

Pepper-licious!



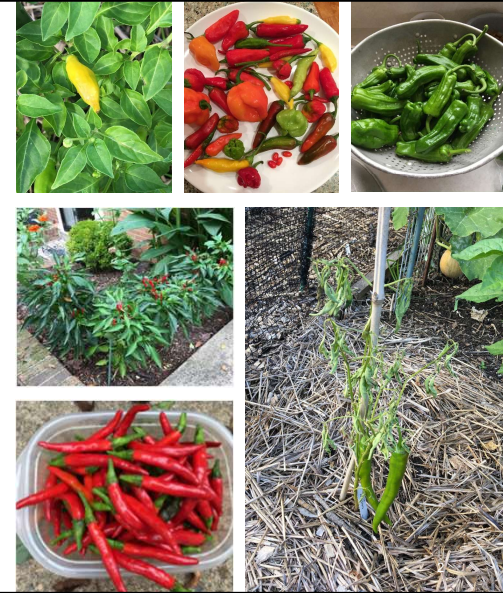
Dona Lee
March 2022



Virginia Cooperative Extension
Virginia Tech • Virginia State University

MGNV Master Gardeners of Northern Virginia
Arlington • Alexandria • mgnv.org

My Own Pepper Growing Experience



Growing-Peppers-at-a-Glance: Right Plant—Place—Time—Care

Pic-a-Pepper(s): Options range from sweet to mildly hot to hot to super-hot; common choices include bell, banana, jalapeno, habanero

Identify a location with well-drained, healthy soil and >8 hrs of sunlight to plant in the ground or fill a container (ideally 3-5 gallon) with commercial potting soil and sunlight or artificial light

Purchase a healthy transplant, acclimatize to temp/light, and plant outside along with support cages or stakes when night-time temperatures reach 55°F (Mother's Day rule)

Initially use balanced N-P-K fertilizer; later switch to (low)N-P-K fertilizer. Water at base of plant only as needed (no more than 1"/week). Harvest regularly using snips. If temps > 90°F, be patient. Contact MGNV Help Desk (mgnvarlalex@gmail.com) if evidence of pests or disease.

Topics

- Background on Peppers: Origin, Taxonomy, Heat
- Pepper Growing Considerations, Buying and Growing Transplants
- Planting Transplants, Care/Harvest During the Season
- Common Pepper Pests and Diseases, Best Practices and MGNV Resources
- References, Interesting Reading, Recipes

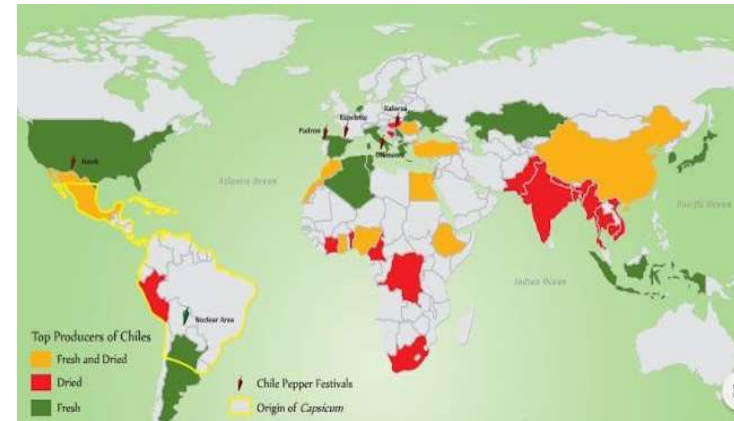
Origins of the Chili Pepper

- Chiltepin ('chil-tə-pēn), a wild chile pepper that originated in southern Brazil/Bolivia, is now also found in Peru, Mexico and the Southwest US; considered by some the mother of all peppers. Aka bird pepper, bird's eye pepper
- New fossil evidence shows prehistoric people from southern Peru up to the Bahamas were cultivating varieties of chilies millennia before Columbus' arrival brought the spice to world cuisine.
- PreColumbian use of chile peppers confirmed in the Valley of Oaxaca, Mexico via Paleoethnobotany procedures
- Chili comes straight from the Nahuatl (Language of the Aztecs) word chilli, meaning "hot pepper" with common variants chilli and chile
- Brought to Europe by Columbus (1492/3); to the east and Africa by the Portuguese; to North America by the Indians, Spaniards and birds!



Fun Fact:
Texas named the chiltepin the state's "official native pepper" in 1997.

The World According to Chile Peppers



Source: *The World According to Chili Peppers*, Gerald Zhang-Schmidt & Crystalyn Delacruz, *Food: An Atlas* (pg 18), 2013, *Guerrilla Cartography* (<https://www.guerrillacartography.org/>)

Pepper Production in the U.S.

Bell Peppers

- Bell pepper production occurs all over the world; top producing countries, listed in descending order, are **China, Mexico, Turkey, Indonesia, and U.S.** India is the top producer of pungent peppers.
- **U.S. produced 1.6 billion pounds** in 2017 but **consumed 2.23 billion pounds** importing 35% of the total amount to meet consumer demand.
- Top states for bell pepper production in descending order are **California, Florida, Georgia, North Carolina, Ohio, New Jersey, Michigan, and New York.**
- A majority (72%) of bell pepper imports to the U.S. are sourced from Mexico.
- Approximately 256 million pounds were **exported in 2016 primarily to Germany, Canada, Japan, and the United Kingdom.**

Jalapeno Peppers

- From 1995 to 2005, the consumption of chili peppers increased by 38% from an average of 4.3 pounds per person from 1993 to 1995 to 5.9 pounds per person from 2003 to 2005.
- The majority of U.S. commercial **jalapeño supply is grown in New Mexico, Texas, and California.**
- Many small farms throughout the southwest grow peppers for sale to local markets.
- Jalapeños are also imported to the U.S.
- In 2019 the U.S. harvested **10,200 acres of jalapenos valued at 63.7 million dollars**, which was down from 2014 with 19,100 acres harvested valued at 216.1 million dollars.

Source: The Food Source Information Wiki Colorado Integrated Food Safety Center of Excellence
<http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/foodsafety/Pages/default.aspx>

Pepper Taxonomy

- Family: Solanaceae (Nightshade); includes tomatoes, eggplant, potatoes
- Genus: Capsicum
 - Tropical, perennial, shrubby plants having many-seeded fruits: sweet and hot peppers; in the absence of winter frosts, it can survive several seasons and grow into a large, shrubby perennial
- Five Domesticated Species:
 - C. Annuum (AN-yoo-um)
 - C. Chinense (chi-NEN-see)
 - C. Frutescens (fro-TESS-enz)
 - C. Baccatum (BACK-uh-tum)
 - C. Pubescens (pew-BES-senz)
- Numerous Wild Species

Fun Fact:
Domesticated means that the species has been cultivated by humans and refined over many generations.

Capsicum Annuum



Origin: South America, many early varieties domesticated in Mexico

Popular varieties: Bell, jalapeño, cayenne, poblano,...

- Heat levels range from none, like bell peppers, to very spicy, like the assam and cayenne peppers.
- Size ranges from enormous and thick walled (bell) to tiny, berry-like pods (bird pepper).
- This species is home to the full range of color in peppers and plants. The fish pepper plant has beautiful white and green variegated leaves and striped peppers turning to red is a standout.

Source of Species Summaries – PepperGeek
<https://peppergeek.com/capsicum-pepper-species/>



Capsicum Chinense



Origin: South and Central America

Popular varieties: Habanero, scotch bonnet, ghost pepper, 7 pot peppers, datil...

- This species is home to some of the hottest pepper varieties in the world ranging to over 1 million on the Scoville scale. Chinense peppers are typically pungent with powerful floral flavors; some have notes of citrus.
- The chinense species is known for having some of the 'ugliest' peppers, with wrinkled skin and long, stinger-like bottoms.
- This is one of the most popular species for cross breeding.



Capsicum Frutescens



Origin: South and Central America

Popular varieties: Tabasco, piri piri,...

- These peppers are typically medium-spicy with thin walls and small pods. Most varieties have a bullet shape and ripen to red or orange.
- The famous Tabasco Brand hot sauce uses a single pepper variety from the frutescens species.
- Some consider the flavor uninspiring, but great peppers to add heat when cooking.



Capsicum Baccatum



Origin: South and Central America

Popular varieties: Aji Lemon Drop, Brazilian starfish, Bishop's Crown,...

- This species come in a wide variety of long and slender or more curled and bizarre shapes. Flavor ranges from super sweet and fruity to bitter and earthy.
- Plants are often very tall and highly prolific with some varieties having pendulum-like hanging pods and long stems.
- There is a lot of breeding activity going on with respect to the baccatum varieties, e.g., sugar rush peach is a hit for its spicy pods and high yields followed by the sugar rush striped pepper.



Capsicum Pubescens



Origin: Bolivia, Peru

Popular varieties: Rocoto, manzano, locoto,...

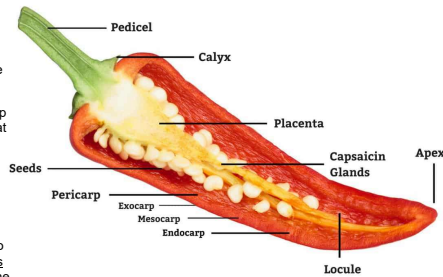
- Known for their 'hairy' foliage, *Capsicum pubescens* seeds are jet black, and the plant's flowers are purple. Known as the 'tree pepper,' ripe pods are thick walled and juicy.
- This species contains some of the only known cold-resistant pepper varieties. Some plants maintain a low and wide structure with small leaves while others can grow to be quite tall.
- Heat varies but can be quite spicy. The pepper shape is usually rotund, ranging from apple-like to more oblong.

Why Grow Peppers: Nutrition & Health Benefits

- Peppers are a low-calorie food packed with nutrition
 - Vitamin C (boosts the immune system); increases with color
 - Flavors range from mild-sweet, tangy, fruity, citrusy, to smoky
 - Culinary uses range from dried spice, sauce, green vegetable, and ingredient in prepared foods across the globe – stuffed, roasted, sauteed, pickled
 - o <https://www.epicurious.com/ingredients/20-types-of-peppers-and-their-uses-article>
- **Capsicum** is derived from the Greek word, *kapos*, "to bite". **The heat comes from a group of alkaloid chemicals called capsaicinoids, principally capsaicin and dihydrocapsaicin.**
 - Capsaicin relieves pain from shingles (Herpes zoster) and diabetic nerve degeneration.
 - Capsaicin ointments relieve sore muscle and arthritis pain.

...in his influential herbal of 1652, English botanist Nicholas Culpepper wrote that cayenne was "this violent fruit" that was of considerable service to "help digestion, provoke urine, relieve toothache, preserve the teeth from rottenness, comfort a cold stomach, expel the stone from the kidney, and take away dimness of sight."

Pepper Parts



- **Pedicel:** stem that attaches the flower or fruit to the plant.
- **Calyx:** part of the stem that connects to the very top of the chili pepper; has outer parts called sepals that are made up of leaves to protect the plant's flower.
- **Seeds:** the reproductive part of the plant. They are not the main source of the heat in chili peppers as they are relatively low in capsaicin compared to the placenta.
- **Placenta or Pith:** attaches the seeds of the plant to the top of the fruit; lies directly below the calyx. This part of the plant is where most of the capsaicin in the chili pepper fruit resides.
- **Capsaicin Glands:** positioned between the placenta and the seeds. If you want to lessen the heat of a hot pepper, this is the part that you will want to remove.
- **Pericarp:** the whole wall of the fruit consisting of three layers:
 - Exocarp (shiny, waxy outermost layer) 's function is primarily protective.
 - Mesocarp (middle wall) provides structural support and holds much of the fruit's water content.
 - Endocarp (innermost part) is the thin, membranous lining of the pericarp that encloses the placenta and the seeds.

Shoulder: rounded part of the pericarp just below the calyx.

Apex: the rounded tip of the fruit. Different varieties of hot peppers are rounded to different degrees. The apex of the chili pepper has the least amount of capsaicin in the whole fruit, so if you're concerned with overall heat, use this portion of the hot pepper first.

Locules: Locules are the chambers within a fruit that contain the seeds. The number of chambers in chili peppers can vary. Some peppers have as many as four locules while others have only one. The locules in hot peppers are separated by placental walls.

Source of Image & Description: <https://www.pepperscale.com/pepper-anatomy/>

Measuring Pungency of Peppers

- In 1912, Wilbur Lincoln Scoville, a chemist, award-winning researcher and professor of pharmacology developed the organoleptic test, which uses human testers to measure pungency in peppers.
- A sample of chili was prepared and repeatedly diluted with water until the test subjects no longer felt any heat. The degree to which the subjects could (subjectively) taste no more heat in the sample was called SHU (Scoville Heat Units)
- Today, the degree of pungency of a chili is determined by means of modern high-performance liquid chromatography (HPLC) which measures the capsaicin.



Fun Fact: His book, *The Art of Compounding*, makes one of the earliest mentions of milk as an antidote for pepper heat.

Scoville Scale

Search the Scoville Database:
<https://scovillescale.org/chili-pepper-scoville-scale/>

Public Service Announcement:
 Peppers ranking high on the Scoville Scale have very high levels of capsaicin, which can cause a burning sensation on the skin. It is extremely important to use caution when cutting them and cooking with them. Wear gloves and avoid touching your face and eyes when working with hot peppers.

Scoville Scale

EXTREME HOT
 1,5 MIO+ SHU / 10+++
 Carolina Reaper, Trinidad Moruga Scorpion, 7 Pot Douglah

FIERY HOT
 1,0 MIO+ SHU / 10++
 Bhut Jolokia, 7 Pot Lucy, Naga Viper, Komodo Dragon

REALLY HOT
 500 K+ SHU / 10+
 7 Pot Yellow, 7 Pot Bubblegum, Red Savina

VERY HOT
 250 K+ SHU / 10
 Habanero, Fatalii Yellow, Devil's Tongue Red

SPICY HOT
 100 K+ SHU / 9
 Scotch Bonnet, Pimenta de Neyde, Jamaican Hot Yellow

HOT
 50 K+ SHU / 7 - 8
 Rocoto, Thai Peppers, Chiltepin, Charleston Hot, Pequin

MILD HOT
 2,000 - 50 K SHU / 3 - 6
 Jalapeño, De Arbol, Lemon Drop, Tabasco, Serrano, Cayenne

MILD
 0 - 2,000 SHU / 1 - 2
 Bell Pepper, Lombardo, Anaheim, Golden Greek, Ancho Poblano
 scovillescale.org

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Questions?

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Pepper Growing Basics

- Peppers are a warm season crop that performs well when temperatures are:
 - 70 to 80°F during the day
 - 60 to 70°F during the night
- 8 or more hours of sunlight
- Fertile, organically rich, and well-drained soil with a pH of 6.0-6.8
- Typical maturity for peppers:
 - 52-100 days; Super-hots can take 100-150 days
- Due to maturity time, peppers are started inside and transplanted after frost danger is past and temperatures increase

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Quick Facts for Northern Virginia

- Arlington & Alexandria, Virginia are in Zone 7a/b of the USDA Plant Hardiness Map
- Average last killing frost (Spring): 4/1 to 4/10
- Average first killing frost (Fall): 11/1 to 11/10
- Growing season of >180 days ←
- Hotter summer days (>90°F) & nights (>70°F)
- Average annual rainfall in this area: ~40 inches
 - In 2018, we broke a longstanding record for annual rainfall with 64.4 inches of rain; in 2020, 57.3 inches
- Clay Soils Dominant

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Nominal Schedule for Zone 7

- **January/February:** get seed catalogs, plan garden, test soil
- **March/early April:** prepare soil – cultivate, mix in organic matter; start seedlings indoors, start select cool weather crops
- **Late March/April:** plant cool-weather crops outdoors, mulch
- **May (Mother's Day Rule):** plant warm-weather crops (seeds and transplants) outdoors, mulch
- **June/July/August:** nurture, water, fertilize, harvest!
- **August:** plant cool-weather crops for fall harvest, preserve your vegetables for winter enjoyment
- **Fall:** start sheet composting over turf for new garden next year, clean up existing beds, mulch for the winter, plant cover crop



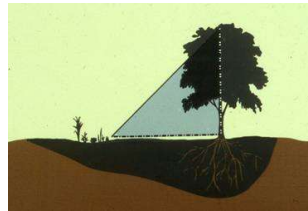
Growing Choices

- What do I plan to do with the peppers?
- How much do I need/want – variety and quantity?
- What is my heat threshold?
- How much space do I have? Where will I grow them:
In-ground, container, raised bed?
- Will I buy seeds and grow my own transplants or buy transplants?
- How much time do I have for taking care of the plants?



Where to Grow Peppers

- Optimum Growing Conditions
 - 6-8+ hrs of sunlight
 - Good air flow & drainage
 - Adequate water supply
 - Wind protection
 - Healthy soil (soil test?)
 - o Prefers pH 6.5-6.8
 - o N-P-K balance
 - o Organic matter
- Some Choices
 - Traditional garden
 - Raised bed
 - Containers (Inside or Outside)



What/How Many...Reality vs. Desire

- Consider where you will plant & how much space you have/will need
 - Traditional rows: 12-24" plant spacing; 30-36" row spacing
 - Raised bed/square foot: 18-24" plant spacing
 - Containers or grow bags: 3-5 gallon with drainage
 - Allow spacing for stakes or cages to support plants
- Grow what you like to eat:
 - Basic Fruit Types: Sweet (Bell, Banana, Shishito); Mild (Jalapeno, Fresno); Hot (Habanero, Thai, Jamaican); Super Hots
 - Colors: Green, Yellow, Orange, Red, Purple, Black

Growing Medium for Containers

- Select a high quality, organic potting mix; typically have fertilizer incorporated
- Avoid garden soil
 - Insects, weeds, and disease
 - Clay holds too much water and too little air
- Avoid soilless mixes
 - Sterile with few nutrients
 - Too light to support plant roots
 - In light containers, taller plants may blow over
- Avoid mixes with water-absorbing polymer products
 - Can pull moisture OUT of tiny root hairs



Buying Transplants

- Peppers are typically grown using transplants vs. direct sowing due to maturity considerations
- Sources of pepper plants:
 - Retail stores: Nurseries, hardware stores, national big box stores
 - Online seed companies
 - Friends, neighbors, fellow gardeners, local plant sales & farmers markets
- Check for varieties offering disease resistance
- Check underside of leaves for spots, or insects
- Check general vitality of the plant
- Check the growing container
 - Is the plant root bound?



Growing Your Own Transplants

PROS

- Allows you to grow crops & cultivars you like best - no need to plant only what's available in retail stores
- Gives you better control over germination conditions and timing for transplanting in the garden or containers
- May (eventually) save you money vs. buying plants
- Very satisfying to grow your own transplants
- Can get kids involved



CONS

- There are initial and annual start-up costs to consider (seeds, seed starting and potting soil, grow lights, trays, pots, etc.)
- Requires dedicated space for period of 2 months or more
- Requires near daily attention to ensure adequate water and light
- Time commitment can become overwhelming



Seed-Starting Supplies

- South-facing window or grow light(s)
- Seed-starting soil
- Containers
- Tray with cover or plastic wrap
- Pepper seeds; seeds viable for 4 years
- Spray bottle with water
- Heat pad (optional)
- Fan or other air source



More Info: VCE Publication 426-001 Plant Propagation From Seed



Planting Seeds

- Start seeds indoors 8-10 weeks before last frost: early Feb-early April.
- Fill your container with seed-starting mix and add 2-3 seeds to each section or container and soak with warm water.
- LABEL EACH CONTAINER WITH A STICKER, SHARPIE, OR DRAW A DIAGRAM.
- Then cover lightly with additional soil and cover with plastic top or plastic wrap and place in warm place to germinate or on heat pad or refrigerator top.
- Keep moist but not soaking wet; remove top or wrap if condensation forms and drain off.
- Your seedlings should poke through in X days (per seed packet) with first set of leaves called seed or cotyledon (kāde' lēdn) leaves.



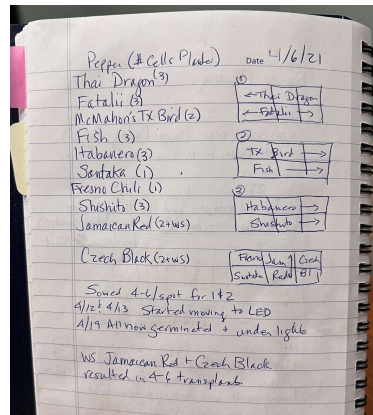
Caring for Seedlings

- Once you have your seed leaves, remove cover/plastic wrap and place in south-facing window or under grow lights for 12-18 hr daily
- Keep plants 1-2" from grow lights to avoid weak, leggy seedlings, turning frequently; put under fan for brief periods to toughen stems
- Water from the bottom but do not allow them to sit in water; it's best for plants to dry out a bit in between watering
- When seedlings have 1-2 real sets of leaves, transplant using potting soil into larger containers, 3" peat pots work well



Seed Starting Experience (2021)

- Planted 10 varieties of peppers in 24 numbered cells on 4/6
- 13 days later (4/19), all were germinated and under lights
- Fertilized 4/22 with weak fish fertilizer solution
- Transplanted 57 plants into 3" pots 5/2
- Planted into garden 5/22



Keep Records...Take Pictures...Keep Notes

Seed Starting Photo Diary



72-cell tray on a heating pad



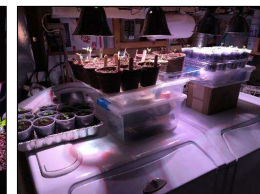
Seedlings under LED lights



Upsizing into 3" pots & cups



Under lights 12-18 hrs



Moving plants close to lights



Moving outside to harden

Questions?

Hardening Off Transplants

- Decrease watering & stop fertilizing 2 weeks before transplanting
- Lower temperature before transplanting
- Over 5-7 days, gradually expose to
 - Wind
 - Sunlight
 - Fluctuating temperatures



When to Plant Transplants

- For Arlington/Alexandria in Zone 7a/7b:
 - Transplant Window: April 30-July 19
 - Harvest Window: July 9-October 17
- Planting date depends on readiness of transplants (size and hardened) and expected maturity.
- Look for night temperatures forecast 55°F for at least 7 days.
- Recommend transplanting on a cloudy day or in the evening.

How to Plant Pepper Transplants

- About an hour before transplanting, thoroughly water plants and soil in the containers (pots, bands, flats, etc.). Don't let roots dry out.
- Try to keep as much soil as possible with each plant when removing from growing container.
- Dig a hole large enough so that the transplanted plant sets at the same depth as the growing container.
- Fill the hole around the plant with soil and firm the soil tightly around the plant.
- Lightly water or pour approximately one pint of diluted fish emulsion around each plant to wet the soil around the roots.
- Set your pepper supports in place.
- Protect plants from heat, wind, or cold if necessary.



Companion Planting

Friends

- Asparagus
- Carrots
- Cucumbers
- Eggplant
- Garlic
- Mustard
- Okra
- Onion
- Peas
- Squash
- Swiss Chard
- Tomatoes
- Basil
- Marjoram
- Oregano
- Parsley
- Rosemary
- Sage
- Geraniums
- Petunias
- Sunflower

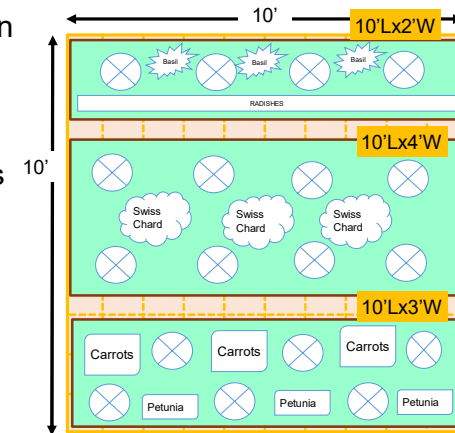
Enemies

- Beans
- Broccoli
- Brussels Sprouts
- Cabbage
- Cauliflower
- Collards
- Kale
- Kohlrabi
- Turnips
- Fennel



Sample Layouts/Companion Planting

- Use space between plants to add other vegetables, herbs, or flowers in rows, beds, or containers
- Do not intercrop with:
 - Vegetables: brassicas (e.g., broccoli, kale), beans
 - Herbs: fennel



Gambling on the Weather

- Avoid the temptation to put peppers in the ground too early. Tender plant roots may not be able to absorb nutrients from cold wet soils, which will lead to poor growth later.
- If you do plant early in the season, closely monitor weather reports for news of an unexpected frost. If predicted, be prepared to protect your tender plants. You can try protecting your plants with a light sheet or newspaper or a hoop/row cover.

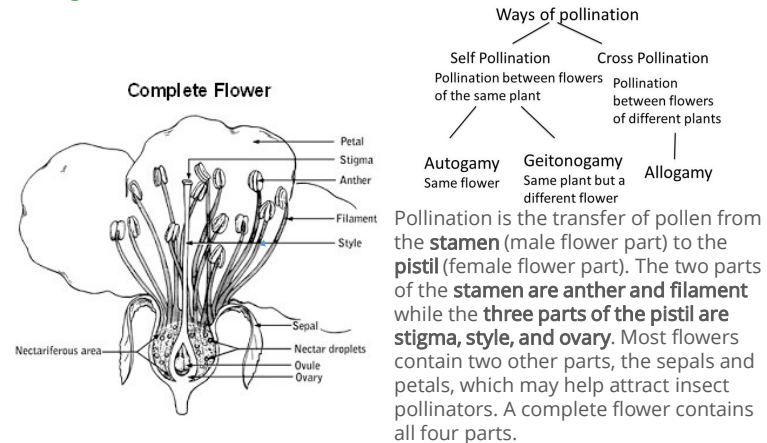


Care of Pepper Plants

- Mulch around plants once established to keep down weeds, protect from high temps and keep in moisture
- Prune away any leaves that touch the ground to prevent transfer of soilborne diseases to the plant and promote airflow
- Support bushy, heavy-yielding plants with 2- or 3-foot-high cages or stake them.
- Critical to water when flowering or fruiting
 - Water at base soaking thoroughly to ensure 1"/week if insufficient rain
- Side-dress plants after first fruit set with a (low N)-P-K fertilizer.



Key Pollination Concepts



Source: Pollination of Vegetable Crops, University of Georgia Extension

<https://extension.uga.edu/publications/detail.html?number=C934&title=Pollination%20of%20Vegetable%20Crops#Pollination>



Four Ways to Improve Pollination

1. Plant flowers nearby to attract pollinators.
2. Give plants a shake now and then once flowers form...you should see fallen pollen around the petals.
3. Stick your finger into the flower and gently move it around to transfer pollen.
4. Insert a Q-tip into the flower and transfer pollen from one flower to another



Surviving Periods of Extended High Temperatures

Fruit set hampered by: Day temp >90°F | Night temp >70°F

- Pay attention to watering
- Keep roots cooler (mulch)
- Provide some shade (row cover)
- Be patient
...Peppers your reward patience in Sep & Oct



Harvesting Peppers

- Begin harvesting when peppers reach a usable size. Know your variety!
- Cut peppers using shears – don't pull.
- Peppers will not ripen further after harvesting, i.e., turn from green to red.
- Leave some peppers on the plant to ripen fully. The peppers will change color and develop greater levels of vitamins A and C.
- Don't let all peppers stay on the plant as this will cut off further blossoming and fruit set.
- Refrigerated peppers will last 2-3 weeks. Peppers can also be frozen.



Questions?

Pepper Diseases

- Fungal
 - Anthracnose
 - Cercospora (Frogeye) leaf spot
 - Damping-off
 - Gray leaf spot
 - Powdery mildew
 - Southern blight
 - Verticillium wilt
 - Bacterial spot
- Bacterial
 - Bacterial canker
 - Bacterial wilt
- Viral
 - Mosaic (Cucumber mosaic virus (CMV)/ Potato virus (PVY)/ Tobacco mosaic virus (TMV)
 - Tomato spotted wilt virus
 - Phytophthora blight (Late blight)



Pepper Pests

- Mites
 - Spider mites
- Insects (cont'd)
 - Stink bugs
 - Thrips
 - Tomato fruit worm (Corn earworm)
 - Whiteflies
- Insects
 - Aphids
 - Beet armyworm
 - Colorado potato beetle
 - European corn borer
 - Flea beetle
 - Leafminers
 - Leafroller
 - Pepper weevil

MGNV Between the Rows: June Pests
<https://mgnv.org/plants/veg-herbs/between-rows/beatng-the-bugs/june-tomatoes-peppers-pests/>

Learn to ID Ones That Really Bug Us.....



Aphids

Brown Marmorated Stink Bug

Colorado Potato Beetle

(Source: Courtesy of David R. Lance, USDA APHIS PPQ, Bugwood.org)



Damage from Chili Thrips

Whiteflies

(Source: University of Florida)

Wealth of Information Available Via VCE & Other University Sites

- **Pepper, Bell | Diseases and Pests, Description, Uses, Propagation**
<https://plantvillage.psu.edu/topics/pepper-bell/infos>
- **Plant Problem Image Gallery**
<https://apps.cals.vt.edu/ppig/>
- **Symptoms and Signs for Plant Problem Diagnosis – An Illustrated Glossary**
https://www.edustore.purdue.edu/item.asp?Item_Number=BP-164-W
- **Garden Insects Pests**
https://www.pubs.ext.vt.edu/tags.resource.html?tag=pubs_ext_vt_edu:garden-insects-pests#.html
- **Garden Plant Diseases**
https://www.pubs.ext.vt.edu/tags.resource.html?tag=pubs_ext_vt_edu:garden-plant-diseases#.htm



Pepper Disorders Caused By Imbalance

- **Blossom-end rot:** Caused by low calcium within the plant which leads to a water-soaked area on end of fruit
- **Magnesium deficiency:** Rare in field-grown peppers but can arise in sandy soils when heavy rain causes leaching
- **Nitrogen deficiency:** Plants exhibit reduced growth and leaves smaller than normal, general yellowing; start with older leaves
- **Salt Injury:** Excessive salt concentration in the soil or irrigation water can result in significant crop losses. Injury often develops after light rains or light irrigations that wash salts into the root zone.



Chile Pepper Disorders Caused by Environmental Stress

- **Cold Soils:** plants experience chilling injury with prolonged temps of 32-50° F. Injury may show up as puckering of the leaves and stunting of the plant. Night temperatures of 45-50°F during pepper flower development can cause the fruit to be smaller than normal, or somewhat misshapen. (Source: *The Effect of Extreme Temperatures on the Tomato and Pepper Crop*, MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS, http://www.omafra.gov.on.ca/english/crops/facts/info_tomtemp.htm)
- **Flower Drop:** occurs when buds, flowers and immature pods drop (abort) from the plant. The problem can be caused by a number of different stress conditions. Any factor that inhibits pollination can cause flower drop. The most common stress factors associated with this disorder are high temperature stress, insufficient water, strong wind, high relative humidity, insect damage and nutrient deficiency, toxicity or imbalances. The best management practice is to ensure proper water and fertilization during flowering. Some cultivars appear to be less susceptible to flower drop than others.
- **Sunscald:** occurs on pepper fruit exposed directly to intense sunlight. This damage often occurs when shaded fruit is suddenly exposed to the sun. Sunscald may occur on foliage when intense sunlight is combined with high temperatures. Defoliation or prolonged wilting caused by other diseases, such as powdery mildew, bacterial leaf spot, Phytophthora root rot, Verticillium wilt and root-knot nematodes, can contribute to problems with sunscald.
- **Wind Injury:** can damage pepper plants in several ways: rapid desiccation of the foliage or hypocotyl. When this occurs on young seedlings, the plants will fall over and die. On older plants, desiccated foliage may wilt beyond recovery. Wind injury also may result in physical damage to the foliage or in broken stems or branches. Physical damage to seedlings occurs from wind whipping the plants back and forth. These plants typically snap off where callus tissue forms at the soil line following injury. (Source: *College of Agriculture, Consumer and Environmental Sciences New Mexico State University, Guide H-249, Natalie P. Goldberg, Extension Plant Pathologist, March 2004* http://aces.nmsu.edu/pubs/_h/H249.pdf)



Ready to Get Creative?

- **Crossing Chili Peppers:** Create a new pepper variety
- **Overwintering Chili Peppers:** Take advantage of pepper's status as a perennial and bring it inside
- **Seed Saving:** Save money; be surprised



Best Management Practices

- Test the soil to learn the pH and nutrients already present
- Determine soil drainage capacity before planting
- Improve compacted soil by aerating, double digging, incorporating organic matter
 - Plant cover crops/green manures to improve soil nutrients & structure
- Practice right plant, right place to take advantage of garden microclimates - hot areas, light angles & moisture sinks - when planning your garden layout
- Select cultivars of plants & seeds bred for resistance & tolerate local conditions
- Use companion planting/intercropping to attract beneficial insects, take advantage of symbiotic biochemical and cultural benefits before taking remedial action using the least toxic alternative
- Identify insects (friend or foe), diseases or weeds and susceptible life cycle stages; and evaluate the extent of the problem
- Rotate crops to avoid the build up of pathogens & pests in the garden



Virginia Cooperative Extension (VCE) & Master Gardeners of Northern VA

- Volunteers serving Arlington & Alexandria
- Promoting public education on environmentally sound gardening practices since 1985 through:
 - **Help Desk Support via email**
 - o mgarlalex@gmail.com
 - **Plant Clinics at Arlington/Alexandria, Farmers Markets and Libraries**
 - **Free Virtual Classes**
 - o <https://mgnv.org/mg-virtual-classroom/>
 - **Demonstration Gardens, including organic vegetable garden**
 - **Online resources:** <https://mgnv.org/>
 - o Search tip — site:edu, site:gov



Potomac Overlook Organic Vegetable Garden

NOTE: Surveys collect information to verify our community service and need for continued funding. Please complete!

MGNV Online Garden Resources

- **Between the Rows** – MGNV's online monthly guide on WHAT to do WHEN for veggie gardening
<https://mgnv.org/veg-herbs/between-rows/>
- **Master Gardener Virtual Classroom** – a treasure trove of recorded training classes on topics ranging from Vegetable Gardening Without Fear to Edible Landscapes to Seed Starting to Soil Improvement and more
<https://mgnv.org/mg-virtual-classroom/>
- **Vegetable Gardening Online Resources** – a collection of resources that supplements this presentation
https://mgnv.org/resources/veg_references/

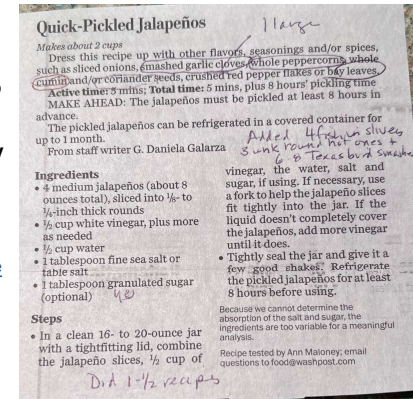
Resources for Gardeners Living Outside of Northern Virginia

- **Find Your Local Cooperative Extension Office**
<https://nifa.usda.gov/land-grant-colleges-and-universities-partner-website-directory?state=All&type=Extension>
- **USDA Plant Hardiness Zones**
<https://planthardiness.ars.usda.gov/>
- **Plant Maps including Hardiness Zone Maps, First/Last Frost Maps, Gardening Maps, Climate Maps and Horticultural Maps**
<https://www.plantmaps.com/>

Questions?

Favorite Ways to Use Peppers

- **Quick-Pickled Jalapeños**, Washington Post
- **Homemade Sriracha Hot Sauce** (We use cheesecloth to ensure no seeds after processing) <https://whiteonricecouple.com/sriracha-recipe/>
- **Candied Jalapeños aka Cowboy Candy** <https://www.foodiewithfamily.com/candied-jalapeños/>
- **Chicken Philly Cheesesteak-Stuffed Bell Peppers** <https://healthyishfoods.com/chicken-philly-cheesesteak-stuffed-peppers>
- **My Riff on Mom's Sausage & Peppers**
- **Dona-sagna (Poblano Peppers)**



References

- **Peppers**, University of Maryland (UMD) Extension Resource <https://extension.umd.edu/resource/peppers>
- **The Chili Pepper Institute**, New Mexico State University <https://cpi.nmsu.edu/index.html>
- **Peppers**, Johnny's Selected Seeds Growers Library <https://www.johnnyseeds.com/growers-library/vegetable-library/peppers/>
- **Search the Pepper Scoville Database** <https://scovillescale.org/chili-pepper-scoville-scale/>

Informal Pepper Resources

- **Facebook Groups:** Pepper Growing For Beginners | Pepper Lovers | Hot Pepper Growers Advice, Tips and Tricks
- **TheChileman.org** https://www.thechileman.org/guide_home.php
- **Pepper Geek** <https://peppergeek.com/>
- **PepperScale** <https://www.pepperscale.com/>

