What is Cooperative Extension?

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

- Established 1914 by the Smith-Lever Act

Practical, non-degree programs

NC COOPERATIVE EXTENSION

NC STATE Extension Master Gardener

Growing Vegetables from Seed

Matt Jones
Horticulture Extension Agent
NC Cooperative Extension - Chatham County Center

N.C. A&T STATE UNIVERSITY

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Today's Workshop

Lecture

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

Activities

- Seed planting
- Transplanting seedlings

Evaluations and Resources

https://go.ncsu.edu/veggieseedresources

What is Cooperative Extension?

A nationwide network of

- Educators
- Researchers
- Volunteers

Additional Resources

Sustainable Vegetable Gardening Resources

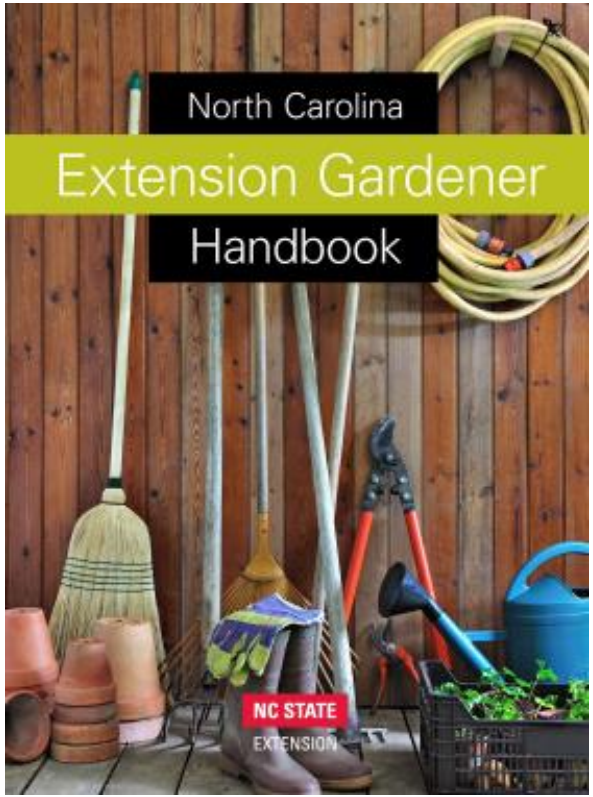
- Many excellent Extension resources
- Slides from previous classes:
- Soils
- Pests & Diseases
- Warm season crops
- Cool season crops

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)

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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)

Cucurbit downy mildew arrives in early summer.

Plant early to reduce yield loss.

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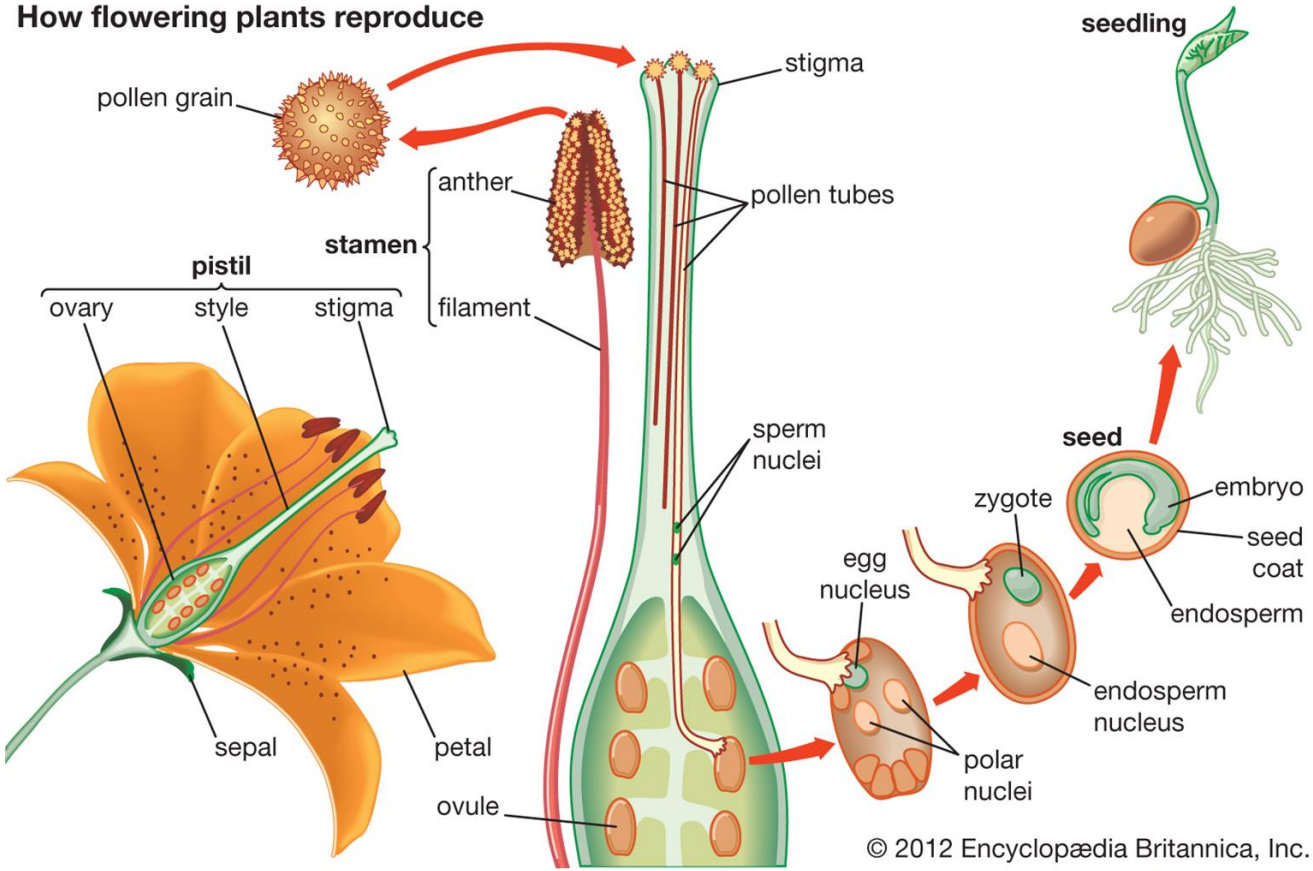
Seeds: Baby Plants in a Box



Seed Anatomy

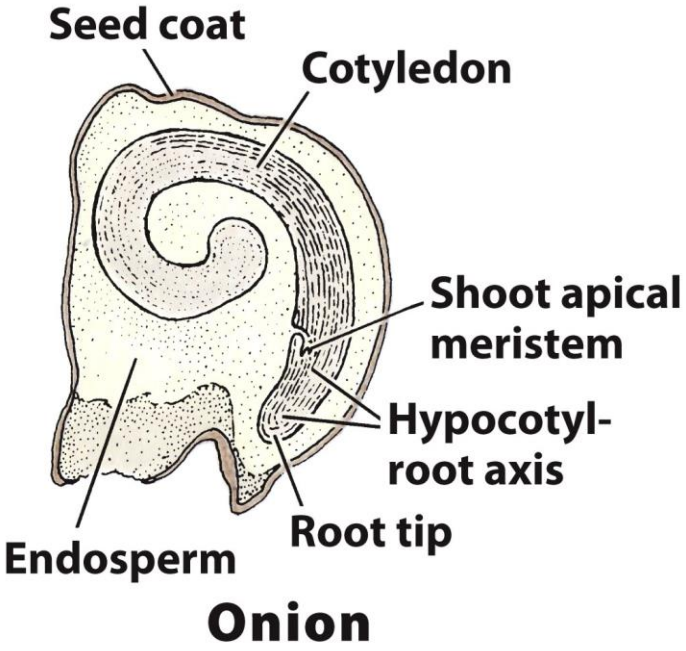


Figure 22-6c
Raven Biology of Plants, Eighth Edition
© 2013 W. H. Freeman and Company

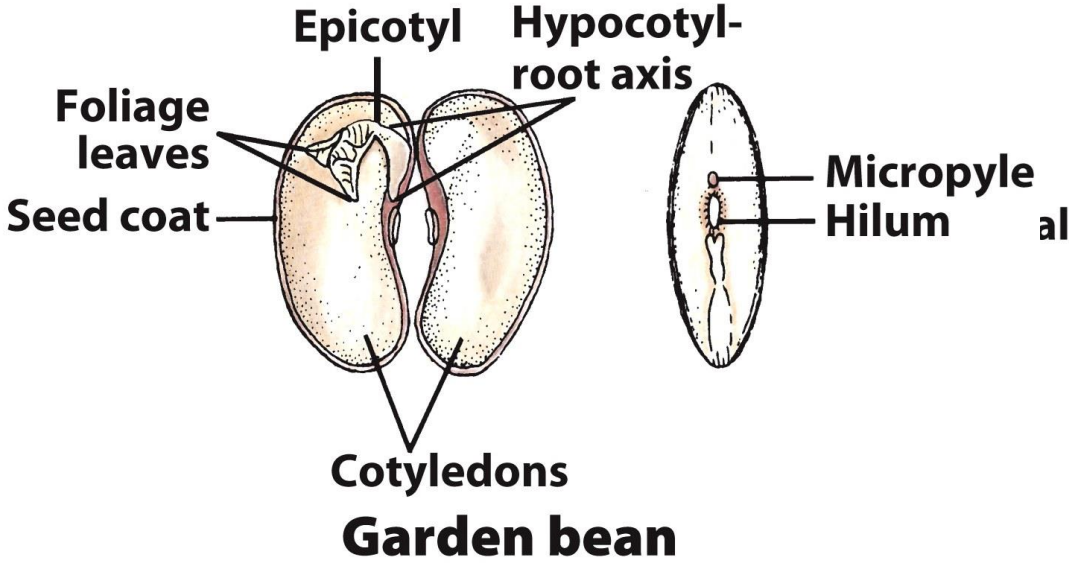


Figure 22-6a
Raven Biology of Plants, Eighth Edition
© 2013 W. H. Freeman and Company

Cotyledon: Embryonic leaves, first to emerge after germination

Seedling Anatomy

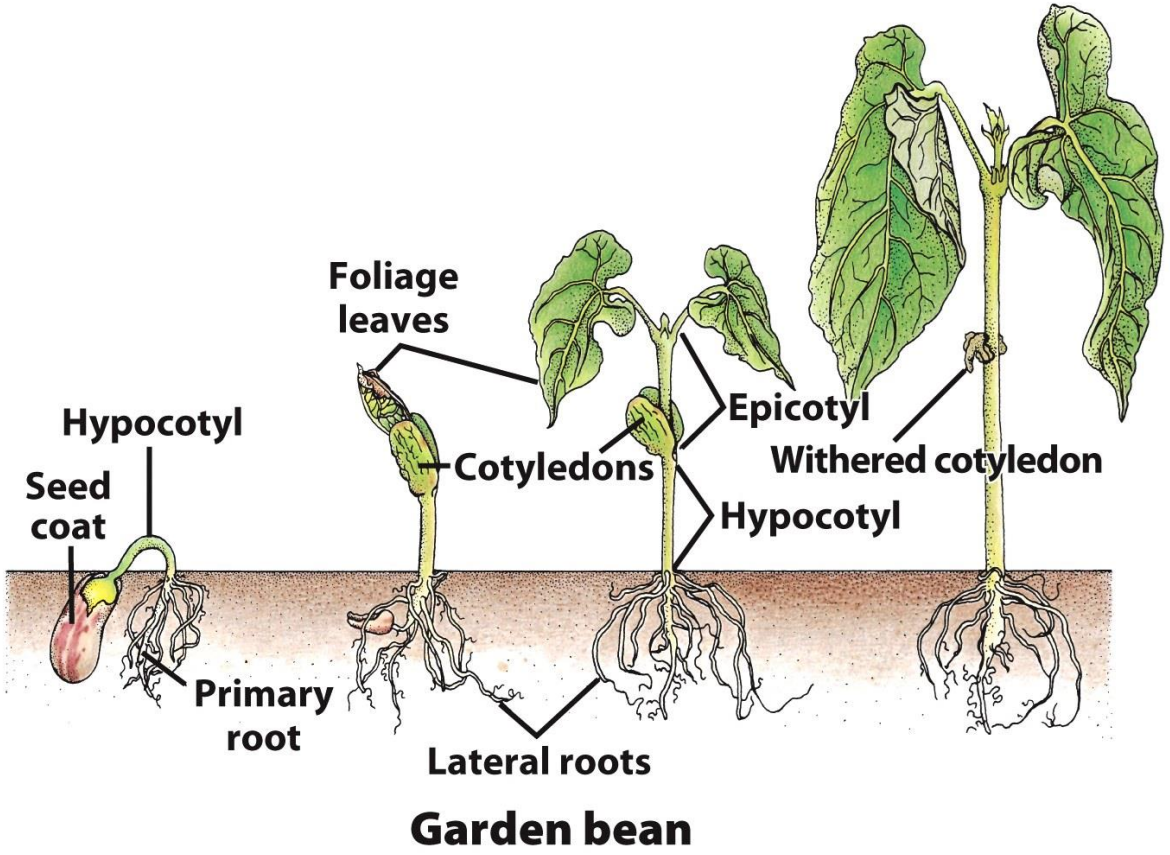


Figure 22-10a
***Raven Biology of Plants*, Eighth Edition**

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

F_1 Hybrid

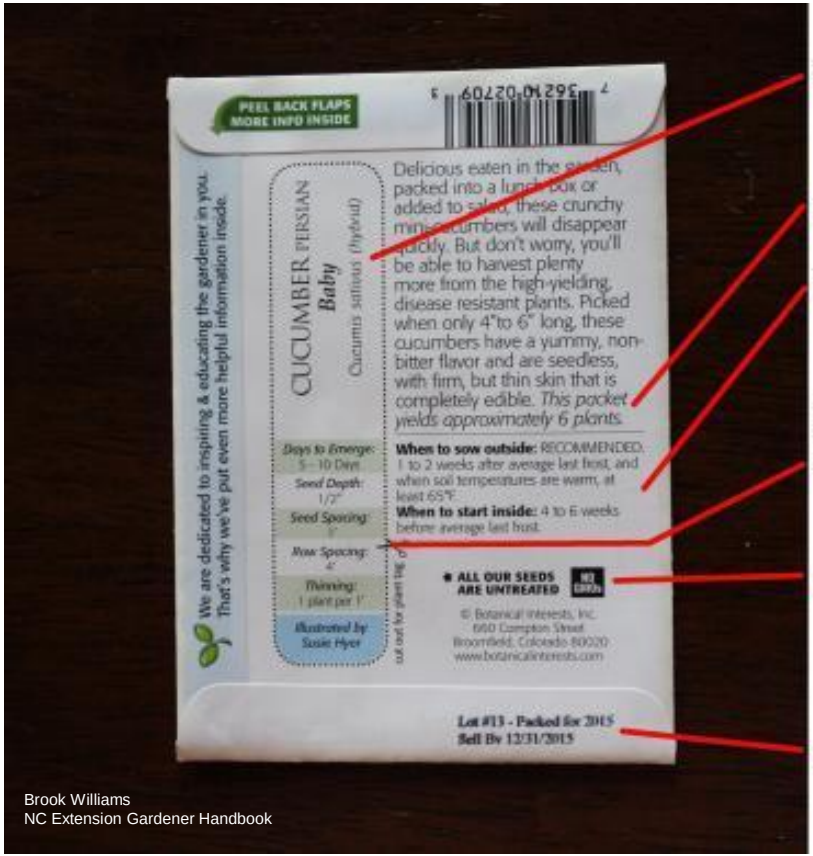
- Specific type of hybrid – first generation
- Usually much more expensive!

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/gmapprovaldatabase/default.asp

Slide: Charlotte Glen – NCSU

Seed Packets



Brook Williams
NC Extension Gardener Handbook

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 emerege and thining recommendations.

Gentically Modified Organism labling

Sell by date

Planting Seasons

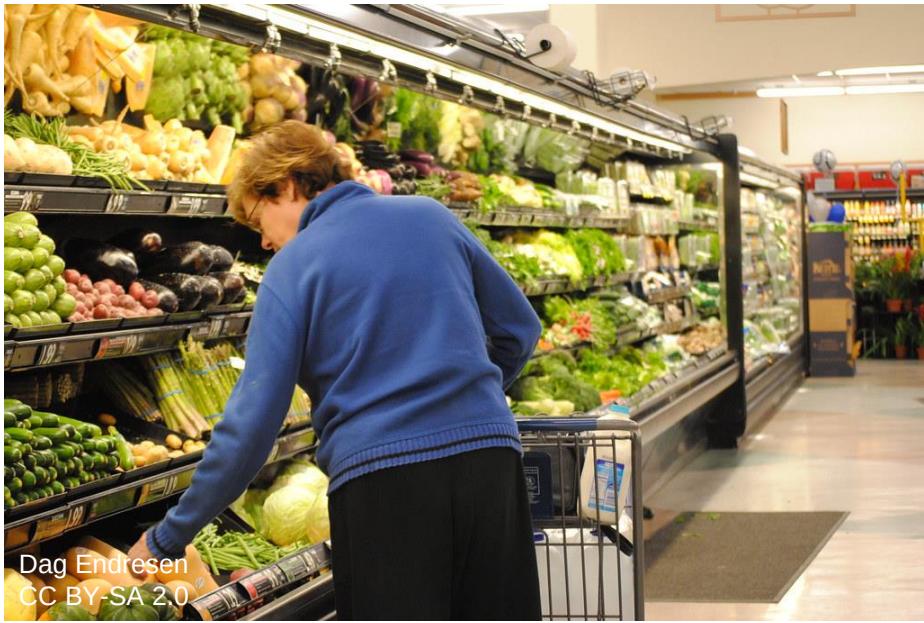
Cool season

- 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!

Slide: Charlotte Glen – NCSU

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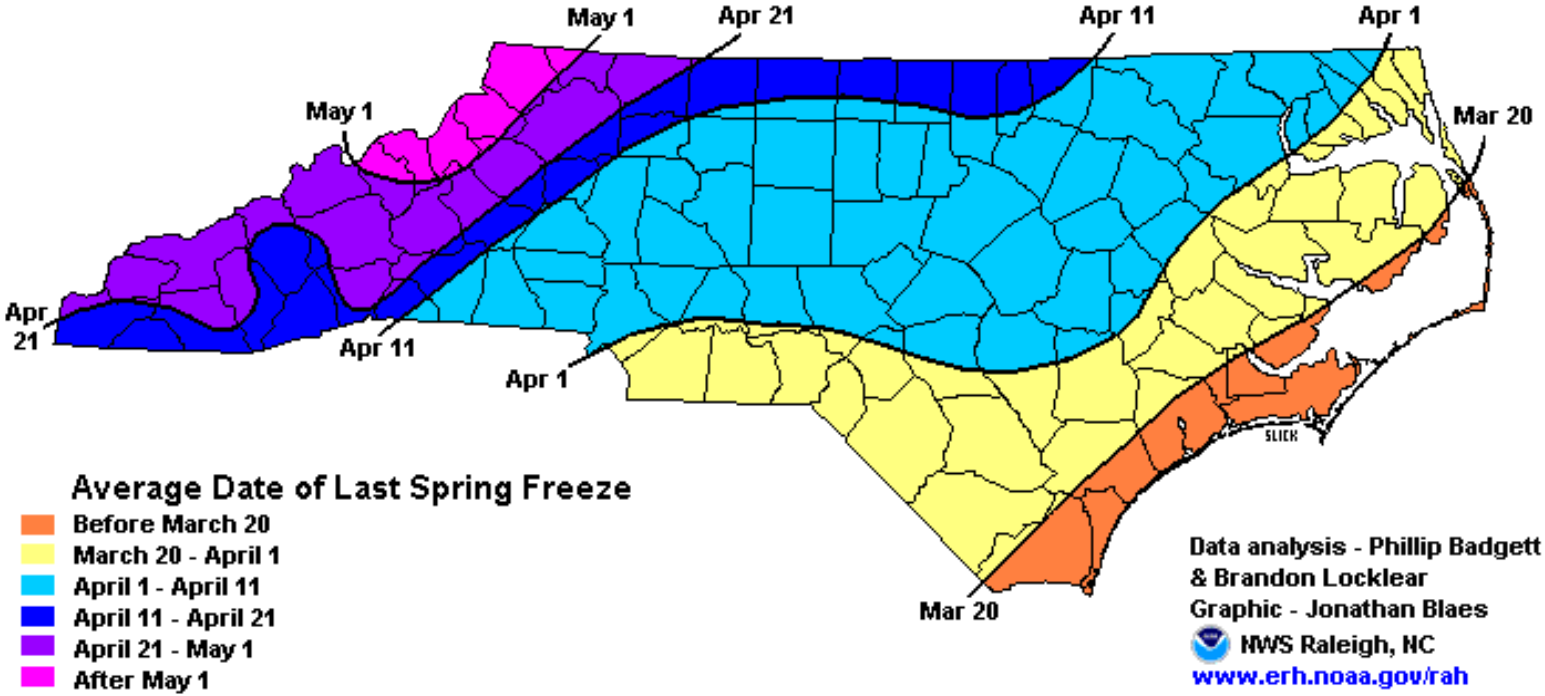
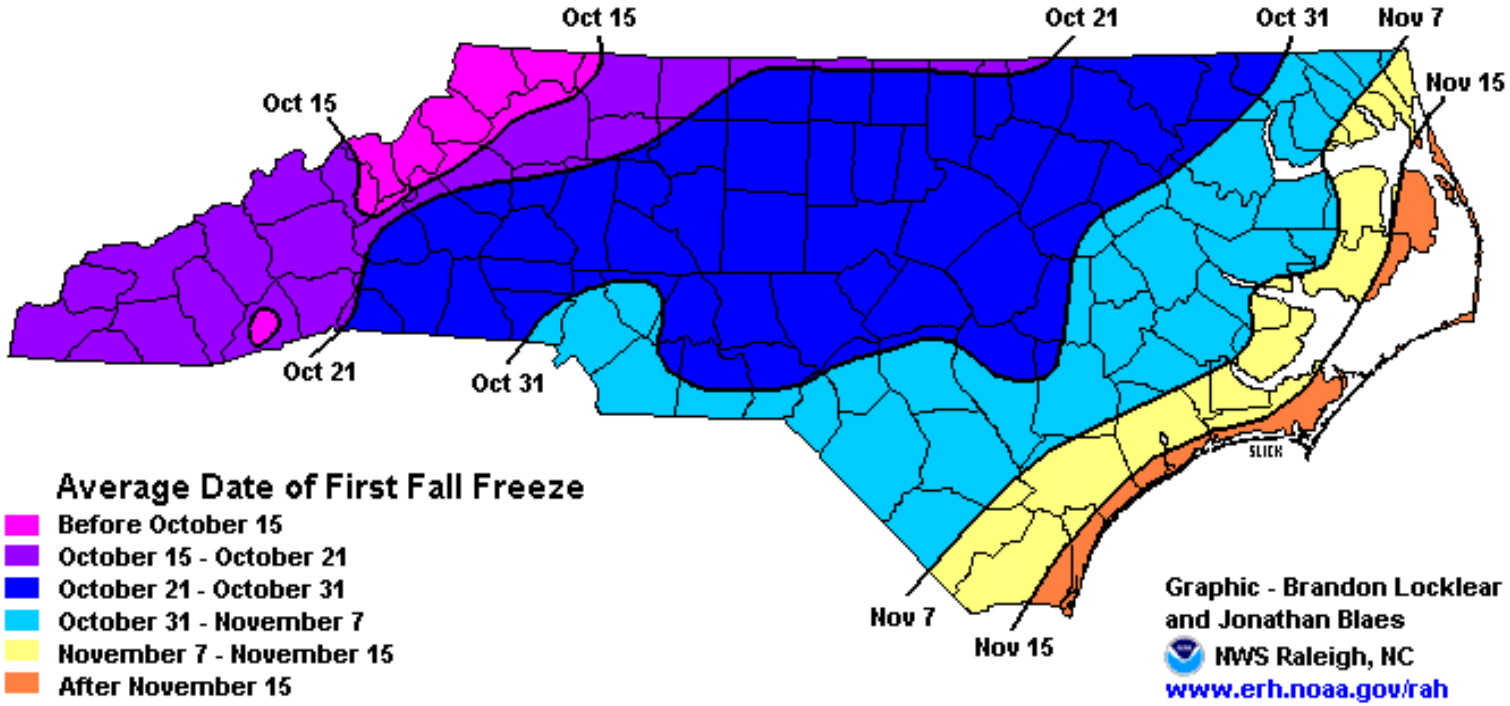
Average Last Frost Date

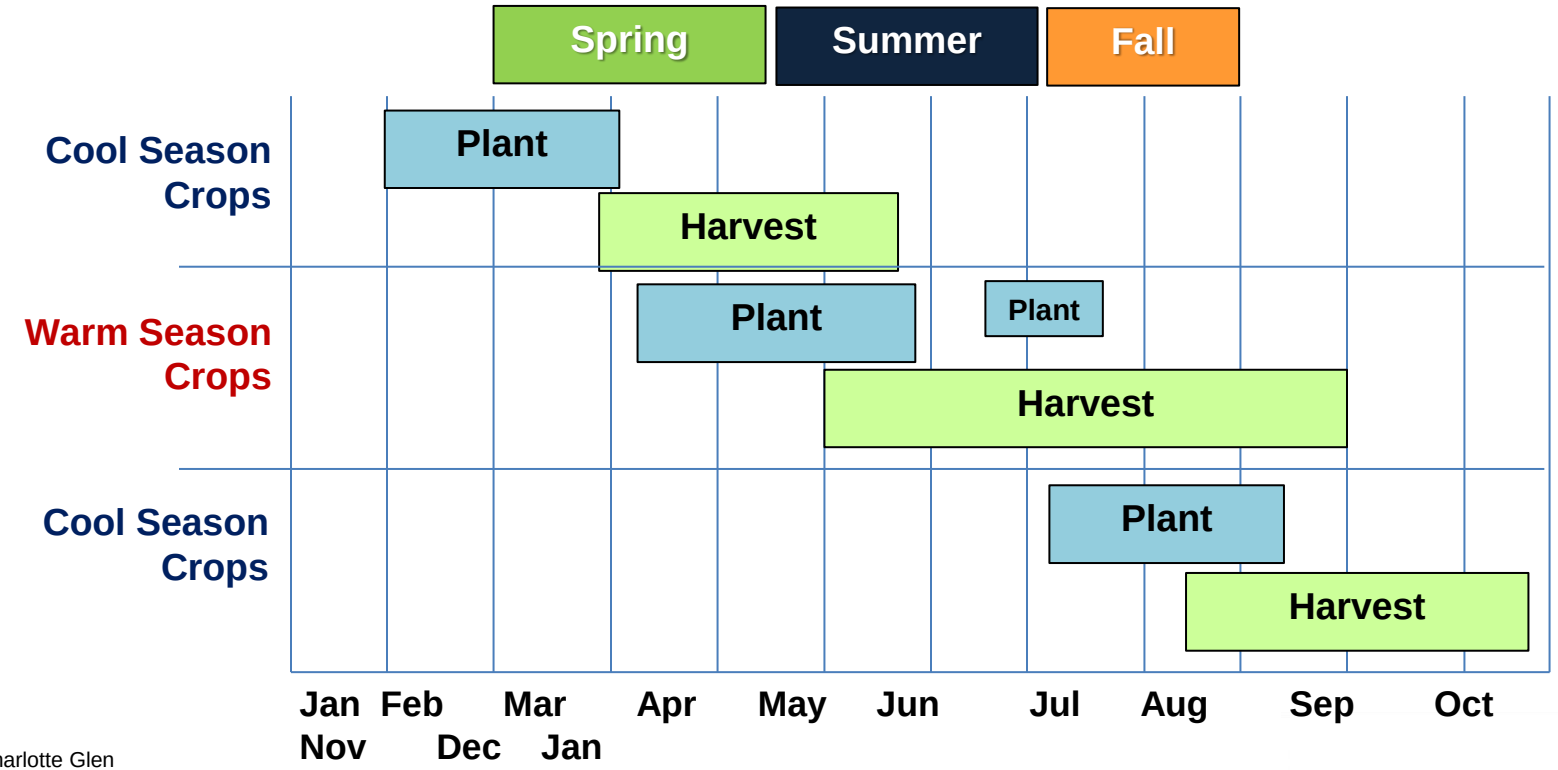


NC COOPERATIVE EXTENSION

Average First Frost Date



Planting Seasons

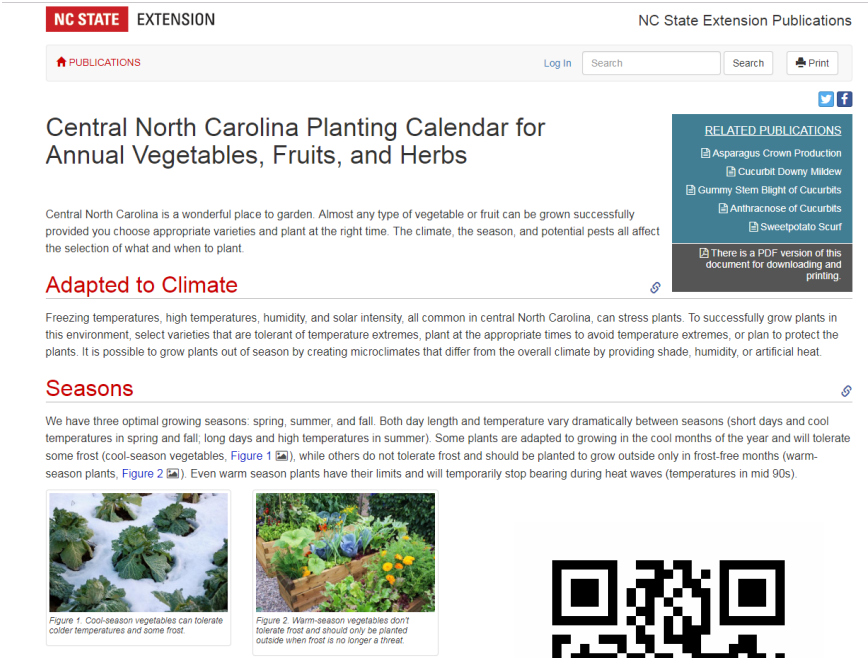


Slide: Charlotte Glen
NC State Extension

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

PUBLICATIONS | Log In | Search | Search | Print

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

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.

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.

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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	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			S										
Beans, snap/bush	50–55	2						S	S	S	S	S	S	S	S	S	S	S	S	S						
Beans, snap/pole	65–70	6							S	S	S	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	T							
Cabbage, Chinese	T = 45–55 S = 75–85	12						S,T									S	S		T	T					
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

https://go.ncsu.edu/veggiecalendar

When to Start Seeds

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

Crop	Weeks in Advance	Crop	Weeks in Advance
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)

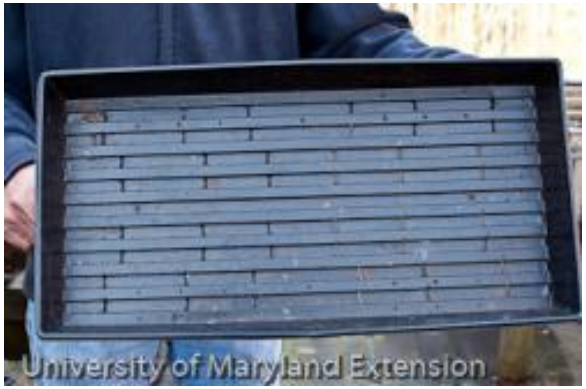
- Broccoli
- Brussels Sprouts
- Cabbage
- Cauliflower
- Celery
- Collards
- Cucumber
- Eggplant
- Kohlrabi
- Kale
- Leeks
- Lettuce
- Melons
- Onions
- Peppers
- Squash
- Tomatoes

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



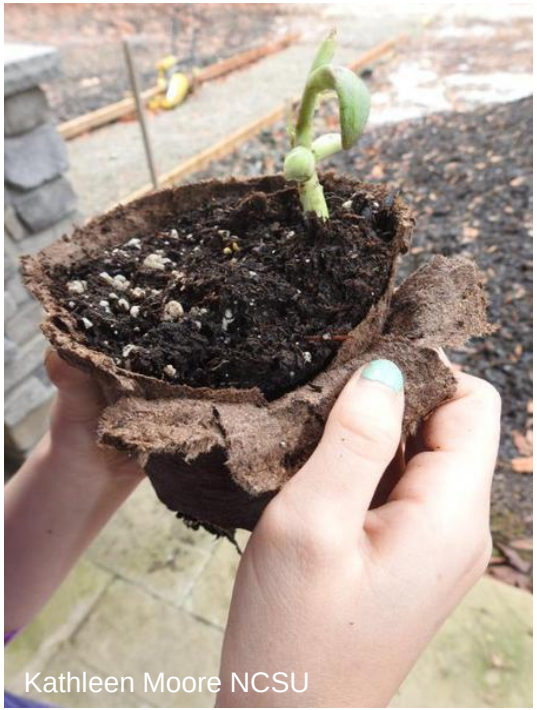
Plastic Flats

Plastic 4 and 6 Cell Packs

Plug Trays

Containers for Seed Starting

Peat Pots



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 O_2
  - 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)	1 cup

Growing Media

Seed starting mixes have the finest particles for the smallest seeds

- More expen$ive
- Most regular potting mixes adequate

- You can mix well-screened compost (20%) with soilless media for additional nutrients

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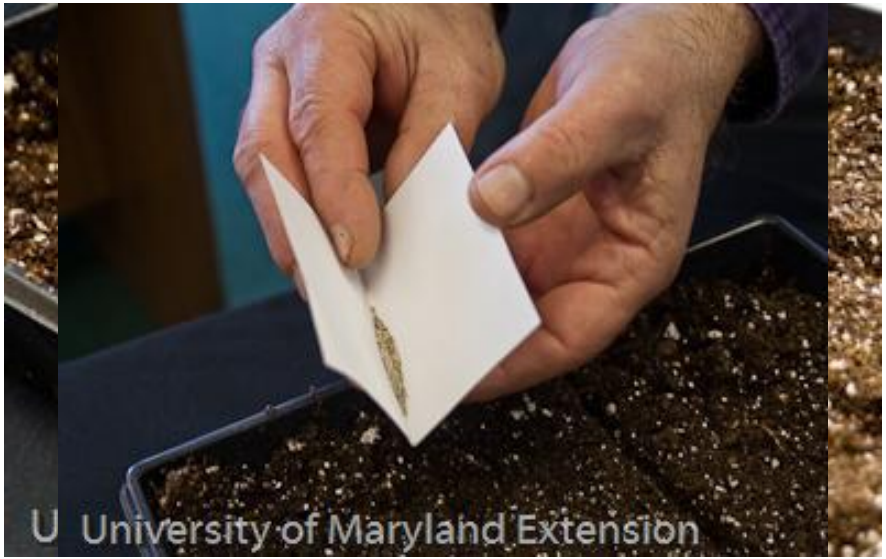
How to Plant Seeds

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**

Slide: Charlotte Glen – NCSU

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)

Slide: Charlotte Glen – NCSU

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

Pre-moisten media

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

Cover Trays to Maintain High Humidity

Remove once seeds have germinated!

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

Slide: Charlotte Glen – NCSU

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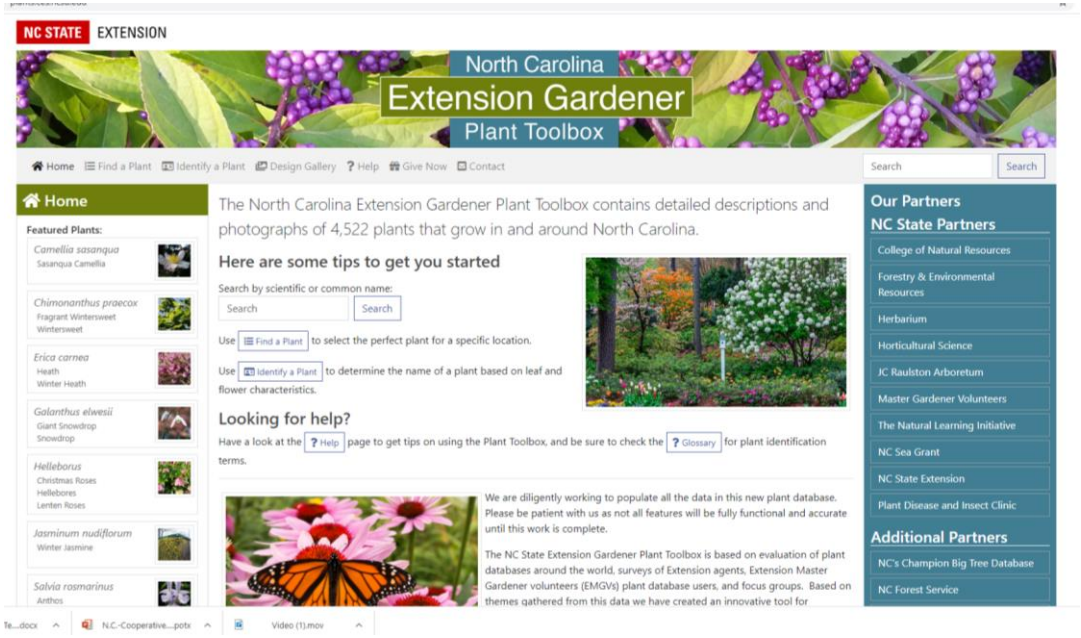
Extension Gardener

Plant Toolbox

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

Select

‘Find a Plant’



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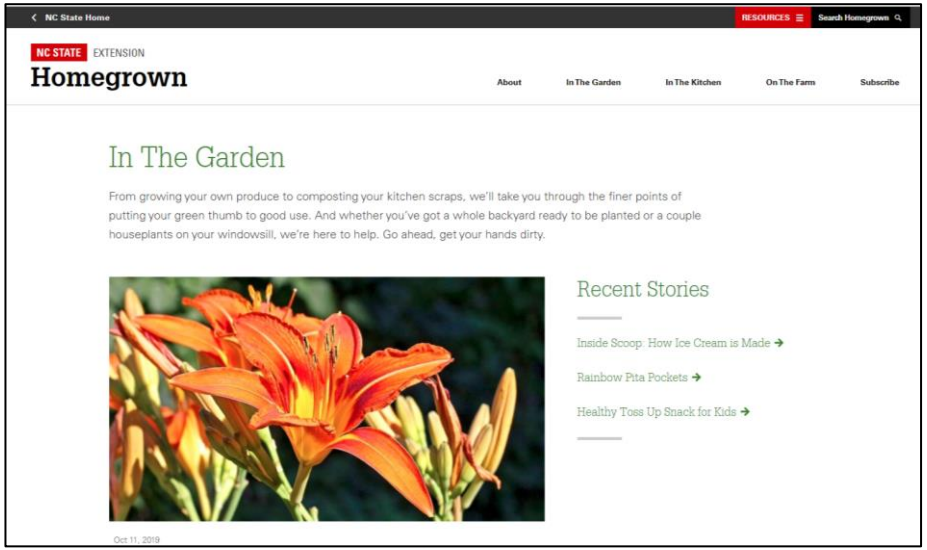
NC State Extension Homegrown

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

Returning in March!

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

chathamemgv@gmail.com

919-545-2715

Send us your problems!

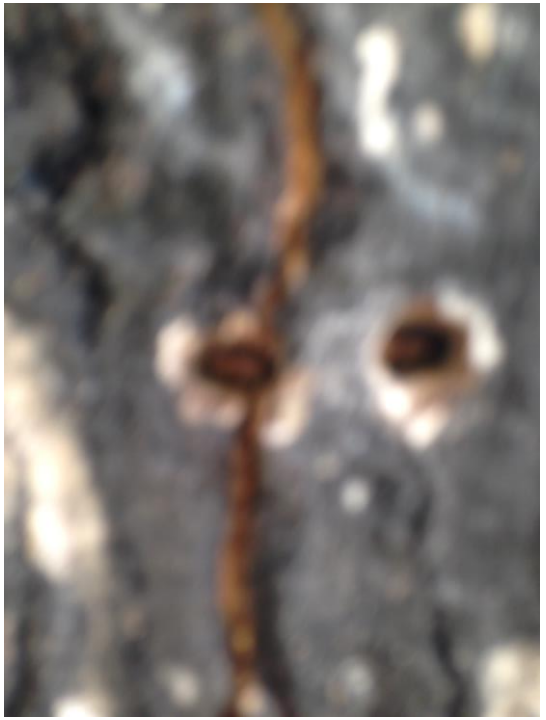
Questions we may ask:

- 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?

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- What to plant, pest alerts, timely tips
- Upcoming classes and events

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Thank you!

matt_jones@ncsu.edu