# Season Extension Techniques

as practiced by members of Tucson Organic Gardeners


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# What is meant by Season Extension? (overview)

**A gardening practice that allows you to grow and harvest your crops outside the expected window.**

- Extending the season on the back end (harvesting summer crops into December)
- Getting a jump on the season by starting varieties early and using kitchen variety propagation cheats
- Choosing varieties that are cold, heat (drought) or bolt resistant
- Growing select varieties as perennials

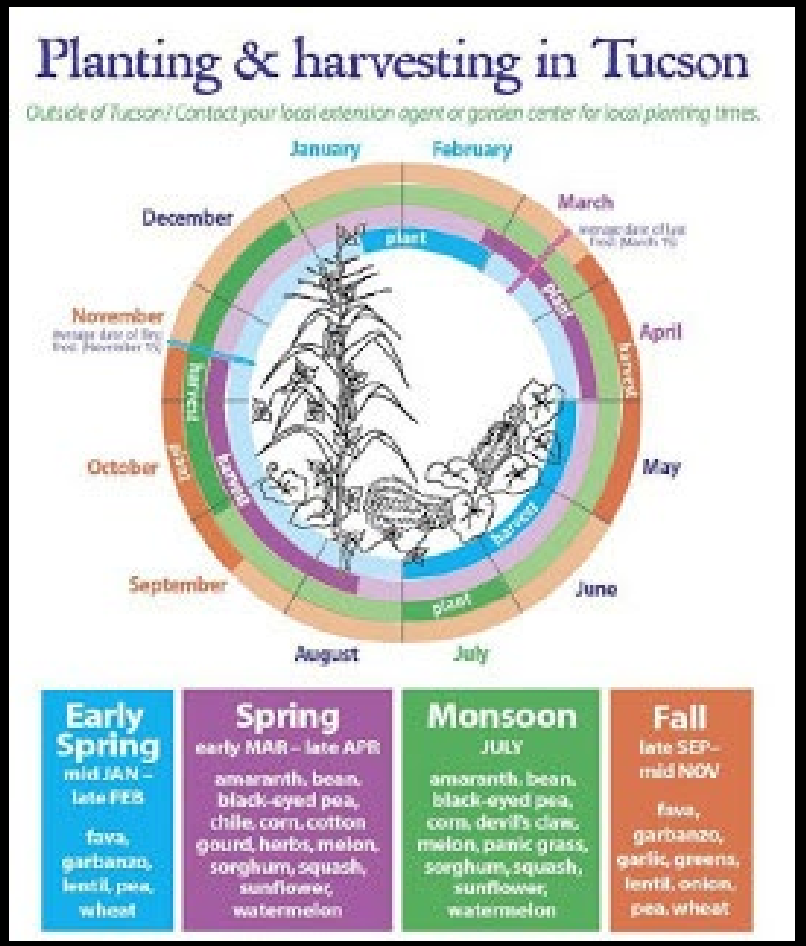
**Although it is technically possible to plant 12 months a year in Tucson, we have three major planting seasons:**

**Spring – soil temperatures gradually warming**

**Monsoon – making use of rainwater**

**Fall – the best planting season of all**

Depiction of seasonal labor, Vezelay Cathedral, France, 1120-1132 CE.




One of 12 pairs of chariot wheels sculpted into the flanks of the Sun Konark Sun Temple, NE India, 13th century CE.

# Cold Season Strategies (November through February)


First, be mindful of what and when you need to protect. Keep an eye on the weather forecast and know how the temperature of the **your** garden compares to the official (Airport) temperature. Adjust your expectations accordingly.

Frost is most likely on cold, clear, dry, windless nights.

# How Cold is Cold?

- Super-sensitive plants. Stevia will die at temperatures below 40 F so take your stevia plants inside for the winter.
- **Light frost** – 32-29 F Some plants like tomatoes, basil, squash and eggplants, can stand a little frost and will survive the occasional night when temperatures dip into this range, but production and ripening of fruit will be hampered. It is best to cover your summer veggies if you want to keep them going.
- 28 –25F (Sometimes called **Hard or Killing Frost).** Your summer veggies will not survive these temperatures without your intervention. You can try heroic methods to keep these plants alive in the ground but at some point it might be better just to tear out your plants and replace them with winter crops.
- Brassicas will do just fine and should even improve in flavor at these temperatures, but cover your lettuce, peas, flowers like nasturtium, and some herbs. Cover citrus! You do not need to cover deciduous trees like figs, pomegranates, quince or any stone fruit.
- **Severe frost** – Below 24 F. That's cold enough to harm most plants, but there are exceptionally cold tolerant plants that can survive these temperatures. Cover all your vegetables as well as citrus if severe frost is a possibility.

# Different plants tolerate different degrees of cold

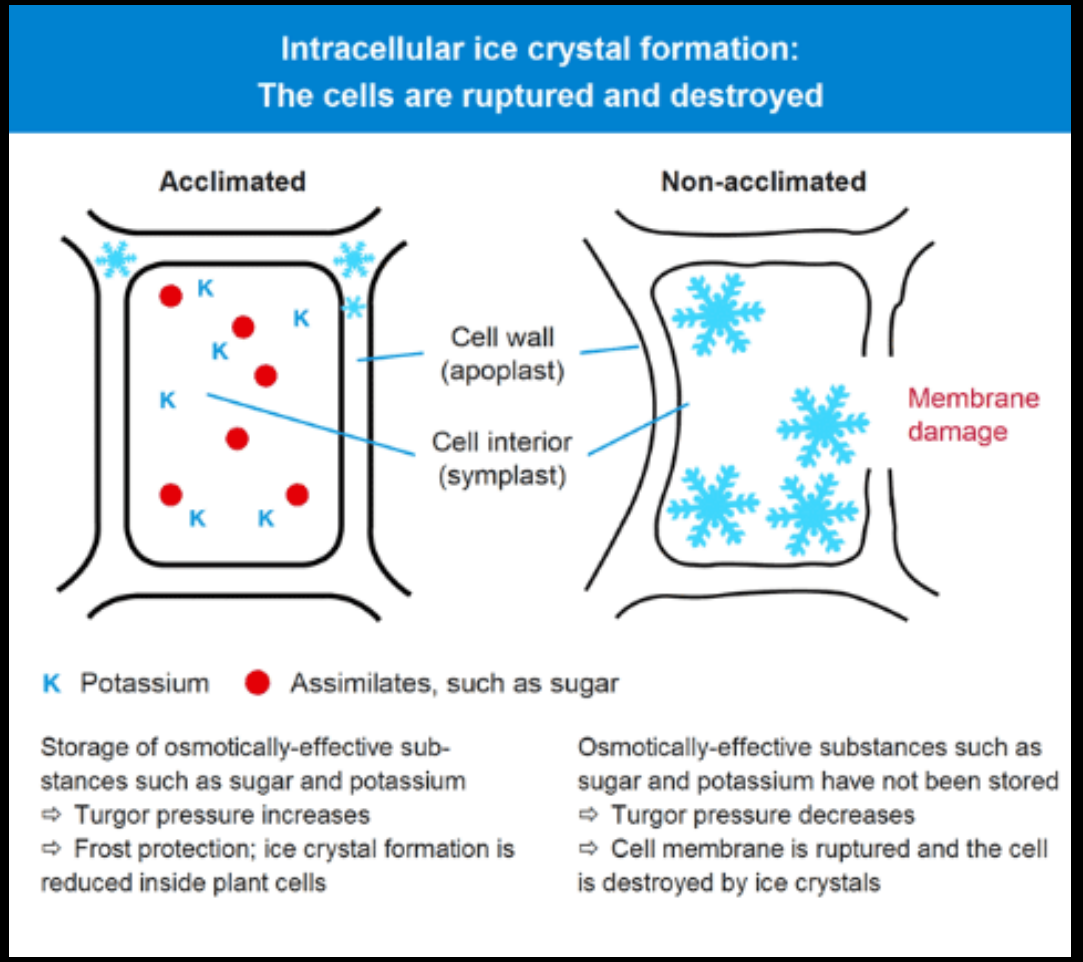
| Very Sensitive | Survives Light Frost | Frost Tolerant |
|---|---|---|
| Sweet Corn | Broccoli | Beets |
| Bush beans | Cauliflower | Brussels Sprouts |
| Cucumbers | Kohlrabi | Cabbage |
| Eggplant | Leaf Lettuce | Carrots |
| Tomatoes | Mustard Greens | Onions |
| Peppers, Hot and Sweet | Spinach | Garlic |
| Pumpkin (vines) | Swiss chard | Turnips |
| Runner Beans | Pumpkins (fruit) | Kale |
| Summer Squash | Winter Squash (fruit) | Leeks |
| Melons | Cilantro | Peas |
| Winter Squash (vines) | Thyme | Potatoes |
| Watermelon | Mint | Radishes |
| Basil | Oregano | Green Onions |
| Marjoram | Rosemary | Chives |
| Stevia (Can die at under 40 degrees F!) | Lemon Balm | Parsley |
| Dill | | Sorrel |
| Borage | | Chives |
| Chamomile | | Sage |

# How Frost Kills Plants

**There are two ways by which frost kills plants**

1. Ice crystal formation inside cells. This is instantly lethal as cell walls burst

2. Water freezing in the extracellular spaces. The plant can die from desiccation, however, cold-tolerant plants have means to prevent dehydration.



# Cold Tolerant Plants

**a.** These plants accumulate solutes (such as sugar or other organic compounds) that lower the freezing point of water. This strategy is effective at temperature range of 32-20F. (Note the improved flavor of brassicas  due to their production of more sugar in response cold weather.) Anthocyanins, the red/purple pigments that plants produce in response to cold or drought, contain sugars.

**b.** Plant produces “antifreeze protein” that inhibit ice crystal formation in extracellular spaces

**c.** Plant produces protein called dehydrins in the cell cytoplasm; these bind the water molecules and change the structure of water in the cell.

**d.** Plant changes lipid (fat) composition of cell membranes

For more info: https://www.howplantswork.com/2010/01/07/how-plants-survive-the-cold-or-not/

# Protecting Plants from Frost Damage (overview)

- Cover them up!
- Locate or relocate plants to warm microclimate, such as by a wall or other thermal mass
- Provide additional heat source (lights, heating coils, manure heated hot bed)
- Frost Protect Spray?

Insulation

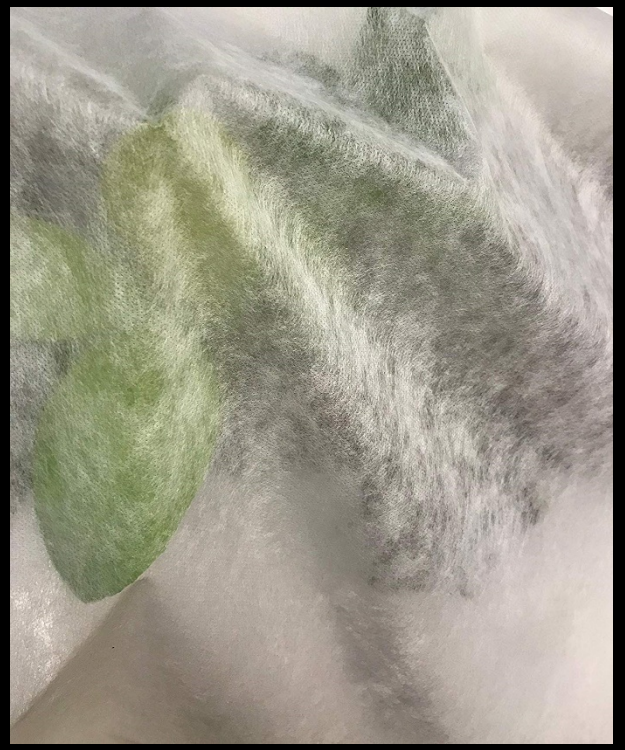
Thermal Mass


Added heat source

# Frost Cover Materials

Fabric, e.g. bed sheets or quilts. Do not leave in place more than a few days.

Natural burlap, made usually from jute fibers but occasionally from hemp or flax.



Lightweight frost blanket of spun polypropylene. Can transmit up to 85% of sunlight and is permeable to rain.


Heavyweight frost blanket

**Please do not cover your plants directly with plastic sheeting! Plants will die at point of contact with the plastic.**

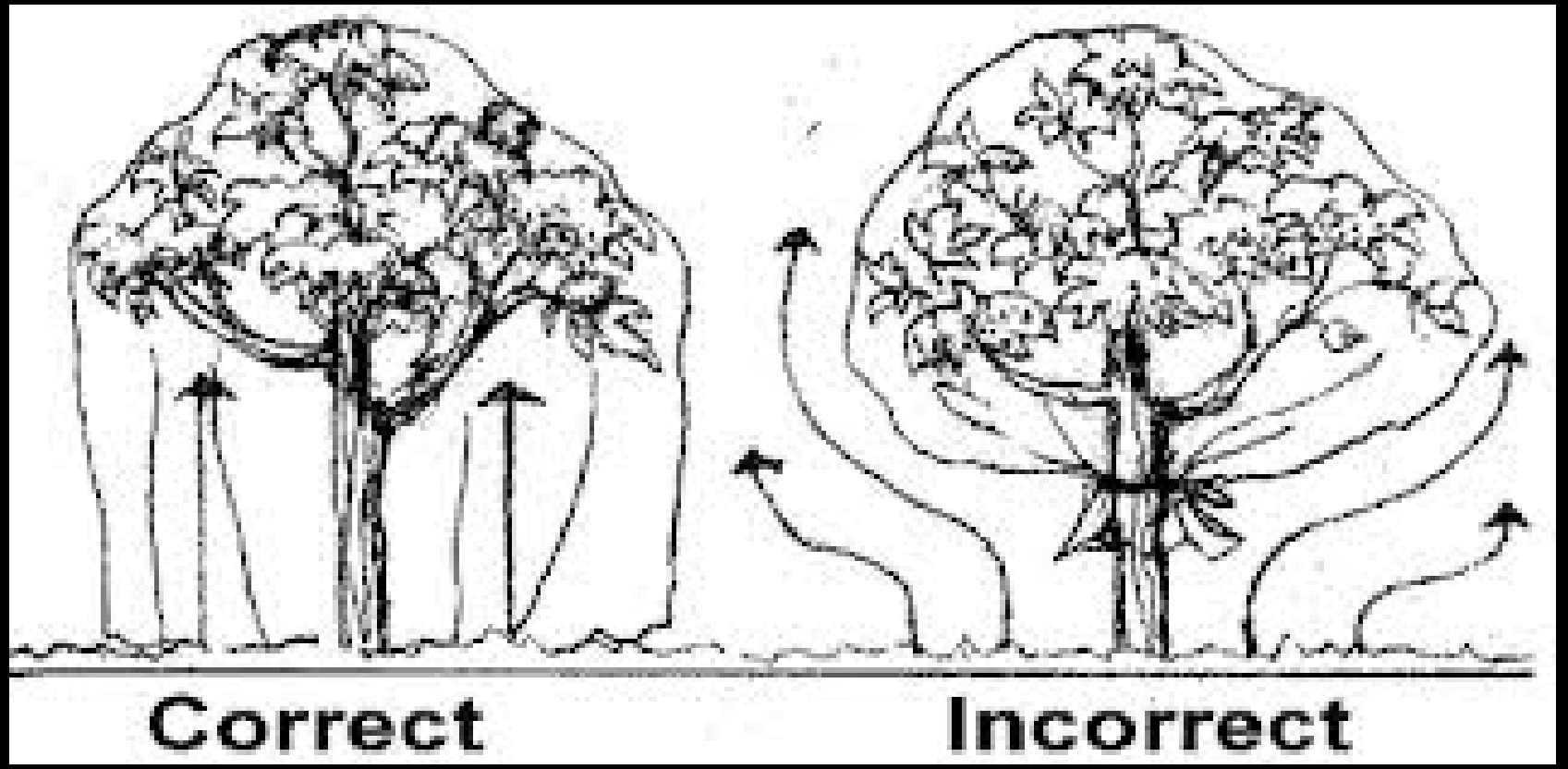
# Frost cover shapes/formats

**Frost cloth by the roll.** Gives you flexibility to address your needs. If you have a lot of plants this is a good  affordable option.



**Frost protection bags for individual plants.** This may be useful for long-term covering in colder regions, but not the best practice in our area.

# Caring for Frost Sensitive Trees




**Best practice for covering fruit trees like citrus.** Allow cover to drape so it collects heat and moisture rising from the ground. Do not “lollipop” the tree cover by tying it around the trunk.

# Caring for Frost Sensitive Trees, 2

1. Locate your citrus or other frost sensitive plants near a masonry wall. We planted a tangelo and Bougainvillea by an east facing wall. The sun shines directly on the west face all afternoon so the wall stores heat for the night.
2. If you are worried about the cover blowing off , build a structure around your young citrus tree that you can attach the cover to. When the tree was still young and vulnerable, I built a wooden structure around it for draping shade cloth in the summer and frost cloth in the winter.

# Floating Row Covers

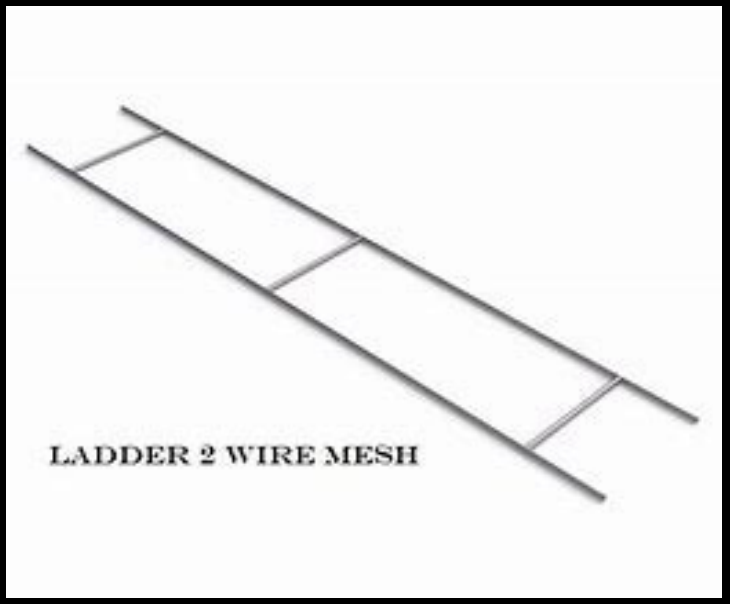
You can cut lengths of spun polyester row cover fabric off a roll and lay them directly on plants (weigh down edges with rocks, bricks or lumber) or you can buy an easy to install manufactured fabric “tunnel cloche” that elevates your fabric above your plants. If you opt for the readymade tunnel you will be stuck with dimensions that might not match those of your garden plot.

# Alternatively, you can purchase more flexible, lighter weight versions from boutique online garden supply companies.

Super Hoops (above) and High Rise Super Hoops (left) available at: https://www.gardeners.com/buy/super-hoops/39-392RS.html#start=9

# Joy Holdread's Garden Tips, 1

"I use the long metal ladder like cinder block reinforcements (used when laying the blocks between layers) as trellises, they are easily used as arches and moveable, reusable.....




Wire Mesh ladder comes in panels approximately 7 inches by 11 feet and is readily available at construction supply retailers. The ladders sell for a bit less than $4 each. They are sturdy and will naturally form a large arc when bent.

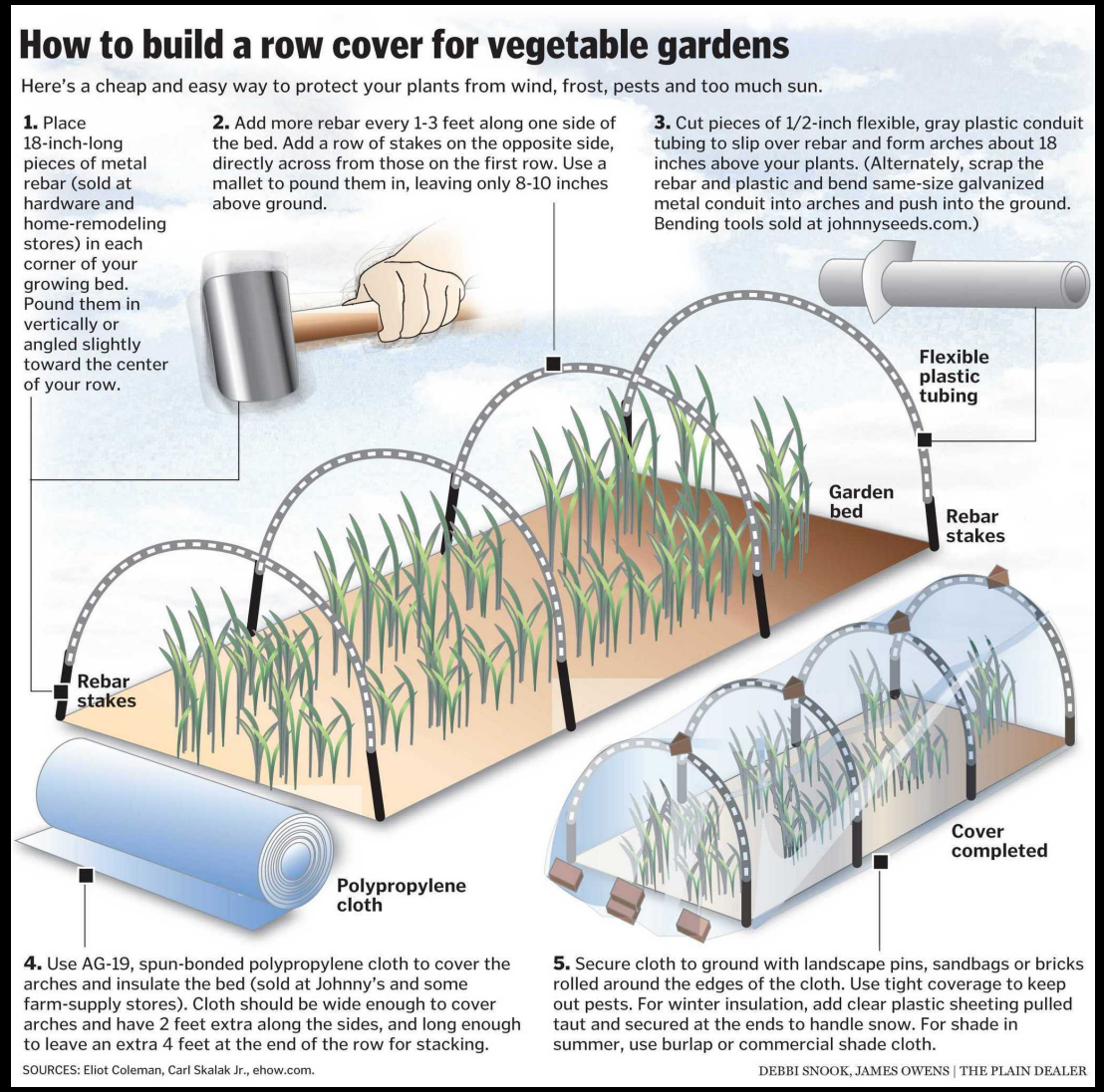
**Another Cheap DYI Solution.** Someone donated a roll of sturdy 24-inch wide wire fencing to our community garden in Rincon Heights, so we have been using curved lengths of it as hoops to support frost cloth in the winter and shade cloth in the summer. Both type of fabric can be temporarily attached with either clothespins or binder clips.

# Rich Johnson at his Payson-area homestead

Rich has built raised beds with block stabilized with rebar. He uses heavy duty spring clamps to fasten frost cloth directly to the concrete block. This is a neat solution to one of the biggest problems associated with using frost fabric, its tendency to blow off, leaving your plants exposed.

Rich has also built critter-proof garden structures that can accommodate both frost cloth and shade cloth.

# Other DYI Structures for Winter Frost Protection




https://www.cleveland.com/insideout/index.ssf/2011/10/eliot_coleman_maines_winter-ha.html

Use link below for YouTube instructions on bending electrical conduit to make your own hoops using no expensive equipment:

https://www.bing.com/videos/search?q=You+tube+bending+conduit+for+row+cover&&view=detail&mid=53AE2E0E01308846301B53AE2E0E01308846301B&&FORM=VRDGAR

# A structure that can be made of PVC pipe and hoops

**Cloches** operate like greenhouses in that they allow radiation from the sun to heat the soil and then trap that heat.

Glass bell jars in historic recreation of a Colonial era garden at Williamsburg.

Commercially available vented glass cloche


Almost any clear plastic container can be used as a cloche. Be careful not to let your plans overheat at midday or in the afternoon!

# Mohye – container gardening as season extension strategy

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# Water Plants before a Freeze

Freezing weather dries plants out. Give your plants a fighting chance by **watering them the day before a freeze** is forecast. You need to allow time for the plants to take up water and for any water that hits the foliage to dry before freezing temperatures arrive. Water left on foliage can freeze and leave black dead spots once thaw sets in.

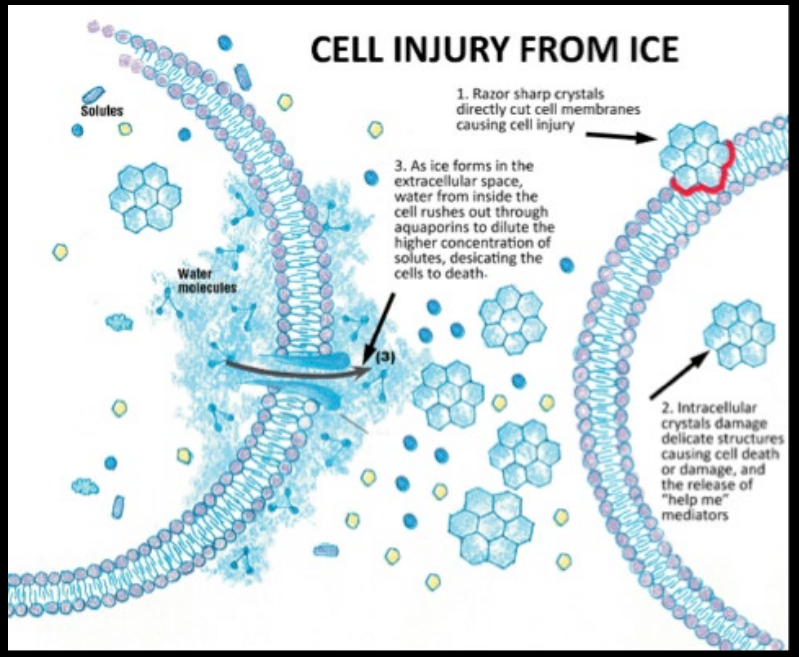
Do not water succulent plants before a freeze!

# Other Strategies to Avoid Frost Damage

- **Use Frost Protection Spray??** Make sure that it is organic and appropriate for use on edibles.


**Has anyone here tried frost protection spray?**

- **Foliar Feed during cold weather.** When the ground temperature is cold it will be difficult for your vegetable plants to take up nutrients. Douse their foliage with an organic fertilizer mixed with plenty of water. Winter veggies require more nitrogen and less phosphorous and potassium than the fruit producing warm season crops, but avoid giving too much nitrogen to plants that should be dormant during the cold period. (Potassium is better for total plant health at this point as in helps regulate osmosis in plant cells, thus maintaining outflow of water from cell, preventing desiccation within cell and maintaining cell turgor.)



# Getting a Head Start on Your Warm- Season Garden


Start germinating your tomato seeds indoors under grow lights in December.

That means now!

# Grow Light Options


If you grow seedlings indoors from December through March you will probably need a heat mat and grow lights. Fluorescent lights (left) are less expensive and emit heat as well as light. This is useful when growing heat-loving tomato, pepper and eggplant seedlings in a cool space. When starting your cool season veggies in August or September, fluorescent fixtures may give off too much heat unless you are able to provide plenty of air conditioning; your best option would be to use another type of light such as LED (above). These fixtures are much more expensive but will last a long time.

For more info:
https://growershouse.com/lights

# Start plants early outside by south-facing wall.

Be sure to have covers available to protect starts from light frost and take them inside if hard frost is forecast.

I place my starts on a shelf with wheels so I can move it to the east side of my studio in the spring when the southern exposure becomes too much. I use this shelf/cart with both frost cloth and shade cloth.

## Mid-Winter Through Early Spring – While your winter garden is in full flush is the time to start seeds indoors if you plan to grow your own starts.

- **November. Barbara Ho's** method for smaller number of plants. Plant tomato seed in pot in sunny outdoor location in November. Transplant into individual pots once they have a few true leaves and overwinter indoor on a sunny windowsill.
- December — Start Tomatoes indoors using heat mat to germinate and grow lights after that. Plant outside mid-February and cover whenever frost is forecast.
- Option. Plant starts in ground early and use water teepees or cloches to get a good growth during cold weather.
- January-February – Germinate seed of other warm season veggies, herbs and flowers indoors. Suggestions: peppers, eggplant, basil, borage, oregano, dianthus, Black-Eyed Susan, zinnia
- Fertilize plants in spring

# Leaf and Trunk Scald

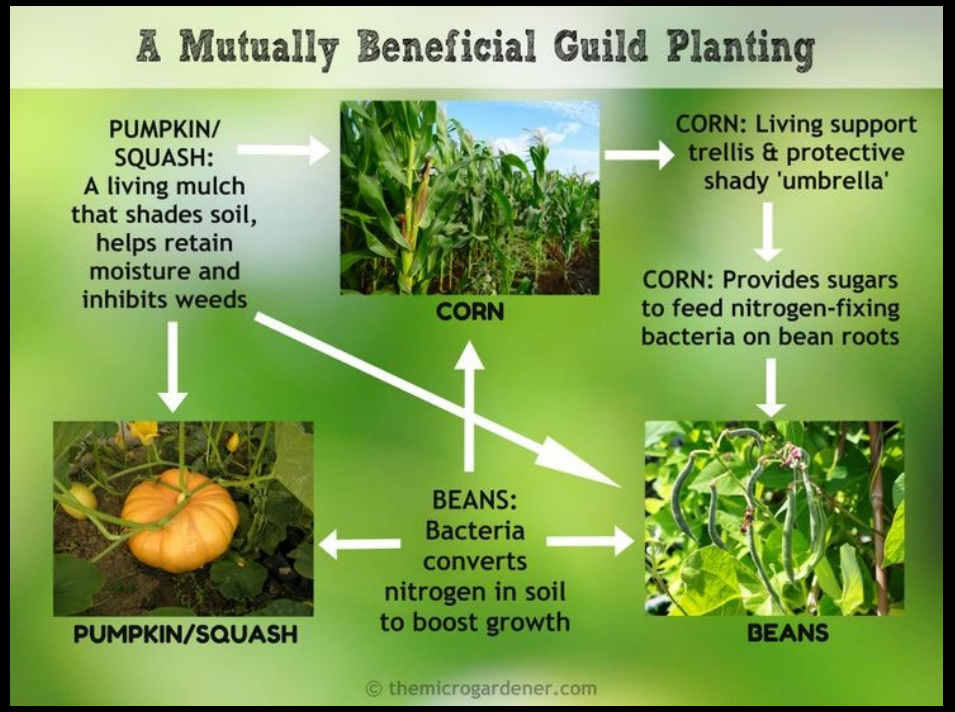
Evergreen plants are subject to sunscald (and to windburn). This can occur in winter and spring as the plants recover from dormancy.  Protect foliage of evergreens such as newly planted citrus, gardenias, avocado, Arabian jasmine by providing afternoon shade especially on south and southwest sides of plants.

Protect trunks of citrus from sun by painting with white latex paint or wrapping with burlap tape.

Easy shade/frost cloth support for newly planted grapefruit tree fashioned from 4 T-stakes and 2 pieces of scrap lumber wired to the T-stakes. A cylinder of lightweight wire fencing covered with shade cloth protects the trunk from sun-scald and from being used as a cat scratching post.

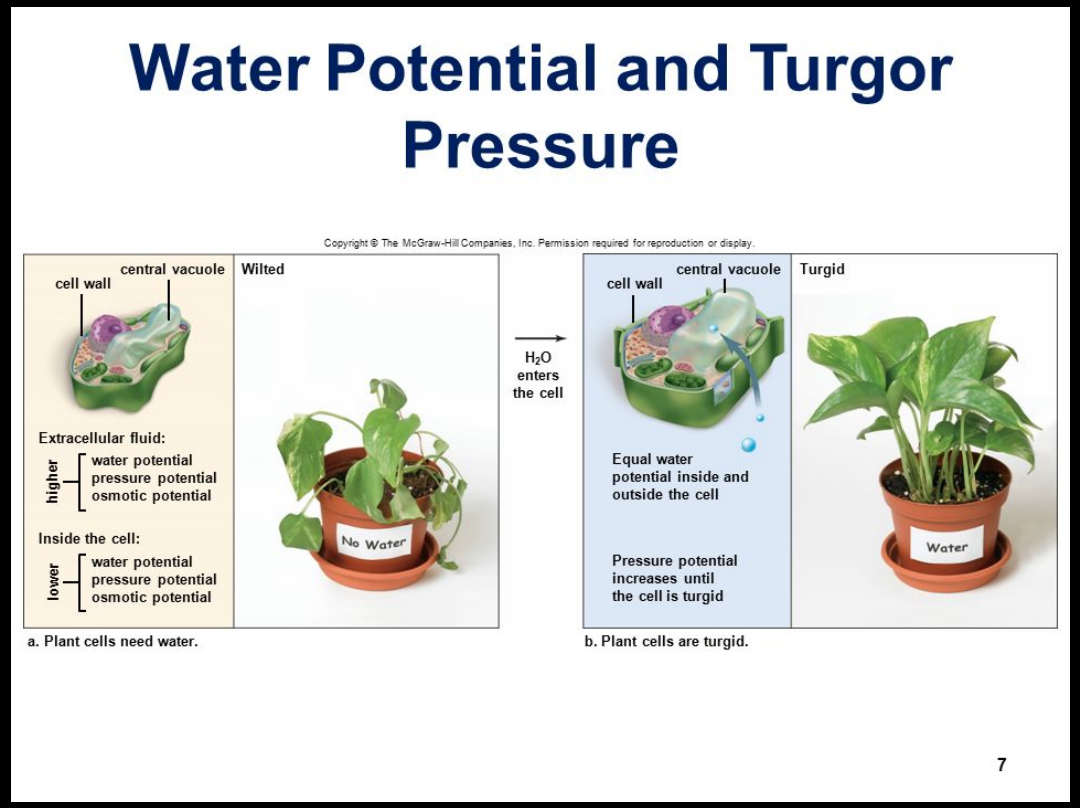
# Warm Season Gardening

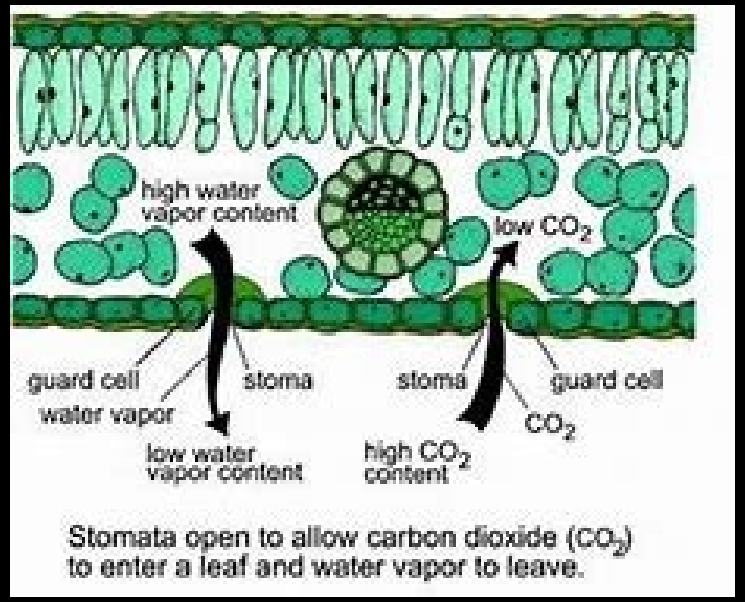
- Choose heat and drought tolerant varieties.
- Start your warm season plants indoors in winter so you can plant as early as possible
- Mulch to depth of 4 to 6 inches to shade soil and to reduce evaporation
- Provide shade by planting it, location, shade cloth and structures
- Water Wisely – Water deeply and less frequently so that deeper part of root zone stays damp while upper part dries out between watering applications. This encourages plants to send roots deep underground where the temperatures are cooler.
- Weed to reduce competition for water and nutrients

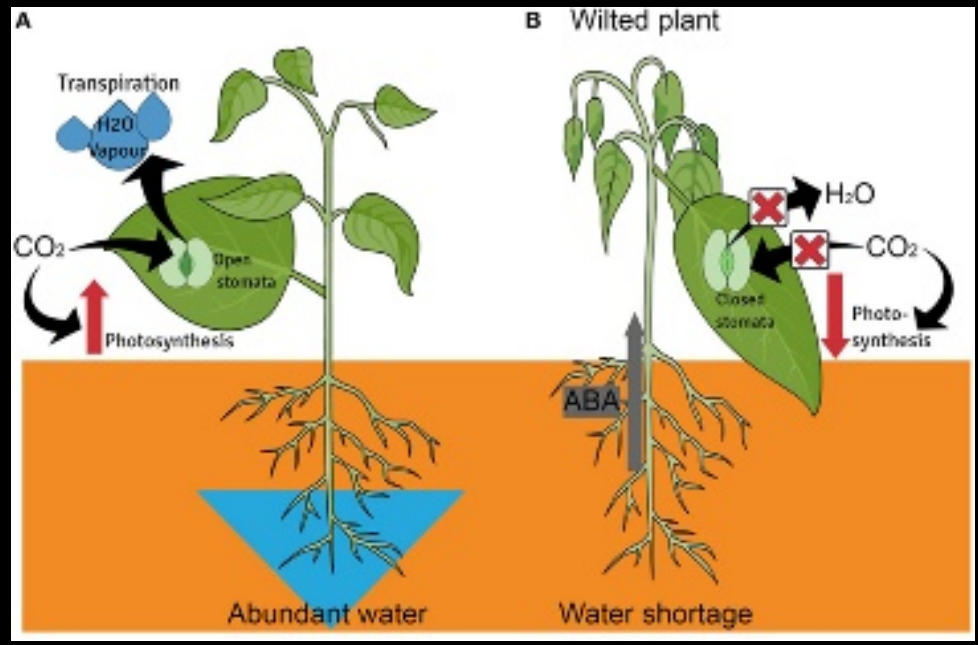



Almost all vegetables will require 6 hours of sun a day. You may need to provide some degree of shade in the summer afternoons. Try using taller vegetable plants to shade smaller less heat tolerant ones. Planting under a tree not is advised as the tree roots will compete for the water your vegetables need.

# Heat Stress and Leaf Wilt

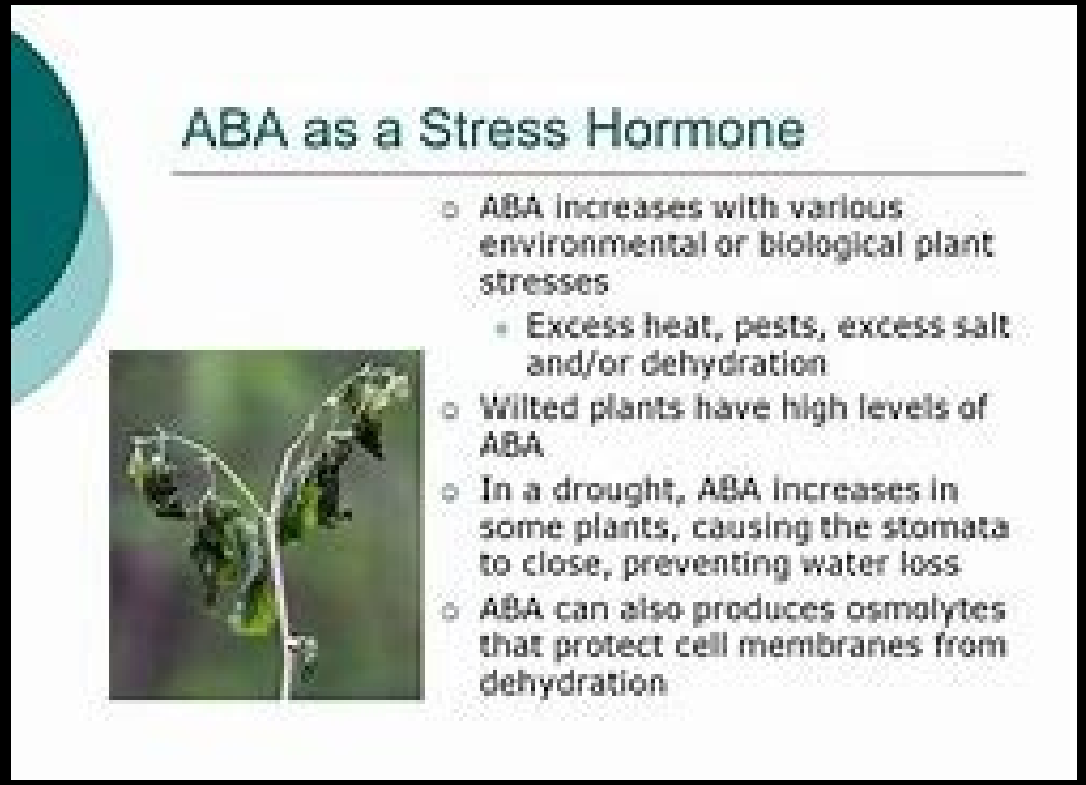



**Plants avoid heat stress through Transpiration.**
Transpiration is release of water vapor through the stomata located on the under surface of the leaf. It provides evaporative cooling, significantly reducing the temperature of the leaf in comparison with the temperature of surrounding air.

# Why Leaf-Wilt, a symptom of under watering, is also an indicator of Heat Stress.




**Wilting is a natural response to heat stress.** If you see your plants wilting midday in the summer do not water them unless you now for sure that the soil is dry. (Use a soil moisture probe if in doubt). Overwatering can starve Your plants' roots of oxygen, cause further wilting and the plants may die. Overwatering also contributes to fungal and other diseases.

**ABA, the Heat Shock Hormone**

Under heat stress a plant will produce a hormone called abscisic acid or ABA. (This multi-purpose hormone also promotes leaf senescence in the fall and seed dormancy, and has a role in cold tolerance too.) In very hot weather ABA prompts the stomata on the underside of the leaf to close. When the stomata are closed the leaf retains moisture, but at the cost of shutting down transpiration and its cooling effects.

# Joy Holdread's Seasonal Gardening Tips, 2

- I have two garden spots, one in full sun for the winter the other in semi shade for the summer.  Both are near my rain water cisterns or my kitchen back door.

- I cover large black plastic planters with scrap fabric material using the cheapest clear caulk to attach the edges of the fabric, then I paint with light colors of left over paints not mixed well.  I have lots of fun with great textures and patterns.  The pots don't get as hot and the plastic lasts longer as it's protected from the sun.

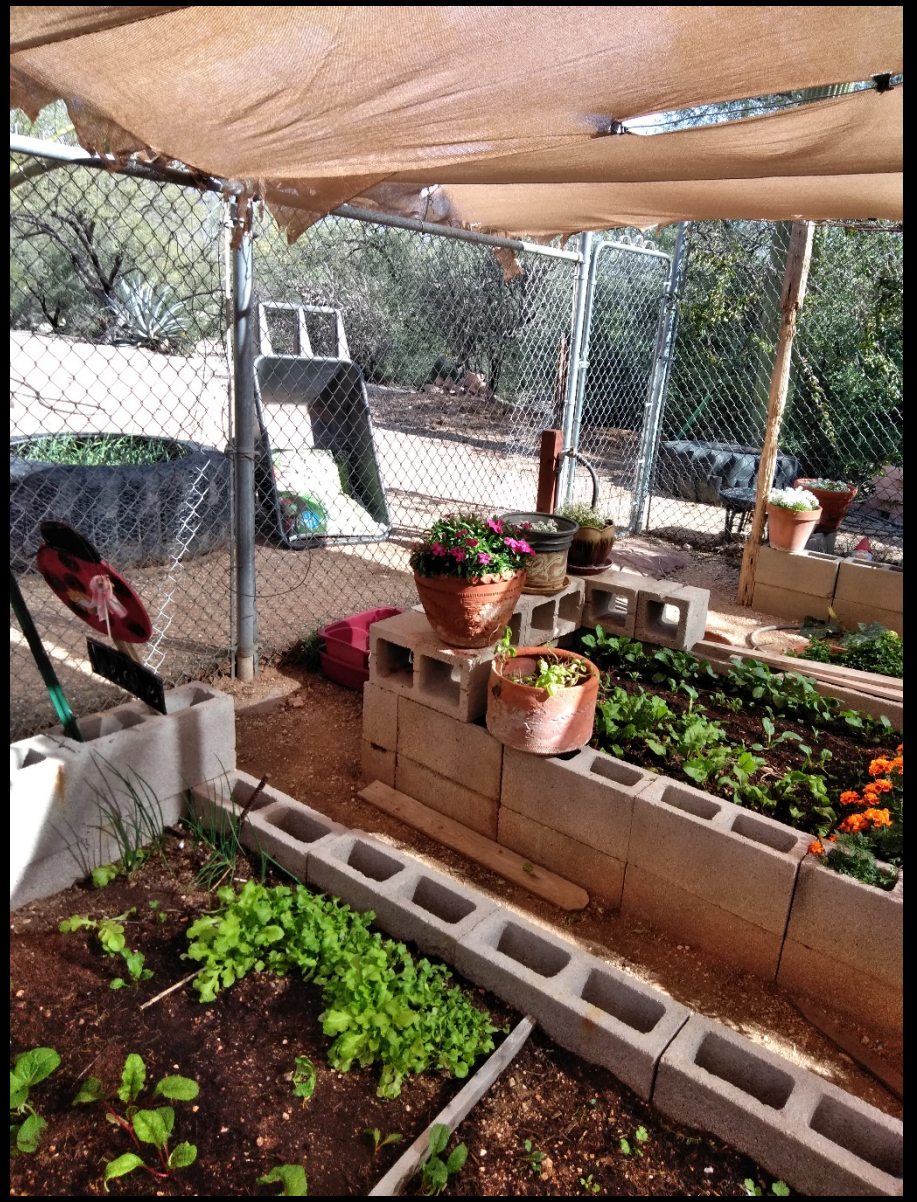
- Some of my eatable plants are part of my front yard landscaping keeping life simple and the plants needs more easily kept track of.

- I use old screens, and mesquite tree trimmings to shade newly transplanted landscape plants.  The tree trimming with lots of leaves provide more shade that naturally decreases as the leaves drop.  The dropped leaves create mulch.

# Beth’s Garden Structure

# Noreen’s Garden Structures

# Noreen’s Garden Structures, 2



# Penelope's Excavation for Spring/Summer Garden Microclimate

# Year-round gardening for the ultimate season extension experience

**True perennials enable you to plant once for years of harvest:**

- Fruit trees
- Nebuka and Egyptian Onions, chives and garlic chives (Chinese leeks)
- Sorrel
- Fennel
- Globe Artichoke
- Jerusalem Artichoke
- Asparagus
- Malabar and New Zealand Spinach

- **Perennial Herbs:** Rosemary, mint, Mexican Tarragon, sage, thyme, oregano, marjoram can be grown as perennials, or at least short-lived perennials. Basil and Holy Basil can survive several years in containers if provided adequate winter warmth. Parsley can be grown as a biennial in a stress-free situation.

Egyptian Walking Onion

Harvest outer Swiss chard leaves

# Growing Annuals as Biennials or Perennials

**Basil, Holy Basil** and other herbs: overwinter in pots against south-facing wall. Bring indoors if hard frost is forecast.

**Collards:** cut down stem in early fall to regenerate plant for great greens the following spring. If you cut off seed stalks as they appear you may be able to get your plants to last several years. Collards can also be grown from cuttings.

**Eggplants and peppers:** to overwinter in container or in the ground, prune down to oldest new growth, mulch well, cover when hard frost expected, and hope for a mild winter. You may be able to extend life of plant 2—5 years but expect declining production.

**Tomatoes:** overwinter in large container located against south-facing wall. Cover if there is any chance of frost. I have harvested Galinas tomatoes grown in a self-watering container throughout a whole winter. Click on link below for directions on growing indeterminate and even hybrid plants as perennials:

http://living-mudflower.blogspot.com/2015/02/perennial-tomatoes.html

Holy Basil is even more frost sensitive than the ordinary Genovese type. It reseeds very easily.

**Perennial Garlic Chives (aka Chinese leeks) and Collards.** When collard stalk grows long you can cut it down to regenerate plant.

Galinas Tomato