



SPRING AHEAD IN YOUR VEGETABLE GARDEN

How and why to start vegetable seeds in containers
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ADVICE TO GROW BY
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INTRODUCTION

Starting your vegetable seeds indoors is fun and a great way to extend the growing season. You'll have a larger selection of varieties and its less expensive than buying plants.

Some seeds can be direct sown but for many others, it's best to start them in containers to transplant late outdoors.

Today's focus: seeding tomatoes and peppers



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Why start from plants from seeds?

- Gives you a jump start. Plants will be ready when weather is right for transplanting
 - Especially important in Paso Robles. Last recorded frost date in 2020 – April 17, 2020
 - Different for coastal areas and south county
 - I set mine out in early May
- Some plants (tomatoes and peppers) are hard to propagate outdoors (direct seed)
- Greater selection of varieties
- Cheaper than buying plants
- Better control of plant health
- You can grow the exact number you want

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It's time to get started! Why?

Tomatoes & Peppers

- Take a long time – 4-6 weeks
- More finicky – need proper growing conditions and extra care.
- Some crops can be direct sown but many are better suited for transplanting.
 - See UCANR Vegetable Planting Summary (lists which plants are better suited for transplanting and more info: <https://ucanr.edu/sites/scmg/files/30787.pdf>)

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When do you do it?

- Time sowing so plants can be safely transplanted outdoors shortly after germination. (Calculate from last frost date for warm season crops)
- Varies for different plants and may range from 4-18 weeks
- Tomatoes and peppers: about 4-6 weeks before transplanting
- If done too early, you have to hold seedlings back, generally under poor lighting and/or temperature ranges. Can result in weak or spindly plants that don't perform well

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What do seeds need to properly germinate?

Appropriate amounts of:

- **Water**
- **Oxygen**
- **Light**
- **Soil Temperature**



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Water	Oxygen	Light	Soil Temperature
<ul style="list-style-type: none"> Germination begins with seed absorbing water An adequate, continuous amount is necessary to ensure germination 	<ul style="list-style-type: none"> Low respiration takes place in all viable seeds It increases during germination so medium must be loose and well aerated 	<ul style="list-style-type: none"> Requirements are different for different crops Most don't require light to germinate but adequate light is necessary once plants emerge Some crops need light or darkness to germinate. Refer to specific crop requirements* 	<ul style="list-style-type: none"> Required temp varies by crop but favorable soil temperatures affect rate and percentage of germination Most seeds have a minimum and maximum optimal germination temperature

*Crop Growth Requirements from Ohio State University:
<https://hcs.osu.edu/sites/hcs/files/imce/images/PlantGrowthRequirements.pdf>

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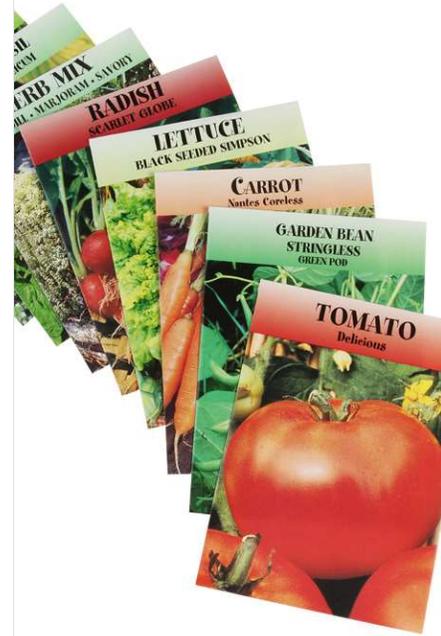
Crops	Minimum (°F)	Optimum range (°F)	Maximum (°F)
Asparagus	50	75-85	95
Beans, Lima	60	75-85	85
Beans, Snap	60	75-85	95
Beets	40	65-85	95
Broccoli	40	60-85	95
Cabbage	40	60-85	95
Carrots	40	65-85	95
Cauliflower	40	65-85	95
Celery	40	*	*
Chard, Swiss	40	65-85	95
Corn	50	65-95	105
Cucumbers	60	65-95	105
Eggplant	60	75-85	95
Garlic	32	65-85	95
Leeks	32	65-85	95
Lettuce	32	60-75	85
Muskmelons (Cantaloupe)	60	75-85	105
Okra	60	85-95	105
Onions	32	65-85	95
Parsley	40	65-85	95
Parsnips	32	65-75	85
Peas	40	65-75	85
Peppers	60	65-75	95
Pumpkins	60	85-95	105
Radishes	40	65-85	95
Spinach	32	65-75	75
Squash	60	85-95	105
Tomatoes	50	65-85	95
Turnips	40	60-95	105
Watermelons	60	75-95	105

SOIL TEMPERATURE CONDITIONS FOR VEGETABLE SEED GERMINATION

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SEED SELECTION

- Only use high quality seeds purchased from reliable dealer
- Select cultivars suited to your area/growing conditions
- Seeds can be saved (from year to year) if stored properly but best to buy only what you need for the year
- Seed companies take great care in processing seeds properly and have good germination rates. (Some companies provide this information – on seed packet)



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Save or Purchase?

Saved Seeds

- It's cheaper
- Easier with some vegetables than others
- If not done properly, seeds can carry diseases or not be viable
- More time and effort as seeds must be cleaned, dried and stored properly
- Requires some experience to get good results.



Purchased Seeds

- Seeds guaranteed to be disease free
- Consistent results
- Can get benefits of hybrid seeds
- Greater selection
- I use a lot of hybrids and want to be guaranteed that my seeds are disease free, etc. so I prefer to purchase seeds.

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Hybrid or Heirloom?

What are they?

Hybrid Seeds

- Seeds developed by plant breeders that have been purposefully crossed to create plants with unique/desirable characteristics such as disease resistance, greater productivity, color or growth habits (dwarf/compact, etc.)
- Can be more expensive but generally have better vigor, uniformity and productivity

Heirloom Seeds

- Open pollinated (by insects, wind or other forms of natural pollination) that have been cultivated for many years
- Characteristics not produced by a controlled process so it maintains genetic diversity
- Offspring will be similar to those of previous generations
- Some vegetables can cross pollinate

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Hybrid or Heirloom?

What's the difference?

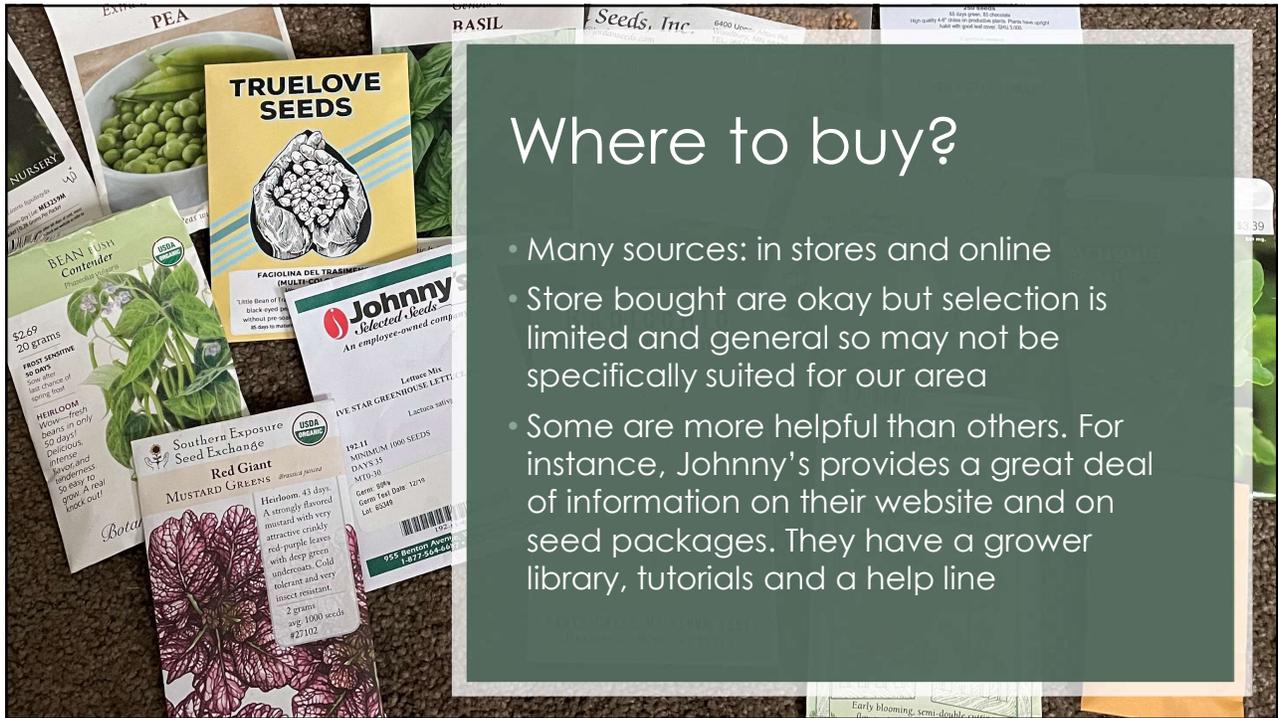
Hybrid Seeds

- Can't save seeds as plants may not breed true meaning they won't have same characteristics as parents
- Growth habits and characteristics guaranteed to be the same
- Can get with a variety of disease resistance packages
 - Important in tomatoes and peppers and other plants that are highly susceptible to disease

Heirloom Seeds

- Valued for unique characteristics
- Generally do not have disease resistance characteristics
- May not be as productive as hybrid counterparts

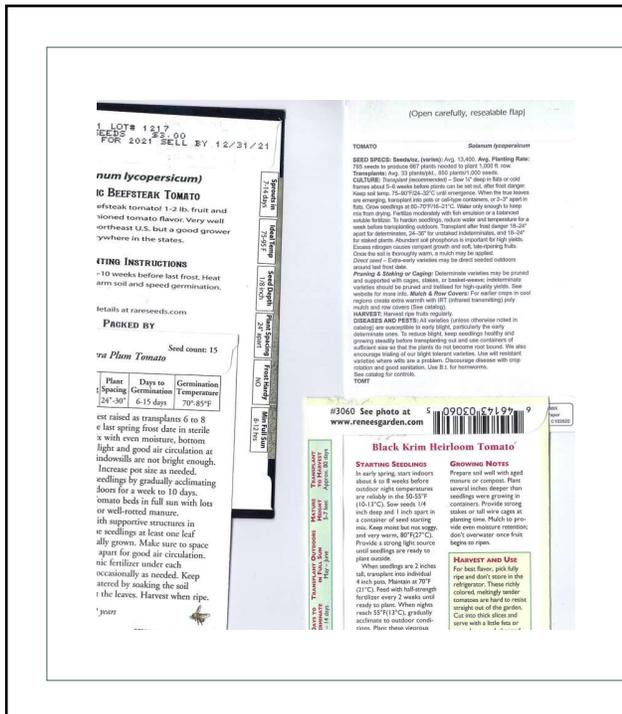
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Where to buy?

- Many sources: in stores and online
- Store bought are okay but selection is limited and general so may not be specifically suited for our area
- Some are more helpful than others. For instance, Johnny's provides a great deal of information on their website and on seed packages. They have a grower library, tutorials and a help line

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What do seed packets tell me?

- Some more than others
- Should at least give you number of days to germination
- Most include planting depth and other info
- I like the ones that provide the most information such as soil temperature, pH requirements, when and how to sow, disease info, etc.

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What do I need to get started?



Tools & Supplies

- Shallow seeding pots and trays
- Pots or containers
- Shelf or somewhere to set seedlings
 - I use inexpensive wire, garden shelves indoors
- Can use a cold frame

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Tools & Supplies

- Watering can and/or hose and water
- Tub/bucket for mixing soil
- Gloves
- Garden spade or fork
- Labels
- Dibbler
- Grow lights or other adequate light source
 - Windows aren't generally enough (heliotropic effect)
 - 12-16 hours of light/day recommended for most crops
- Heat mats with temperature probes recommended

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Proper Growing Medium

- One that's highly absorptive yet consists compaction and good aeration
- Don't use garden soil or reuse potting mix – too dense or heavy and contain pathogen
- **Seed starting mixes**
 - Generally made of compost combined with fibrous and porous ingredients that lighten mix and improve aeration and moisture retention. Typical ingredients:
 - Perlite – heat-treated volcanic glass that resembles Styrofoam balls. It aerates and improves drainage
 - Vermiculite – heat-treated naturally occurring mineral that is gold in color and sponge-like. It improves moisture retention. It is pH neutral.
 - Peat moss and/or coir (made from coconut husks)



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Proper Growing Medium

- **Germination mix** – usually extra light weight and best for small-seeded crops to be bumped-up (repotted)
- **Seed-starting mix** – more suitable for larger-seeded crops



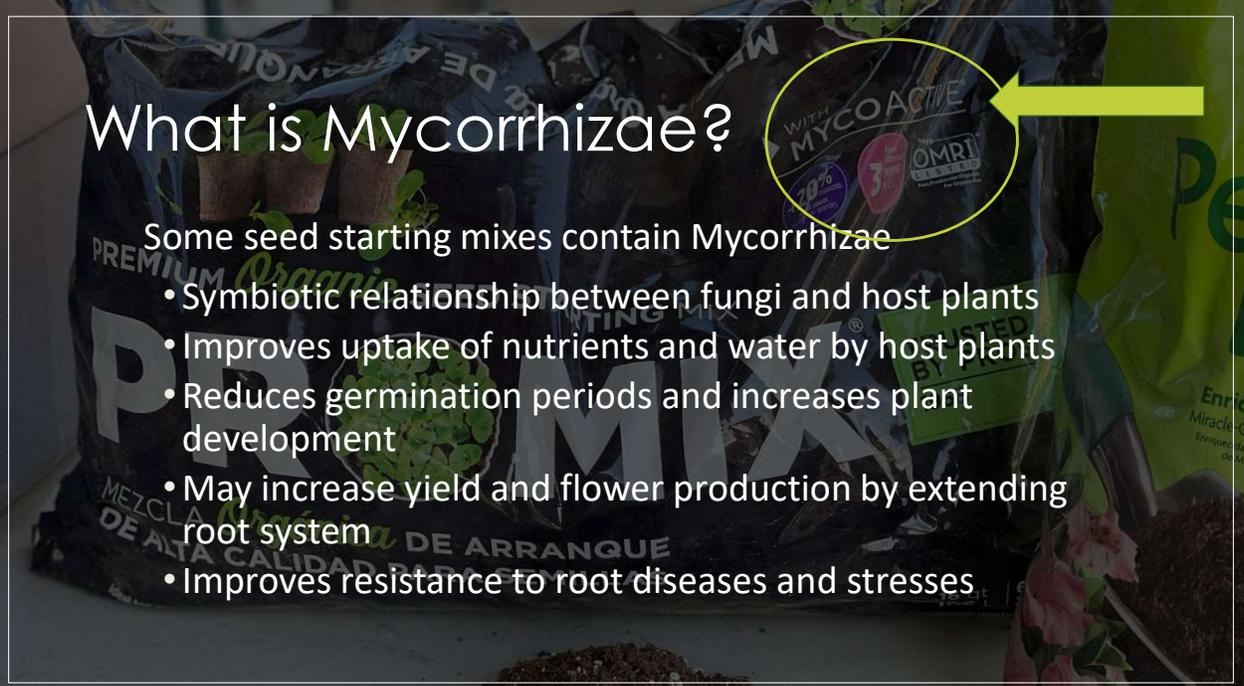
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Growing Mediums

- You can make your own or purchase them already made
- Should contain some or all of the ingredients in the pre-mixed starting mixes
- I use 1/3 of each: peat moss, perlite, vermiculite
- **Soil Mixes for Container Gardening.** *Healthy Garden Tips*, UC Master Gardeners, Napa County. December 2010.
<https://ucanr.edu/sites/ucmgnapa/files/81894.pdf>

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What is Mycorrhizae?

Some seed starting mixes contain Mycorrhizae

- Symbiotic relationship between fungi and host plants
- Improves uptake of nutrients and water by host plants
- Reduces germination periods and increases plant development
- May increase yield and flower production by extending root system
- Improves resistance to root diseases and stresses

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"How to" Steps for Success

Sanitize	Sanitize work area and tools, and containers if reusing
Gather	Gather seeds and supplies
Moisten	Moisten growing medium (should hold shape when squeezed but not release water)
Fill	Fill Containers with growing medium and place into trays, making sure that amount of soil is consistent in each pot and level
Sow	Sow - Place seeds in medium. Follow variety-specific information for quantity and spacing
Press	Press seeds firmly into the growing medium (I use a dibbler)
Cover	Cover seeds with small amount of growing medium



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“How to” Steps for Success

Water	Mist/lightly water top of trays. Add warm water to bottom of tray (@ 1"). Just enough to saturate soil
Cover	Cover the tray – ventilated humidity domes recommended. Helps maintain constant moisture, retain warmth and humidity
Maintain Temperature	Maintain optimal soil temperature Check soil temperature chart or seed package for crop specific recommendation Use a heat mat with soil temperature probe (for best results) Keep flats/pots out of direct sunlight as that will increase temperature and harm seed.
Maintain Moisture	Maintain optimal moisture. Ideally, flats should remain moist enough during germination to not need extra water Keep tops moist. Mist if necessary. Use spray bottle or misters in greenhouse
Provide Light	Provide appropriate amount of light during germination (if necessary)

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Emergence

- Make note of days to emerge for specific crop
- Once plants emerge, they will require more light.
 - Generally 12-16 hours/day.
 - Window light not enough.
- Remove domes
- Water from below to keep soil and roots moist

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Emergence

- After first true leaf, fertilize lightly with a liquid nutrient solution according to produce label
- Thin to one plant per pot
- Keep in an area that's approximately 55-60 degrees at night – no more than 70 during the day
- Pot-up if necessary. Use potting soil at this point. I add peat, vermiculite and perlite to my potting soil
- Add a dry fertilizer to potting mix

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DIAGNOSIS AND CORRECTION OF TRANSPLANT DISORDERS		
Symptoms	Possible Causes	Corrective Measures
1. Spindly growth	Shade, cloudy weather, excessive watering, excessive temperature	Provide full sun, reduce temperature, restrict watering, ventilate or reduce night temperature, fertilize less frequently, provide adequate space
2. Dwarf plants	Low fertility	Apply fertilizer frequently in low concentration
A. Purple leaves	Phosphorus deficiency	Apply a soluble, phosphorus-rich fertilizer such as 10-55-10 or 15-30-15 (1 oz/gal of water to each 6-12 sq ft of bench area)
B. Yellow leaves	Nitrogen deficiency	Apply KNO ₃ (1 oz/3 gal of water for 6-12 sq ft of bench area). Wash the foliage with water after application
C. Discolored roots	High soluble salts from overfertilization High soluble salts from poor soil sterilization	Leach the soil by excess watering Do not sterilize at temperatures above 160° F. Leach soils before planting when soil tests indicate high amounts of soluble salts

DIAGNOSIS AND CORRECTION OF TRANSPLANT DISORDERS—Continued		
Symptoms	Possible Causes	Corrective Measures
D. Normal roots	Low temperature	Maintain suitable day and night temperature
3. Tough, woody plants	Overhardening	Apply starter solution (10-55-10 or 15-30-15 at 1 oz/gal to each 6-12 sq ft of bench area) 3-4 days before transplanting Use a sterile, well-drained medium. Adjust watering and ventilation practices to provide a less moist environment. Use approved fungicidal drenches
4. Water-soaked and decayed stems near the soil surface	Damping-off	Use approved fungicidal drenches
5. Poor root growth	Poor soil aeration. Poor soil drainage. Low soil fertility. Excess soluble salts. Low temperature. Residue from chemical sterilization. Herbicide residue	Determine the cause and take corrective measures
6. Green algae or mosses growing on soil surface	High soil moisture, especially in shade or during cloudy periods	Adjust watering and ventilation practices to provide a less moist environment. Use a better drained medium.

Adapted from J. W. Mastalerz (Ed.), *Bedding Plants*, 2nd ed., Pennsylvania Flower Growers, University Park, PA (1976).

TRANSPLANT DISORDERS

Knott's Handbook for Vegetable Growers. 2nd Ed., Oscar A. Lorenz and Donald N. Maynard. 1980

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Hardening Transplants

- Objective: to slow plant growth to prepare it to withstand the stress conditions outside such as extreme temperatures, drying winds, low soil moisture, root injury during transplanting.
- Method: Any treatment to restrict growth will increase hardiness.
 - **Water supply** – gradually reduce water by watering lightly at less frequent intervals. Do not allow plants to dry out.
 - **Temperature** – gradually expose plants to lower temperatures (5-10° F) than those used for optimum growth. High temperatures during the day may offset effects of cool nights which may make temperature management difficult.

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Hardening Transplants

- **Fertility** – do not fertilize immediately before or during initial stages of hardening.
- **Combinations** – using a combinations of these methods are more effective than one alone.
- **Duration** – 7-10 days is usually sufficient. Do not make conditions so severe that plants will be over-hardened. Over-hardened plants require too much time to resume growth and may have lower yields.

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References

- **"The effect of mycorrhizae on seed germination, development, and reproductive yield of Rapid Gro Radish,"** *ESSAI: Vol. 13, Article 18*. Available at: <http://dc.cod.edu/essai/vol13/iss1/18>
- <https://core.ac.uk/download/pdf/33196501.pdf>
- **Growing Media.** *The California Garden Web*, http://cagardenweb.ucanr.edu/Houseplants/Growing_Media/
- **Guidelines for Starting Seeds Indoors: Tips & Troubleshooting Advice for Starting Healthy Seedlings.** Johnny's Selected Seeds Tech Sheet. <https://www.johnnyseeds.com/growers-library/tools-supplies/seed-starting-transplanting-guidelines-tech-sheet.html>
- *Knott's Handbook for Vegetable Growers*. 2nd Ed., Oscar A. Lorenz and Donald N. Maynard. 1980.
- **Soil Mixes for Container Gardening.** *Healthy Garden Tips*, UC Master Gardeners, Napa County. December 2010. <https://ucanr.edu/sites/ucmgnapa/files/81894.pdf>
- **Vegetable Growing Guides.** Cornell University, <http://www.gardening.cornell.edu/homegardening/sceneb771.html>
- **Vegetable Planting Summary.** University of California Agriculture and Natural Resources: UCCE Master Gardeners of Sonoma County. Originated by Marge Tobias; revised by Food Gardening Specialists Pub No. 090924, Rev. July 2019.
- **What is Perlite? What is its use in the garden?** *Tree.com*, <https://www.trees.com/gardening-and-landscaping/perlite>
- **Soil Temperature Conditions for Vegetable Seed Germination.** UCANR Cooperative Extension, Sacramento County. DecVierra, and Dave Vaughan. Edited by Judy McClure, UCCE Sacramento County Master Gardener Coordinator. <http://cetrinity.ucanr.edu/files/260364.pdf> ember 2015 revised. February 2013 written by UCCE Sacramento County Master Gardener Gail Pothour, reviewed by UCCE Master Gardeners Kim Brady, Dan Vierra, and Dave Vaughan. Edited by Judy McClure, UCCE Sacramento County Master Gardener Coordinator. <http://cetrinity.ucanr.edu/files/260364.pdf>

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