasons. Many edibles have great ornamental value, such as the fine, feathery foliage of dill, the bright red stalks of chard, the snowy white blossoms of peas, and the bold purple color of eggplant. Besides providing a fresh source of nutritious locally produced food, the act of gardening has the added benefits of improving both your mental and physical health. The sense of joy and pride in planting, growing, and harvesting can be tremendous. Children also benefit from being included in container gardening projects. Growing edibles can connect children with the biological world around them, increase their knowledge of where food comes from, and expand the variety and quantity of fresh fruits and vegetables they consume.

Varieties

When choosing plants for your containers, select ones with a confined or compact growth habit. Not all edibles are developed in containers, but new varieties are developed every year. Look for varieties that are labeled compact, bush, dwarf, or mini-

ature. To maximize success, choose varieties that are pest and disease resistant. Initials following the plant variety—for example, tomato—indicate that it has been bred to be resistant to a disease or pest. “V” means resistance to *Verticillium* wilt, “F” indicates resistance to *Fusarium* wilt, and “T” indicates resistance to Tobacco Mosaic Virus. While these codes are the ones most commonly used, they are not universal. So be sure to check the key in the catalogue you are using. Finally, choose varieties that will provide the taste, texture, and color that you desire.

Climate

Edibles can be grown in the piedmont throughout the year by utilizing microclimates and protecting plants by moving containers close to a warm wall or house. The average low temperature in December, January, and February is 28°F to 30°F, but collards, kale, and some herbs such as bay and rosemary will tolerate the cold weather. The summer months of June, July, and August are when most plants are pro-



How to Create a Container Garden for Edibles in the North Carolina Piedmont

Edibles can be grown in containers in a variety of outdoor spaces: a small apartment balcony, a large deck space, or even a front stoop. People grow edibles for a variety of reasons. You may want to grow tomatoes for a sandwich or lettuce for a salad, or you might be providing herbs, vegetables, and fruit for a family. Regardless of the scope or size of your container garden, selecting the right containers, planting media, and plant combinations are the first steps on the road to success. In this publication you will find ideas to get you started growing your own edibles. Included are simple designs and potential settings for a single container, a small group of containers, and a larger grouping of containers. The benefits and challenges of various planting options will also be explored.

Selecting a Container

Edible plants can be grown in containers that you purchase, build, or recycle. Almost anything will work as long as it has drainage holes, such as a reclaimed galvanized metal bucket, a discarded wooden dresser drawer, or a bright glazed pot whose color contrasts with the plants' foliage, flowers, or fruit. Wood, clay, and unglazed ceramic containers will lose moisture more quickly and will therefore require more frequent watering than plastic, metal, fiberglass, or glazed pots. This is also true for small or dark-colored containers. The temperature of the planting media in a metal pot can fluctuate by as much as 30°F between day and night. However, roots can be protected from extremes of heat and cold by lining the pot with bubble wrap or 1-inch-thick foam. Plastic and wood containers can safely remain outside year round, and cedar and redwood containers will last around 10 years without staining or painting.

Select a container to provide adequate space for roots. Container size should match the plant's growth requirements to prevent restricted root growth, which

can result in decreased plant growth (for more information on container size requirements for certain edibles, refer to publication AG-748, “Container Garden Planting Calendar for Edibles in the N.C. Piedmont”). The larger the pot, the less frequently it will need to be watered. If larger plants need to be moved indoors for overwintering, it may be best to have them on a rolling platform; a 20-inch-diameter container filled with growing media and lots of water can weigh up to 100 pounds. When plants become larger, they can be more difficult to move.

Selecting Planting Media

Container planting media can be purchased or homemade, but careful consideration must go into its composition. Otherwise, the media may be too dense and compacted to allow the plants to thrive. Garden soil should not be used because some soils do not drain well (i.e., red piedmont clay), which limits plant roots' access to air. In addition, garden soils may contain many pests, such as weed seed, disease, or insects. Many soilless mixes

<https://content.ces.ncsu.edu/container-garden-planting-calendar-for-edibles-in-the-piedmont>

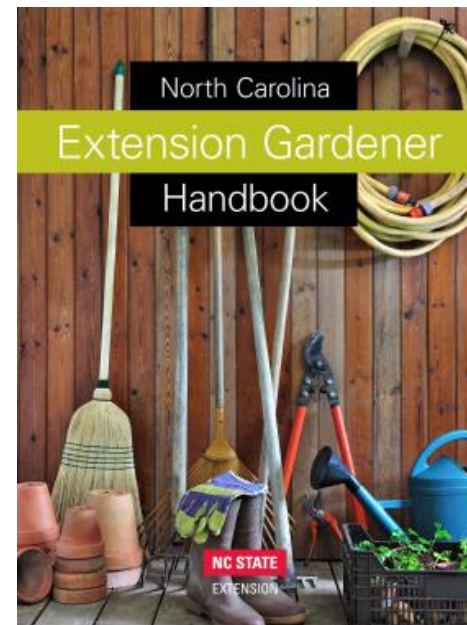
<https://content.ces.ncsu.edu/how-to-create-a-container-garden-for-edibles-in-the-north-carolina-piedmont>

These will be emailed AND posted on Tuesday!

Resources on Container Gardening

NC State Extension Gardener Handbook

- Chapter 18 Plants Grown in Containers
- Chapter 16 Vegetable Gardening
- Chapter 17 Organic Gardening
- FREE online!
- <https://content.ces.ncsu.edu/extension-gardener-handbook>



Color Hardback (700+ pages)
from UNC Press (\$60)

Chatham Gardener List

- Garden Tips and Updates
- Monthly newsletter returning this fall!
- Upcoming classes and events

To subscribe:

<http://go.ncsu.edu/subscribecg>



Thanks to Country Farm and Home (101 S. Small St., Pittsboro) for donating our door prizes!



Potting and Planting Demonstration

NC STATE EXTENSION

Master Gardener | Chatham County