

Growing Vegetables from Seed



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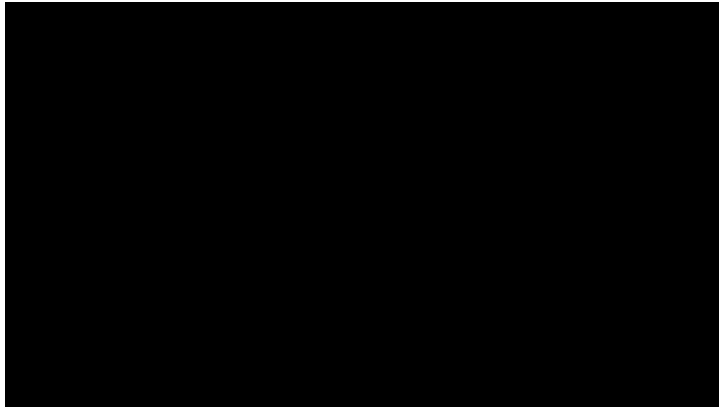
Tonight's Webinar

- Why grow from seed?
- Seed and seedling biology
- Planting calendars
- **Seed starting methods**
- Evaluations and resources

What is Cooperative Extension?

World's largest **non-formal education** network

- Established 1914 by the Smith-Lever Act



Practical, non-degree programs

What is Cooperative Extension?

A nationwide network of

- Educators
- Researchers
- Volunteers



Additional Resources

Sustainable Vegetable Gardening Resources

- Many excellent Extension resources
- Slides from previous classes:
- Soils
- Pests & Diseases
- Warm season crops
- Cool season crops



<https://go.ncsu.edu/chathamveggies>

NC STATE

EXTENSION

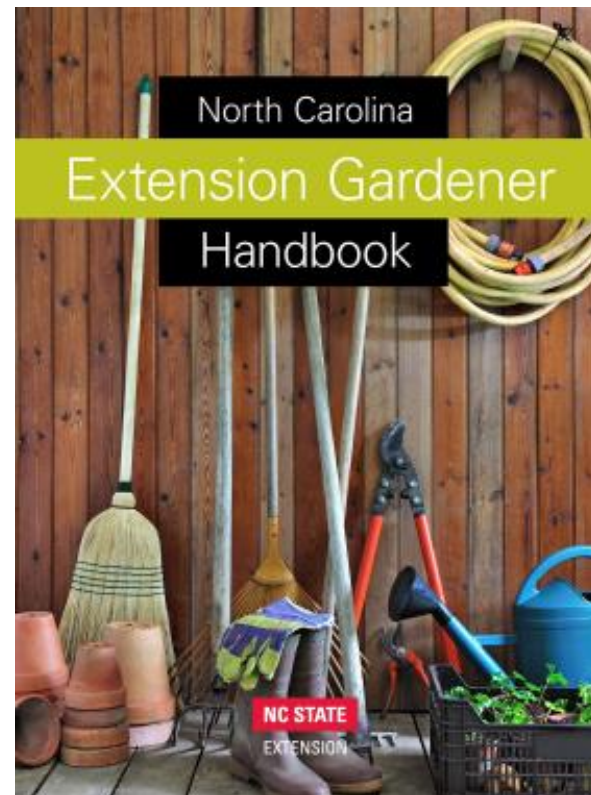
NC Extension Gardener Handbook

<https://go.ncsu.edu/eg-handbook>



Free Online!

Hard copy – UNC Press (\$60)



Growing Vegetables from Seed



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Why grow veggies from seed?

- More cultivars
- Earlier harvests
- Less expensive
- Pest and disease avoidance
- Only cure for Gardener-Associated Winter Depression Syndrome (GAWDS)



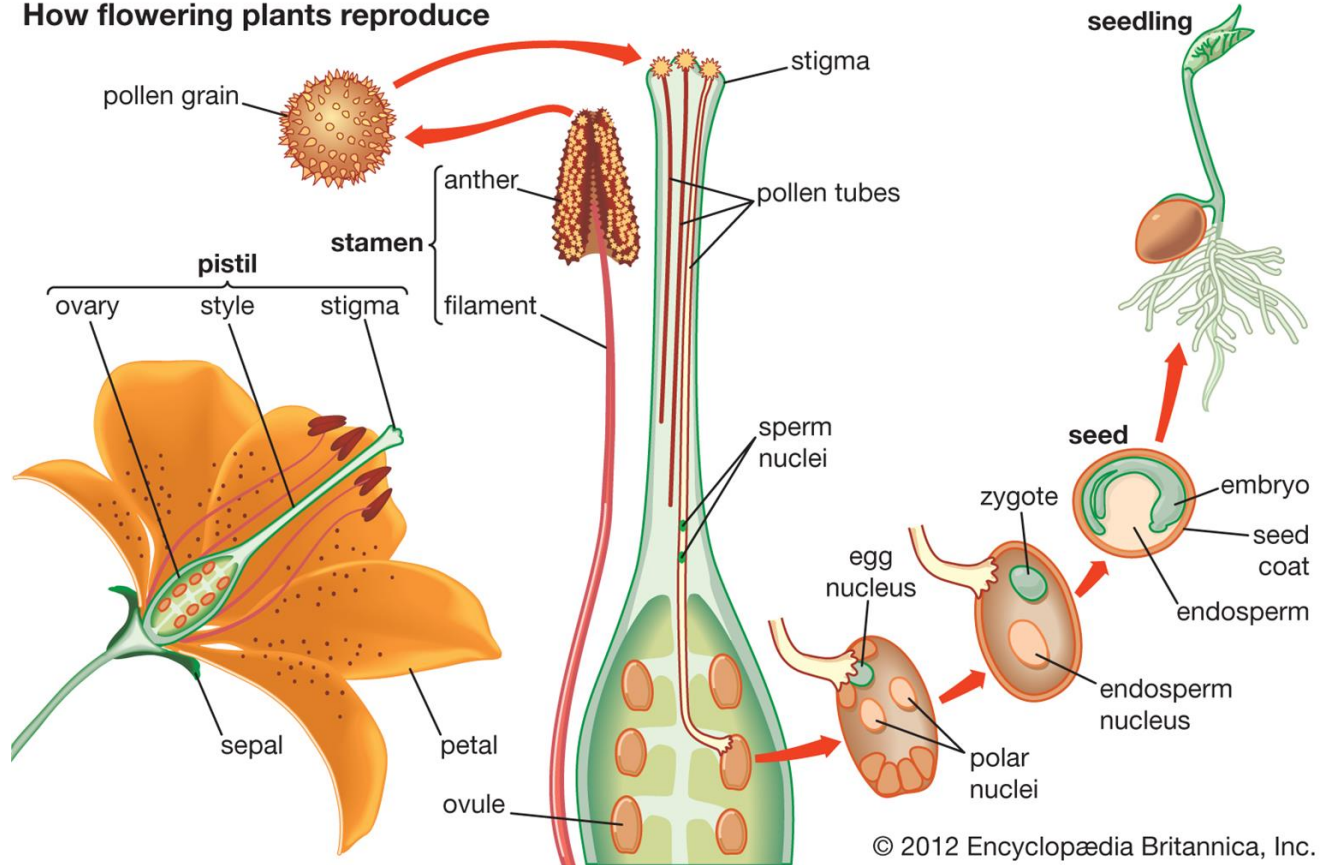
Dr. Lina Quesada, NCSU Vegetable Pathology Lab

**Cucurbit downy mildew arrives
in early summer.**

Plant early to reduce yield loss.

Seeds: Baby Plants in a Box

How flowering plants reproduce



Seed Anatomy

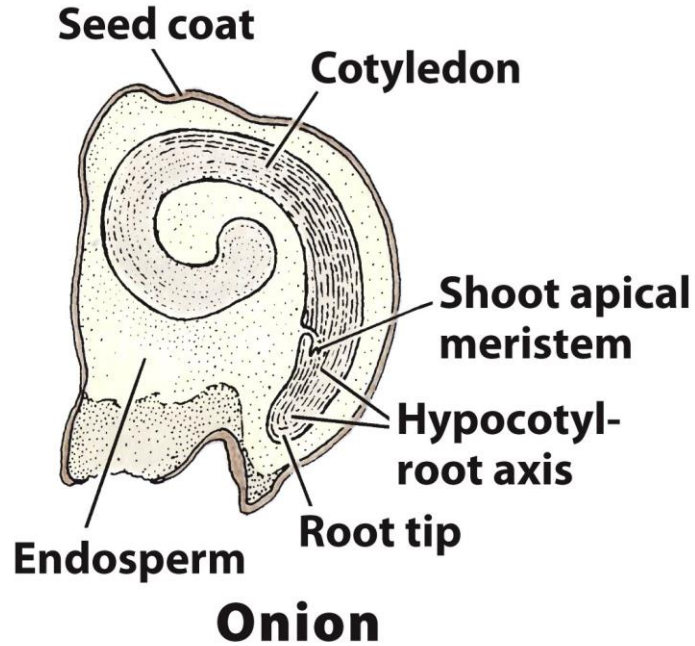


Figure 22-6c
Raven Biology of Plants, Eighth Edition
© 2013 W. H. Freeman and Company

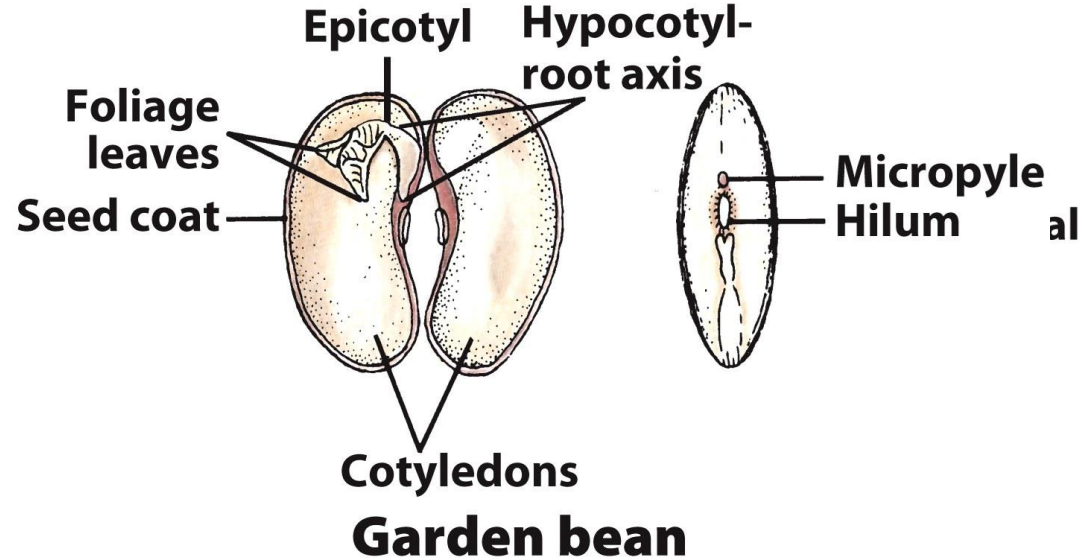


Figure 22-6a
Raven Biology of Plants, Eighth Edition
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Cotyledon: Embryonic leaves, first to emerge after germination

Seedling Anatomy

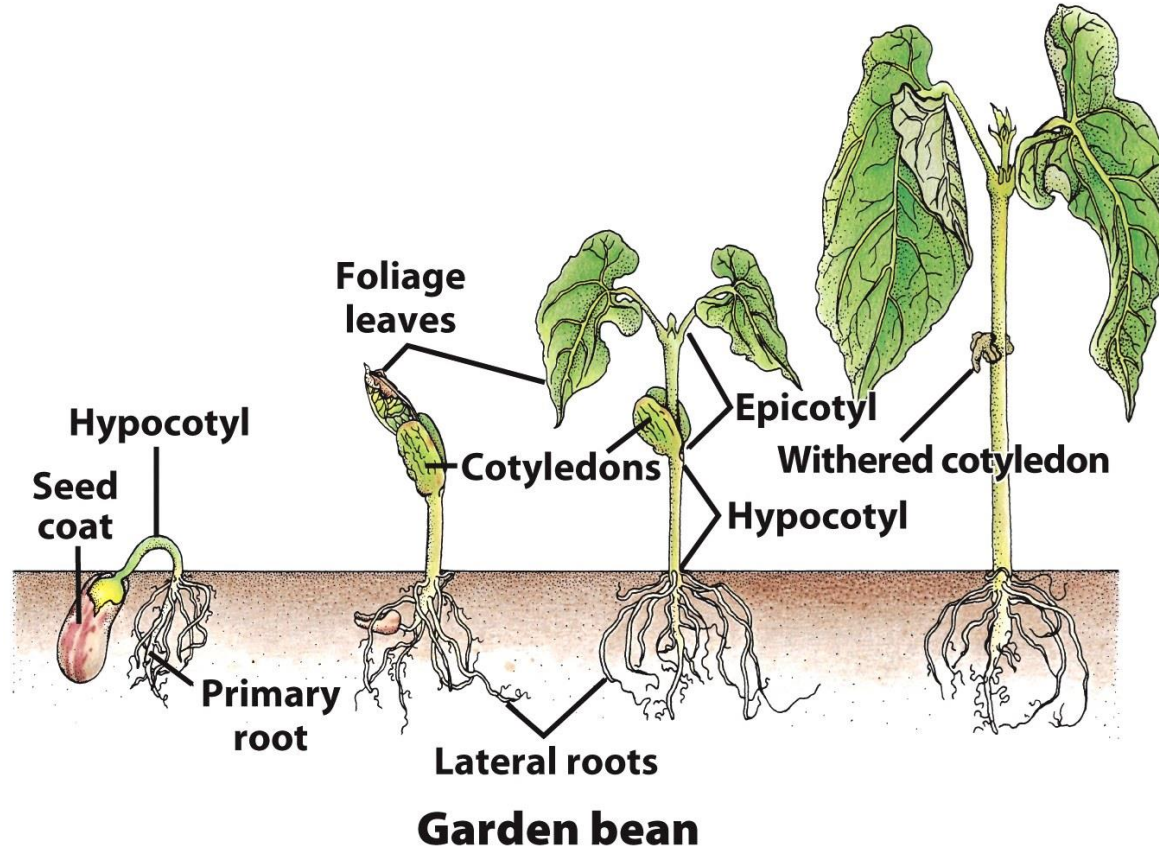


Figure 22-10a
Raven Biology of Plants, Eighth Edition
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Factors Affecting Germination

- Seeds must be alive
- Need the right environment
 - Temperature
 - Moisture
 - Air (oxygen)
 - Darkness/light
- Germination rates decline over time



Leftover seeds can be stored in an airtight container in a cool place

Types of Vegetable Varieties

Open Pollinated

- ‘Heirloom’ varieties – can save own seed and varieties will come true to type

Hybrid

- Result of a cross between 2 or more parents.
- Saved seed do not breed true
- Usually more uniform, more vigorous, more disease resistant

F₁ Hybrid

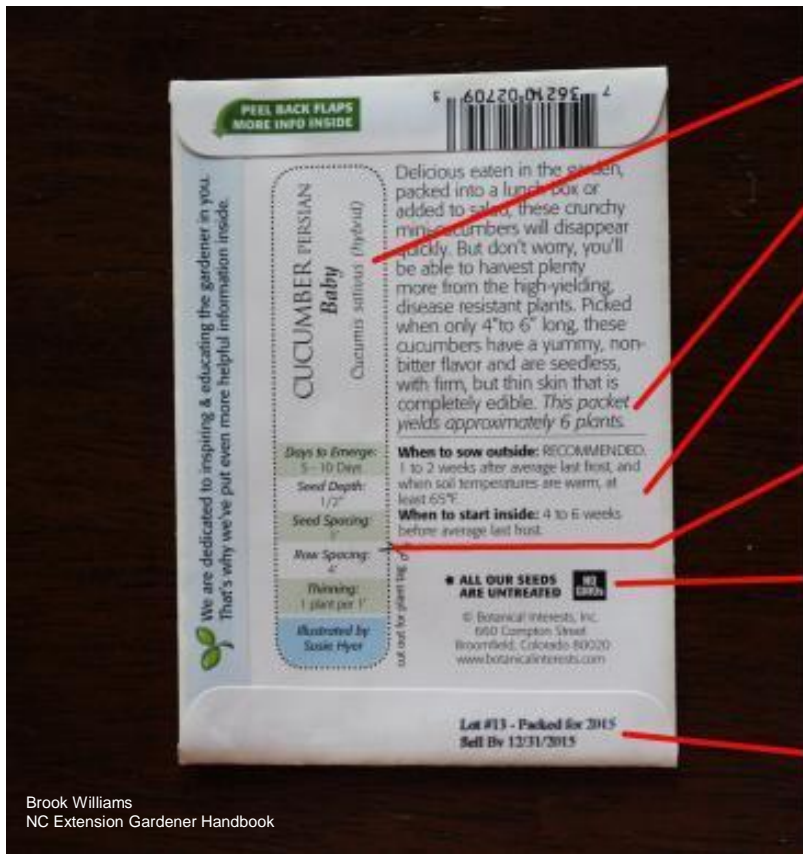
- Specific type of hybrid – first generation
- Usually much more expensive!

GMO (Genetically Modified Organism, aka molecular breeding)

- Specific genes for specific traits incorporated via molecular biology
- Very few veg. crops: Sugar beet, apple, tomato, potato
- <http://www.isaaa.org/gmaprovaldatabase/default.asp>



Seed Packets



Common name and latin name of plant

Number of plants per seed packet

When to sow outside or inside

Planting depth, seed and row spacing, days until plants emerge and thinning recommendations.

Genetically Modified Organism labeling

Sell by date

Planting Seasons

Cool season

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

Warm season

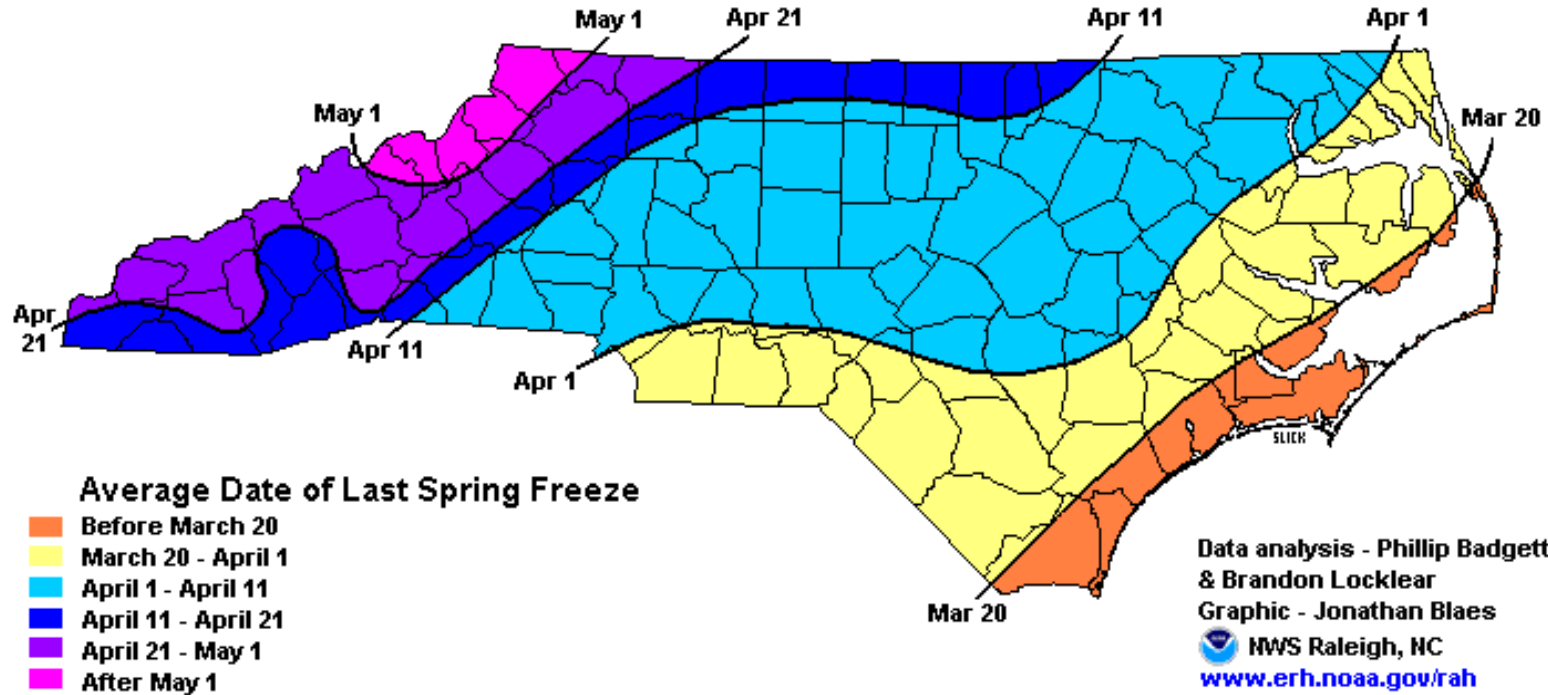
- Plant after average last spring frost date, April 15
- See “Central NC Planting Calendar” for specific dates

<https://go.ncsu.edu/veggiecalendar>

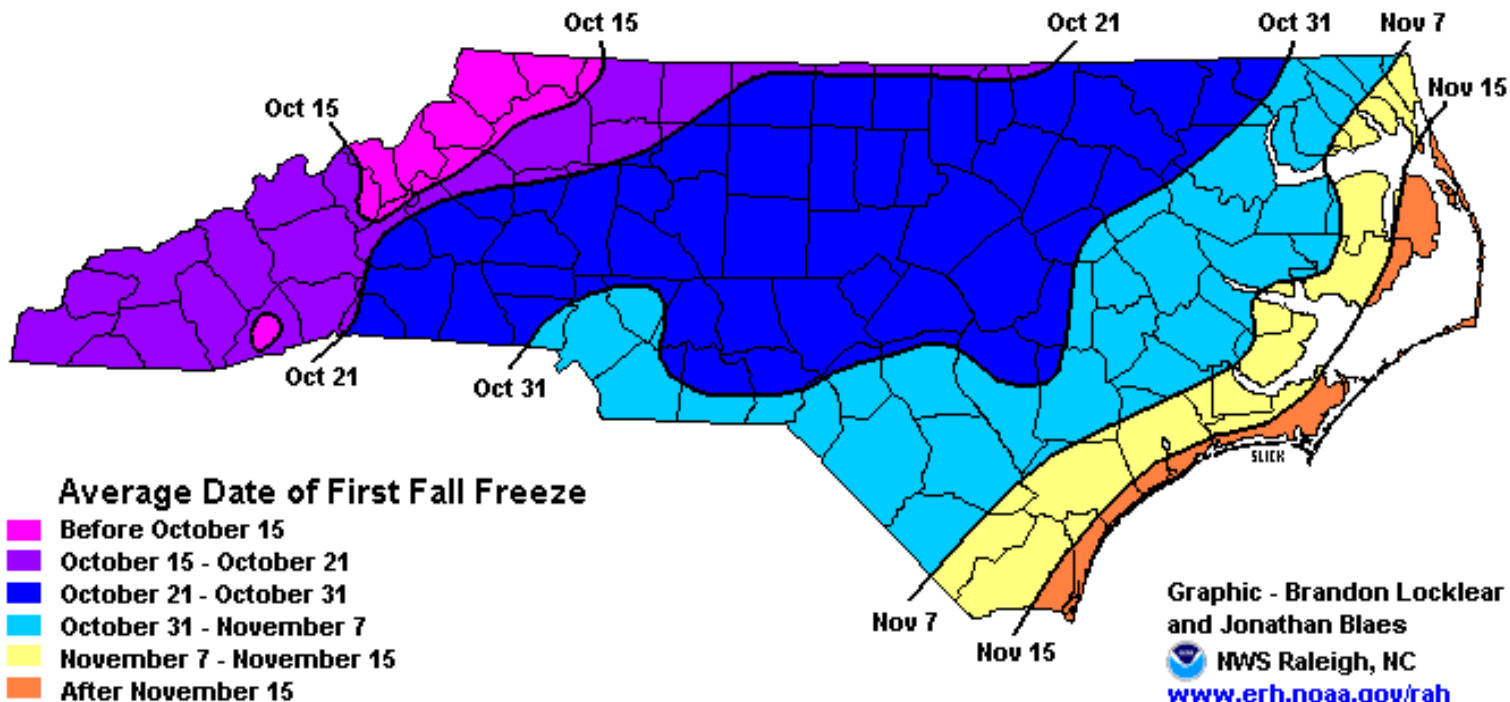


Not the same as the produce aisle!

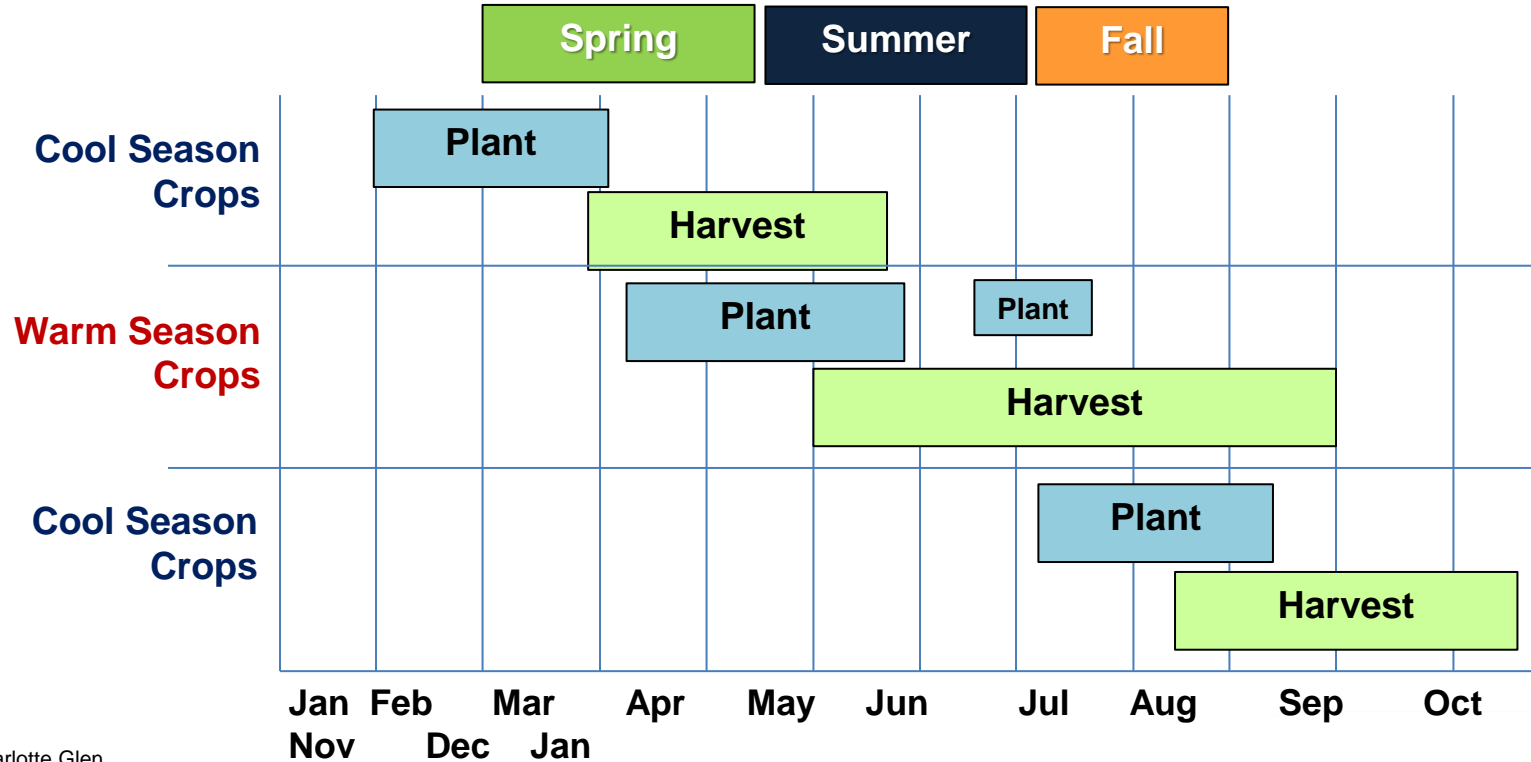
Average Last Frost Date



Average First Frost Date



Planting Seasons



Planting Calendars

- Use Extension planting calendars
- Do not rely on seed packets for regionally-accurate information!
- Refer to direct planting, not seed starting

<https://go.ncsu.edu/veggiecalendar>

NC STATE EXTENSION NC State Extension Publications

HOME PUBLICATIONS Log In Search Search Print

Central North Carolina Planting Calendar for Annual Vegetables, Fruits, and Herbs

Central North Carolina is a wonderful place to garden. Almost any type of vegetable or fruit can be grown successfully provided you choose appropriate varieties and plant at the right time. The climate, the season, and potential pests all affect the selection of what and when to plant.

Adapted to Climate

Freezing temperatures, high temperatures, humidity, and solar intensity, all common in central North Carolina, can stress plants. To successfully grow plants in this environment, select varieties that are tolerant of temperature extremes, plant at the appropriate times to avoid temperature extremes, or plan to protect the plants. It is possible to grow plants out of season by creating microclimates that differ from the overall climate by providing shade, humidity, or artificial heat.

Seasons

We have three optimal growing seasons: spring, summer, and fall. Both day length and temperature vary dramatically between seasons (short days and cool temperatures in spring and fall, long days and high temperatures in summer). Some plants are adapted to growing in the cool months of the year and will tolerate some frost (cool-season vegetables, [Figure 1](#)), while others do not tolerate frost and should be planted to grow outside only in frost-free months (warm-season plants, [Figure 2](#)). Even warm season plants have their limits and will temporarily stop bearing during heat waves (temperatures in mid 90s).




Figure 1. Cool-season vegetables can tolerate colder temperatures and some frost.




Figure 2. Warm-season vegetables don't tolerate frost and should only be planted outside when frost is no longer a threat.

RELATED PUBLICATIONS

- [Asparagus Crown Production](#)
- [Cucurbit Downy Mildew](#)
- [Gummy Stem Blight of Cucurbits](#)
- [Anthracnose of Cucurbits](#)
- [Sweetpotato Scurf](#)

There is a PDF version of this document for downloading and printing.



Table 1. Garden planting calendar for vegetables, fruits, and herbs in Central North Carolina.

Fruit, Herb, or Vegetable	Days to Harvest (from seed unless otherwise noted)	Distance Between Plants (inches)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	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
Artichokes, globe	T = 1 year	30			T	T	T							
Artichokes, Jerusalem*	Tu = 6–8 months	9–12			Tu	Tu	Tu							
Arugula	40–50	6–9		S	S	S	S			S	S	S	S	
Asparagus	C = 2 years	18		C	C	C								
Basil	T = 14–35 S = 50–75	2–8					S,T,S,T,S,T,S,T,S,T							
Beans, lima/bush	65–80	6				S	S	S	S	S	S	S		
Beans, lima/pole	75–95	6				S	S	S	S					
Beans, snap/bush	50–55	2			S	S	S	S	S	S	S	S	S	
Beans, snap/pole	65–70	6			S	S	S	S	S	S	S	S	S	
Beets	55–60	2		S	S	S			S	S	S	S		
Broccoli	T = 70–80	18		T	T	T	T			T	T	T		
Brussels sprouts	T = 40–50 S = 90–100**	14–18							T	T	T	T		
Cabbage	T = 63–75 S = 90–120**	12		T	T	T	T			T	T	T	T	
Cabbage, Chinese	T = 45–55 S = 75–85	12			S,T					S	S	T	T	



When to Start Seeds

- **Growing time before transplant varies by crop**
- **Count backwards from recommended transplanting date in planting calendar**

Crop	Weeks	Crop	Weeks
Broccoli	6-7	Kale	4-6
Brussels Sprouts	6-7	Leeks	10-12
Cabbage	6-7	Lettuce	5-6
Celery	10-12	Okra	2-3
Collards	5-7	Onions	10-12
Cucumber	2-3	Peppers	8-10
Eggplant	8-10	Tomatoes	6-8

Tolerance to Transplanting

Transplant Well (Start Indoors)

- Broccoli
- Brussels Sprouts
- Cabbage
- Cauliflower
- Celery
- Collards
- Cucumber
- Eggplant
- Kohlrabi
- Kale
- Leeks
- Lettuce
- Melons
- Onions
- Peppers
- Squash
- Tomatoes

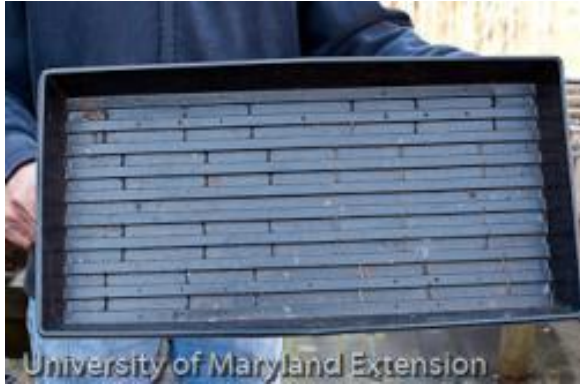
Transplant Poorly (Direct Seed)

- Beans
- Beet
- Carrot
- Corn
- Parsnip
- Peas
- Radish
- Rutabaga
- Spinach
- Turnip



Some crops are best seeded directly in the garden

Containers for Seed Starting



Plastic Flats



Plastic 4 and 6 Cell Packs



Plug Trays



Containers for Seed Starting

Peat Pots



Kathleen Moore NCSU



Kathleen Moore NCSU

**Remove top + bottom or
entire pot before planting**

Containers for Seed Starting

Recycled Materials

- Anything with a drainage hole
- Disinfect with 1:10 bleach solution for 5 min., rinse and dry



Growing Media

Don't use soil from the garden!

- Weed seeds
- Poor drainage kills roots
 - Lack of O₂
 - Pathogens

Instead, use soilless substrates
a.k.a. seed starting/potting mixes



Healthy



Nope!

Growing Media



Peat Moss



Coconut Coir



Vermiculite



Perlite

Simple Seed Starting Mix (Rutgers University)

Shredded sphagnum peat moss	10 gallons
No. 2, 3, or 4 domestic or African vermiculite ^b (horticultural grade, dust screened)	10 gallons
Pulverized Limestone Dolomitic Lime for mixes with domestic vermiculite or Calcitic Lime for mixes with African vermiculite	1 1/4 cups or 3/4 cups
Superphosphate (20% P) or Triple superphosphate (46%)	1/2 cup or 1/4 cup
Fertilizer (5-10-10), 10 gallons	1 cup

Growing Media

Seed starting mixes have the finest particles for the smallest seeds

- More expensive
- Most regular potting mixes adequate
- You can mix well-screened compost (20%) with soilless media for additional nutrients



How to Plant Seeds

Plant according to recommendations

- Seed packet or Extension literature
- Depth = 1.5-2x seed diameter



Lightly cover seeds and carefully firm media for good soil contact

Exception: no need to cover lettuce seeds

Seed Sowing Strategies I

Sow many seed in a flat or pot, transplant individual seedlings to pots or 4 packs, etc.

- Efficient use of space
- Transplanting can help strengthen seedlings
- Works well for **small seed** and slower growing vegetables
- Best method when need **individual plants**



Individual Transplants



Solanaceous Crops



Cruciferous crops, head lettuce

Transplanting to Cells or Pots

- Transplant when first set of **true leaves** appear
- **Lift from beneath** with label, pencil or dibber
- Hold by **cotyledon** or leaf, **NOT stem!**
- Can transplant **up to cotyledon**, especially if leggy
- Keep out of direct sunlight for a day, **water well**



Seed Sowing Strategies II

Sow 1-3 seeds in a pot/cell (peat pot, 4 or 6 pack) to grow until large enough to transplant into garden

- Best for large seed (squash, cucumbers)
- Or plants grown in clumps/groups (lettuce, parsley)



Growing in Containers Outdoors



Grow Food in Small Spaces



Flexibility & Accessibility



Avoid Soil Problems

Growing in Containers Outdoors

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

More Info:

<https://go.ncsu.edu/chathamveggies>



Thinning Seedlings



When in doubt...

DECAPITATE!

Thin to recommended spacing by snipping with scissors

Watering



University of Maryland Extension

Pre-moisten media



University of Maryland Extension

Wrung-out sponge

Newly planted seeds

- Water carefully – don't let seeds float away!
- Cover container to maintain high humidity

After germination

- Keep soil moist, but not wet
- When slightly wilting
- If you cannot squeeze-out water from top half-inch of media

Damping-off Diseases

Favored by cool, wet conditions

- Young seedlings more vulnerable to infection
- *Rhizoctonia*, *Fusarium*, *Pythium*

Symptoms

- Germination failure
- Seeds or seedlings soft, mushy, discolored
- Stems thin, roots absent or stunted

Prevention

- Don't over water
- Make sure containers are clean
- Don't over-apply fertilizer
- Provide adequate light



Light Requirements

Outdoor/Natural Light

- Greenhouse?
- Windows not enough

Indoors

- LED grow lights (\$\$)
- Fluorescent bulbs
 - T-8 or T-12 shop lights
 - Cool + warm
 - Broad spectrum grow lights



Keep lights 1-4 inches from seedlings for 12-16 hours per day

'Leggy' Seedlings

- Aim, for short, stocky, transplants
- Legginess caused by inadequate light



Heat Improves Germination Rates

Seedling heat mats are ideal



Crop	Min. (°F)	Optimum (°F)	Max. (°F)
Bean	60	75-85	95
Broccoli	40	60-85	95
Cabbage	40	45-95	100
Cucumber	60	65-95	105
Eggplant	60	75-85	95
Pea	40	65-75	85
Pepper	60	65-75	85
Tomato	50	65-85	95

Optimum temperatures vary among crops

See UC Davis Extension: <http://sacmg.ucanr.edu/files/164220.pdf>

Fertilization

- Some media have trace nutrients
- After first or second set of **true leaves**, apply 1/4 strength liquid fertilizer weekly
- Well balanced N-P-K

Liquid synthetic

- MircaleGro, Peters, Vigoro

Organic

- Fish emulsion (stinks!)
- Compost tea
- Rinse off any fertilizer that contacts foliage



Hardening-off Seedlings

Kicking the kids out of the house

1-2 weeks prior to transplant time, gradually expose to daytime outdoor conditions

- Protected from wind
- Shaded
- Reduce watering
- Bring in at night

Exceptions

- Harden-off tomatoes by reducing water
- Cucurbits and cauliflower – very gradually



Night temps < 54°F affects fruit development

Setting Out

Planting transplants in garden

- Plants are ready to set out when their roots have filled the container and have several sets of true leaves
- Monitor watering closely – check daily
- Mix in slow release or organic fertilizer at planting time, continue to liquid feed for few weeks



**Healthy roots are
white and firm**

Extension Gardener

Plant Toolbox



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

Select 'Find a Plant'

The screenshot shows the homepage of the NC State Extension Gardener Plant Toolbox. The header features the NC State Extension logo and a banner for the "North Carolina Extension Gardener Plant Toolbox" with a background image of purple berries. Below the header is a navigation menu with links for Home, Find a Plant, Identify a Plant, Design Gallery, Help, Give Now, and Contact. A search bar is located on the right side of the navigation menu.

The main content area is titled "Home" and includes a "Featured Plants" section with a list of plants and their images:

- Camellia sasanqua* Sasanqua Camellia
- Chimonanthus praecox* Fragrant Winterweet Wintersweet
- Erica carnea* Heath Winter Heath
- Galanthus elwesii* Giant Snowdrop Snowdrop
- Helleborus* Christmas Roses Hellebores Lenten Roses
- Jasminum nudiflorum* Winter Jasmine
- Salvia rosmarinus* Anise

The main text area contains the following information:

The North Carolina Extension Gardener Plant Toolbox contains detailed descriptions and photographs of 4,522 plants that grow in and around North Carolina.

Here are some tips to get you started

Search by scientific or common name:

Search Search

Use [Find a Plant](#) to select the perfect plant for a specific location.

Use [Identify a Plant](#) to determine the name of a plant based on leaf and flower characteristics.

Looking for help?

Have a look at the [Help](#) page to get tips on using the Plant Toolbox, and be sure to check the [Glossary](#) for plant identification terms.

There is a large image of a garden scene with various plants and trees.

At the bottom, there is a section titled "We are diligently working to populate all the data in this new plant database. Please be patient with us as not all features will be fully functional and accurate until this work is complete." Below this is a small image of a monarch butterfly on a pink flower.

The footer includes a section titled "Additional Partners" with the following links:

- NC's Champion Big Tree Database
- NC Forest Service

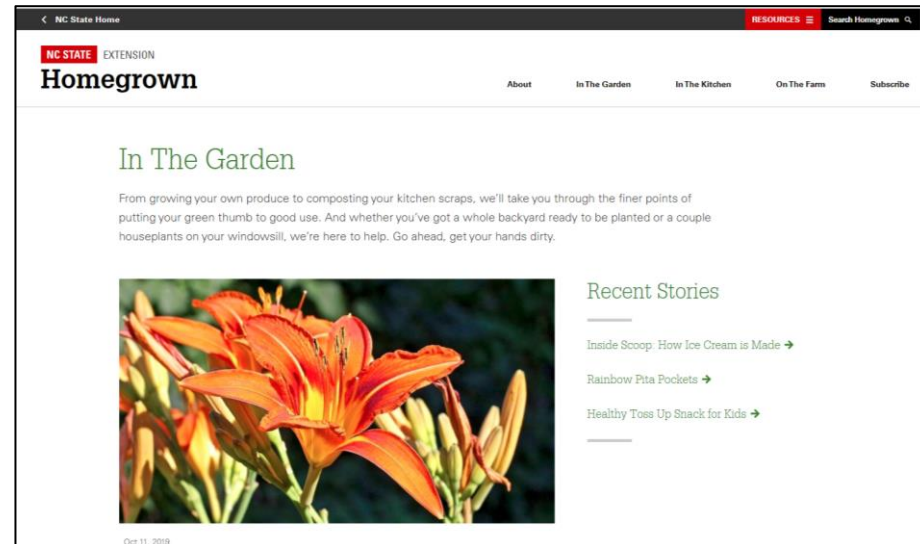
The right sidebar contains a section titled "Our Partners" with the following links:

- NC State Partners
- College of Natural Resources
- Forestry & Environmental Resources
- Herbarium
- Horticultural Science
- JC Raulston Arboretum
- Master Gardener Volunteers
- The Natural Learning Initiative
- NC Sea Grant
- NC State Extension
- Plant Disease and Insect Clinic

NC State Extension Homegrown

<https://homegrown.extension.ncsu.edu>

- In the Garden Videos
- In the Kitchen Videos
- On the Farm Videos



Need Help with Garden Problems?

NC STATE EXTENSION

Master Gardener | Chatham County

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

chathamemgv@gmail.com

919-545-2715

(Except during COVID-19, email is preferred)

Send us your problems!

Questions we may ask:

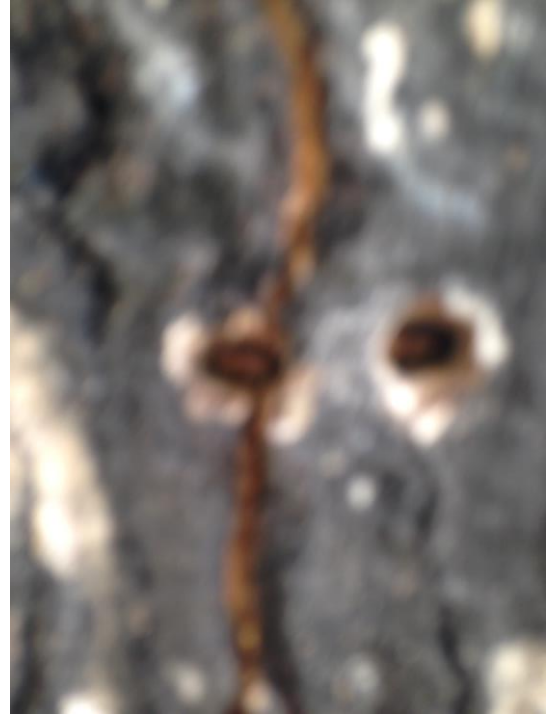
- Crop and cultivar
- Describe signs and symptoms
 - Include photos!
- When you started noticing problems
- Cultural conditions
 - Light, soil, water, planting time etc.



Send Us *Good* Photos!

Photos should:

- Include healthy and unhealthy parts
- Have a scale object
- Be in focus
- Show an up-close image
- Show the whole plant
- The more, the better



Diagnosis: cataracts?

Subscribe to the Chatham Gardener Newsletter

Chatham Gardener email list

- Sustainable gardening information
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- Upcoming classes and events

To subscribe: <https://chatham.ces.ncsu.edu/email-me/>

Thank you!

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