

Growing More and Growing Longer in the Colorado Mountains

Jan Fedrizzi & Kathy Yeiser, Colorado Master Gardeners

Eating locally in Zones 4b to 5a, which includes much of the Eagle River Valley, requires ingenuity, observation and a little luck.

“Eating locally” is now a buzz phrase, thanks to those like Barbara Kingsolver, who brought the local food issue to the forefront in her book, Animal, Vegetable, Miracle, in which she outlines her family’s attempt to eat exclusively from local sources near their Virginia home, growing much of the food themselves. Given the Eagle Valley’s elevation of from 6500-8000+ feet (from Gypsum to Vail), with an average of 11 inches (in Eagle-Gypsum) to 22 inches (in Vail) of precipitation and approximately three months of frost-free days, a local diet without season extension could consist of only about 15 different vegetables.

As a novice gardener and inspired by Kingsolver’s book, co-author Kathy Yeiser fed her family on local sources for about two months, but says, “We were bored to death by the few things that grew really well and that we actually liked. In the second year, I was able to use some simple season extension techniques to extend the eating season by more than a month, plus increase the production enough to preserve some vegetables for winter.”



Utilizing season extension techniques will lengthen the growing season, and also increase the variety and quantity of plants that can be grown in the warmest months. Certain crops, like the sought-after tomato, are affected not only by freezing, but also by nighttime temperatures below 55 degrees during pollination.

Cantaloupe, eggplant, peppers, beans, melons and squash like daytime temperatures above 70 degrees and may be stunted by several days of cooler weather.

Since 2010 CSU Extension in Eagle has been involved in a trial study of season extension row cover techniques. The study results are not yet available for publication but the Master Gardeners were harvesting spinach from the trial beds in May,

when most people have not yet planted! Imagine, a fresh garden salad in May!

Some season extension strategies are very easy, with minimal cost and effort, while others zoom to the opposite end of the spectrum, with more elaborate and expensive structures. Season prolonging enhancements include utilizing your microclimates, selecting crops and seeds for your climate, using simple row covers and erecting greenhouses and cold frames. The payoffs can be a wider variety of produce in your diet, the ability to pick produce at its peak for better taste, access to a known source of food and a decreased carbon footprint.

Researching and planning a garden can seem overwhelming, and adding a month to either end of the growing season can seem to compound that process, but several garden planning tools are available to assist with this daunting process. The Colorado Master Gardener Notes #720, your seed company website and Barbara Damrosch's The Garden Primer are some of the tools that can help you.

As your season extends, so will the work that your soil must do. Keeping the ground fertile will mean more compost or additives and more time spent prepping, weeding, top dressing and observing. But, in the authors' opinion, this time in the garden is far superior to more time in the grocery store.

Learning to eat from the garden and to utilize what is available can take some getting used to. You must be flexible in your eating choices or have friends who appreciate the bounty as much as you do.

Using Information to Extend Your Season

Good garden practices, a bit of research, observation and recordkeeping can bring new crops to your table for little additional cost.

Begin by considering what you like to eat. From that list, seek out varieties labeled short season, frost tolerant, high altitude, etc. If you are hoping to expand your palate, consider the high altitude seed bucket from seedstrust.com. It will give you a chance to explore a large variety of crops, all selected for the challenges of high elevation and shorter growing season.

Focus on generous employment of perennial vegetables and herbs—asparagus, good king Henry—a reliable, low-maintenance spinach relative, chicory, rhubarb, and herbs, such as chives and mint—for solid crops throughout the early part of the growing season. Also try Jerusalem artichokes for their fall harvest. These crops supplement your annual plantings, and, once established, are easy to care for.

As you come across established gardens and gardeners, ask lots of questions. The local Extension Office and Master Gardeners can give you insight into plant selection and season extension. The Eagle CSU Extension staff and volunteers have been trialing vegetables for performance in the mountain climate. Give them a call, 970-328-8630.

Keep records of what, where and when you planted and how the effort turned out. You will also want to keep records for crop rotation purposes, which can help keep the soil healthy and limit some pests.

Leandre and Gretchen Poisson of the landmark book, Solar Gardening, note that one must experiment with what works best in an individual growing situation. Thus,

though you have followed the directions to the letter, a crop may not perform for you, or it may perform one year, but not the next. Keep records, so you can remember why Bull's Blood beets won't darken your door again.

Using Microclimates for Season Extension

Know your microclimates—your property may contain many. Use these to your best advantage, by trying to place the right plant in the right place. Heat-loving crops, such as peppers, like hot days and warm nights. A south or east-facing rock wall can provide the heat they prefer and stabilize the nighttime temperature while protecting them from desiccating westerly winds. Conversely, excessive heat can make fruit taste less sweet, reduce some crop yields and increase water demands.

Cold air sinks, so valley floors may be 10 degrees cooler than the hills around them. South- and north-facing slopes can differ by one to two zones. Moist, smooth soil absorbs more heat which will be released at night to provide frost protection.

The plants' proximity to walls, fences, taller plants, etc. will affect their water usage and amount of wind damage.



A choice microclimate allows tomatoes in Steamboat Springs to grow unprotected even into late September.

Frost Protection Aids

In the Rockies, frost can strike at any time, during any month, so be prepared with row covers, blankets, etc. Many factors influence frost's effects, such as bed location, wind, humidity and soil moisture.

In spring and fall, placing and removing blankets or row covers can be a daily ritual unless a more permanent structure is in place. Assure that blankets stay dry, as wet blankets will create a colder microclimate. In a handy spot near the garden keep a stash of stakes, blankets, Reemay™ floating row cover or other lightweight cloth (not plastic) covers. Lightweight Reemay™, which allows light to penetrate, can be placed directly over crops and provides frost protection. Containers—one-gallon plastic jugs with the

bottoms cut out, boxes and even old lamp shades—work well and will provide 2-5 degrees of extra heat for plants. Stake fabric carefully over tall plants. Remember to remove the covers during the day to allow light and heat to reach the plants.

Other frost protection aids are traditional glass cloches or domes, Wall-O-Water™ covers, solar-charged hot water bottles—just plastic bottles sprayed with flat black paint, filled with water and taped together in a circle to hold heat around a plant at night. Heat-retaining mulches, such as black plastic to warm up the soil in the spring, and loosely-packed bags of leaves placed between rows or around plants will boost the soil's warmth.

Warming the Soil

For starting seeds, and early spring planting, the soil temperature is more critical than the air temperature. If soil is too cold when seeds are planted, the seeds may deteriorate before they can germinate. Roots also grow more slowly when soil is less than 45 degrees.

To measure soil temperature, use an inexpensive meat thermometer or designated soil thermometer. Soil should be measured four inches deep at 8 A.M.

Black plastic applied a few weeks before your desired planting date can help warm the soil. Plastic is laid over the bed and the sides are buried, stapled or staked. Holes are cut for each plant and the excess plastic is removed. Black plastic allowed to touch the plant could cause burns on the stem, so trim extra plastic away. For heat-loving crops such as tomatoes, cucumbers and squash, the plastic can be left in place throughout the growing season. For crops which do not appreciate such warm soil, the plastic can be removed before they grow too big and the soil temperature moves out of the optimal range. (Check your seed packet, or the CMG Vegetable Planting Guide for temperatures.) Remove the plastic and throw it away after its useful life. Do not till it into the soil.

Raised beds can also warm the soil and can help prevent soil compaction. With less compaction, you will do less tilling and bring fewer weed seeds to the surface, enabling your crops to flourish, thereby increasing their productivity.

Succession Planting

Plant successively, and plant early and late--try to plant cold hardy vegetable seeds such as spinach, radishes, peas, lettuce and broccoli in the garden every week, beginning as soon as the ground can be worked (though seedlings may need to be covered at first). Successively seed semi-cold-hardy crops such as carrots, beets, potatoes and chard every two weeks, beginning a few weeks before the last average spring frost.

Succession planting helps assure that you have seeds in the ground when the soil is warm enough to sprout them and that you will likely have sprouts ready to pop through in the event that hail or wind damages your more mature plants.

Succession planting also allows for a longer harvest, continuing into the fall. You may want to use different seed varieties for different plantings. Plan carefully, so the variety will match its intended harvest time and garden bed placement.

Water Just Enough

In the mountains of the arid West, conserving water is an accepted and necessary practice. You want your crops to put down long roots, while conserving water at the same time. To determine if your garden needs watering, pick up a handful of soil and squeeze. If it doesn't hold together when you open your hand, get out the soaker hose. When you do irrigate, apply a generous amount of water, penetrating at least 6-8 inches deep into the root zone.

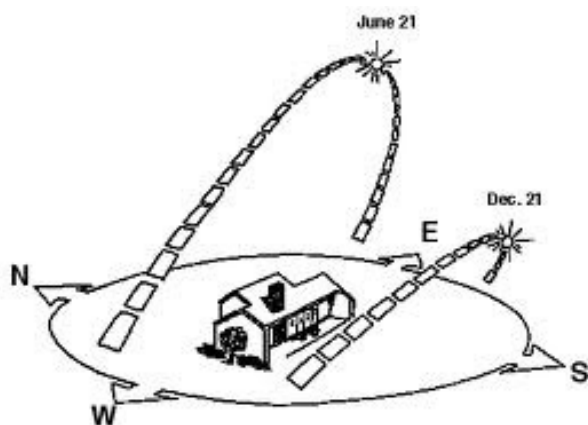
The exception is starting seeds, when the soil surface must be kept moist, but a deep watering is not necessary. During seed sprouting multiple, very short, waterings per day will be sufficient.

If your vegetable garden is watered by a timed irrigation system, check often throughout the gardening season to assure that water is getting where it is needed. As the summer goes on, larger plants can block the overhead sprinkler flow; hoses and spray heads can clog, develop cracks or break ; and general gremlins descend on the irrigation system, so checking often is vital.

Watering effectively equals a longer, dependable and a tastier vegetable yield.

Structures

More expensive and permanent approaches can extend the season even further. Cold frames, low tunnels, greenhouses and their ilk allow you to start seeds earlier and harvest later into the fall/winter. They can also provide frost protection to plants started mid-summer, offering a late fall crop. Greenhouses, when optimally designed and managed, provide year-round production of some greens and produce.



The sun's path across the horizon changes with the seasons, as does day length. Notice how much higher off the horizon the sun is during summer months than winter months. (Douglas Bailey, NCSU)

When designing your structure, consider the path of the winter sun, your snow load, local wind, access, budget, and available materials.

A site with unobstructed sun exposure to the south or southeast is an ideal location. A site with only north-facing exposure will not support most plants. Access to water and electricity should also be considered.

Cold Frames and Their Cousins

The simplest structures include cold frames and low tunnels. A cold frame is an unheated, usually bottomless, box with a translucent cover of Plexiglas or glass—we recommend Plexiglas for safety—on top to catch light and trap warmth. Cold frames are economical, compact, relatively portable and user-friendly. Cold frames and row covers can also help to protect plants from deer, which could mow off early spring and fall plants.

Cold frames are a good choice for starting seeds, sheltering seedlings until time to plant outside or for overwintering bulbs or perennials. In severely cold weather, baled straw may be placed around a cold frame to provide extra insulation; and blankets or space blankets may be thrown over it to protect against freezing temperatures.

Cold frames can be as simple as an old window set into a box, or straw bales laid in a U and covered with a light-permeable material such as Plexiglas. It should be possible to build a cold frame for about \$100-200, depending on size and materials. Garden supply catalogs also carry kits from about \$300 for a 4 X 6 foot cold frame to \$450 for a deluxe 8 x 6 foot cold frame.



Plans to build this inexpensive cold frame, from [This Old House](http://www.thisoldhouse.com/toh/how-to/intro/0,,20417543,00.html) magazine, are available at: <http://www.thisoldhouse.com/toh/how-to/intro/0,,20417543,00.html>

If you are constructing a frame yourself, the dimensions of your cold frame will depend on the size of your plot. A well designed frame will allow you to access all areas of the box without strain. A 3-4 foot-wide by 3-4 foot-long box, with a 2 foot-high back and about an 18 inch-high front will work well for most adults. A sloping lid allows for optimal light penetration and moisture and snow run off.

The cold frame's orientation should be south facing. Modern frames may be covered for optimal effect with fiberglass, rigid insulated polycarbonate plastic or glass. Gardeners in colder climates may prefer models with wood or masonry frames, rather than metal, to reduce heat loss.

See Eliot Coleman's extended discussion of cold frame design and of his plan for growing in his cold frames in his book, [Four Season Harvest](#).

A hotbed is another variation of a cold frame, with heating cable installed underground as a heat source to aid in starting seeds and maintaining a consistent temperature inside the frame.

Low Tunnels

A step up from a cold frame is a low tunnel, exceptionally attractive in its economy, in which plastic covers a series of arches made from electrical conduit or concrete wire mesh. The arches are placed about four feet apart; and the plastic covering is generally secured by burying its edges with soil along the sides and ends. It is a stable and windproof structure, but access to the protected area is impeded in the winter, as the buried edge has to be pulled out, not always convenient when dealing with several feet of snow.



Low tunnel at the CSU trial garden in Eagle (Photo courtesy Rick Kangas rickk@coloradofresh.net)

For less than \$75 and an afternoon, a low tunnel can be added to a raised bed. Arches can be constructed of PVC electrical conduit screwed to the existing bed, or secured by slipping the conduit over pieces of rebar tapped into the soil. The arches are covered with Reemay™ and clamped on with four inch pieces of garden hose cut lengthwise. To create the warmest conditions, the edges of the Reemay™ are buried, staked or held down with rocks.

The CSU Extension horticulturist in Eagle has successfully adapted the low tunnel, with PVC pipes or high wire arches used as supports for the floating row cover, which is secured

to the frames. This set-up provides several extra degrees of frost protection, protects tender plants from cold spring winds, and provides warmer growing temperatures within the tunnel. Tunnels are removed or vented when warm weather arrives and the danger of frost is past.

Other tunnel adaptations—with saplings or with different types of fencing wire as supports are described in garden magazine articles, such as “Extend Your Growing Season,” by Barbara Pleasant.

Solar Pods and Cones



Photo courtesy of [Solar Gardening](#) by Leandre and Gretchen Poisson

Solar Pods, the invention of Leandre and Gretchen Poisson, are a small, simple solar greenhouse. The solar pod is a hinged box with a curved insulated fiberglass-reinforced sheet glazing material

curved over a wooden frame that can be moved to protect the plants of choice and also propped open for ventilation.

While more expensive and more durable than a low tunnel, a solar pod provides benefits similar to a greenhouse, at the same time being more energy efficient and decreasing issues with pests. (The portability of a solar pod—though they are heavy-- means that crop rotations can still occur.) Efficiency is increased further if used with the Poissons' philosophy—known as American intensive solar gardening. The concept is very integrated, partnering their Solar Pods with a plan for growing vegetables throughout the seasons of the year. One of their precepts is organizing all vegetable varieties into three lists: heat-loving vegetables, cool-hardy vegetables and cold-tolerant vegetables and focusing on the best growing conditions for each group.



Solar cones, “inspired by the glass cloches used by the French since the time of Louis XIV, help retain heat and moisture, as well as protecting seedlings and plants from wind, insects, and animal predators. They also help warm up the soil in spring and fall, and can be used in winter for many leafy crops.” Photo and caption courtesy of [Solar Gardening](#) by Leandre and Gretchen Poisson

Chris LaVenture, a market grower in Gypsum has used the solar pods for more than a dozen years to grow mâche and spinach late into fall and early winter and to force the same greens into growth in February and March. Also, she has overwintered Zone 7 plants, such as rosemary, in the pods; and transplants very early lettuces and Chinese greens in them. Leafy brassicas and radishes/turnips may be seeded in the pods in late winter for crops that can be harvested in April.

Additionally, LaVenture says, “The solar cones are excellent for warming the ground for planting peas and for forcing rhubarb, tarragon, chives and other herbs, as well as thawing the ground earlier to dig sunchokes. They allow harvest a full month earlier.”

Greenhouses

Greenhouses are the ultimate in season extension buildings. For the home grower, these greenhouses are usually referred to as “hobby greenhouses.” The image of a cute little greenhouse perched in the backyard brings many gardeners down a path that is romantic, but not necessarily more energy efficient or productive than options listed above.

Research at Colorado State University suggests that “Winter vegetable production in a greenhouse is only cost effective with an energy efficient greenhouse structure, a well-designed solar collector, and optimum management...The use of artificial light for vegetable production (except for starting transplants) is generally not

cost effective.” The permanent location required for a greenhouse can also bring about pest issues that would not be encountered in an area exposed to all of nature’s elements.

Just as for the cold frame and other such season-stretching structures discussed above, considerations such as size, siting, construction materials, heat mass, ventilation, size and height of interior beds are important. A thoughtful approach to building with these factors in mind will pay off in the finished product.

Much of Eliot Coleman’s and the Poissons’ research and experience—in which they focus extensively on cold frames and solar pods—can be applied to growing in a hobby greenhouse. Before investing in a greenhouse, however, explore the less expensive options and also become educated in greenhouse management, lest your new addition become more of a headache than a help.

High Tunnels and Hoophouses

High tunnels and hoophouses are unheated greenhouses that can help market gardeners extend their growing season so that they can improve the profitability of their farms. The cost, size and necessary maintenance make them uncommon for the hobby gardener.

Conclusion

Many people automatically assume that a greenhouse is the only ticket to a better garden. We hope that the options discussed above will encourage you to consider all the factors that limit your vegetable production. More expensive options do not always bring bigger, better vegetables from your soil, so play with the basics and build on them over time. A few simple changes could bring you more tasty and a larger amount and variety of produce. As with anything in gardening—or life—do your research, experiment, and enjoy the process.

Resources for Growing More and Longer

Many of the following references are available at your local library.

General Gardening Resources

Damrosch, Barbara. **The Garden Primer**, Workman, 2008. This general gardening “bible ” plays its strong suit in regard to vegetables, with its appealing discussion of many varieties of vegetables, some unusual, at length and in laymen’s terms. Growing habits, garden layout, size and style of garden are addressed. Includes a helpful section on starting seeds, a succinct section on season extension, and a very complete list of mail order sources for every gardening need—plants, seeds, tools, organizations.

Kingsolver, Barbara. **Animal, Vegetable, Miracle: a Year of Food Life**. Harpercollins, 2007. www.animalvegetablemiracle.com Family lives for a year on only food they produce or buy locally.

Toensmeier, Eric. **Perennial Vegetables: from Artichoke to ‘Zuiki’ Taro, a Gardener’s Guide to Over 100 Delicious, Easy-to-Grow Edibles**, 2007.

Season Extension Resources

Coleman, Eliot. **Four Season Harvest: Organic Vegetables from Your Garden All Year Long**, Chelsea Green, c1999.

Coleman, Eliot. **The Winter Harvest Handbook**, Chelsea Green, 2009. Coleman’s experience shines. Gardeners and farmers can use the innovative, highly successful methods Coleman describes in this comprehensive handbook to raise crops throughout the coldest of winters.

Coleman offers clear, concise details on greenhouse construction and maintenance, planting schedules, crop management, harvesting practices, and even marketing methods in this complete, meticulous, and illustrated guide.

Damerow, Gail. **14 ways to extend your gardening season**. Mother Earth News, Vol. 144, 1994, p.58. <http://www.motherearthnews.com/Organic-Gardening/1994-06-01/Fourteen-Ways-to-Extend-Your-Gardening-Season.aspx>

Jensen, Erika. **Hardy greens extend the season**. Countryside & Small Stock Journal, September/October, 2003, Vol. 87, p. 74. Search “Hardy greens extend the season” on-line, then go to article abstract, and click on PDF text version, courtesy of local library.

Pleasant, Barbara. **Extend your growing season.** *Mother Earth News*, February/March, 2007, p. 34. <http://www.motherearthnews.com/Organic-Gardening/2007-02-01/Garden-Know-how.aspx?page=2>

Poisson, Leandre and Gretchen Vogel Poisson. **Solar Gardening: Growing Vegetables Year Round the American Intensive Way**, Chelsea Green, 1994.

A considerably shortened version of the Poisson book is available from <http://eap.mcgill.ca/MagRack/SF/Winter%2094%20O.htm>

Protective structures

How to build a cold frame, <http://www.thisoldhouse.com/toh/how-to/intro/0,,20417543,00.html> with accompanying on-line instructional video

Smith, Shane. **Greenhouse Gardener's Companion**, revised. Fulcrum, 2000. Good information on greenhouse building considerations, plant propagation, transplanting, selecting the right seed, mail ordering seeds. Focusing on growing vegetables primarily in a greenhouse, not outside, Smith also offers advice on winter greenhouse crops.

Undercover gardening in Colorado throughout winter with a cold frame, <http://www.frontrangeliving.com/garden/coldframe.htm> 09/12/10

Web resources from CSU

CSU Extension publications, many and varied topics:

<http://www.cmg.colostate.edu/pubs.shtml>. Be sure to check these!

CMG GardenNotes:

CMG GardenNotes #720, *Vegetable Planting Guide*
<http://www.cmg.colostate.edu/gardennotes/720.pdf>

CMG GardenNotes #721, *Sample Planting Guide for Raised-Bed Garden*
<http://www.cmg.colostate.edu/gardennotes/721.pdf>

CMG GardenNotes #722, *Frost Protection and Extending the Growing Season*
<http://www.cmg.colostate.edu/gardennotes/722.pdf>

CMG GardenNotes #723, *Growing Vegetables in a Hobby Greenhouse*

CSU Planttalk publications:

#1310, Hobby greenhouses: construction & foundations;

www.ext.colostate.edu/ptlk/1310.html

#1311, Hobby greenhouses: coverings; www.ext.colostate.edu/ptlk/1311.html

#1312, Hobby greenhouses: heating & cooling;

www.ext.colostate.edu/ptlk/1312.html

Eagle County CSU Extension web resources

The Eagle County CSU horticulture and small acreage website promotes many helpful CSU GardenNotes publications (besides our favorites above), as well as other go-to Powerpoints and resources:

[http://www.eaglecounty.us/csu/horticulture and small acreage/resources/](http://www.eaglecounty.us/csu/horticulture_and_small_acreage/resources/)

Edmunds, Brooke. *Greenhouse Growing Workshop held in April 2009 for Eagle County Extension Service:*

[http://www.eaglecounty.us/CSU/Horticulture and Small Acreage/Resources/](http://www.eaglecounty.us/CSU/Horticulture_and_Small_Acreage/Resources/) Click on Greenhouse Growing Workshop

Pottorff, Laura. *Backyard Greenhouses, Sunspaces, and Cold Frames*. Powerpoint presentation of protective enclosure scenarios and considerations:

<http://www.colostate.edu/Depts/CoopExt/Adams/gh/pdf/dbghobby.pdf>

Many equipment and seed catalogs are chock full of planting information, growing suggestions, and unique seed selections. Suggested general and specialty catalogs listed below:

A favorite source for growing supplies is Growers Supply, 1440 Field of Dreams Way, Dyersville, IA 52040, 1.800.476.9715, www.growerssupply.com

Garden seeds--authors' favorites:

Heirloom seeds and seed planting: <http://www.heirloomseeds.com/germination.html>

High altitude seeds: www.seedstrust.com

Other useful seed catalogs and seed information, many courtesy of frontrangeliving.com:

Botanical Interests in Broomfield, Colorado--offers a variety of winter salad greens including mâche, endive and all the other more traditional favorites:
www.gardentrails.com

Cook's Garden in Vermont--specializes in a great array of salad greens for home gardeners at www.cooksgarden.com

Fedco Seeds--www.fedcoseeds.com--detailed seed descriptions, large variety

John Scheepers Kitchen Garden Seeds--offers a pack of winter vegetable seeds for gardeners at www.kitchengardenseeds.com

Johnny's Selected Seeds—www.johnnysseeds.org—offers a large variety of organic seeds, a mainstay seed company from Maine

Le Jardin Du Gourmet in Vermont—European varieties of vegetables not readily available elsewhere at www.artisticgardens.com

Seeds West Garden Seeds in Albuquerque, New Mexico has open-pollinated, certified organic seeds, short-season vegetable seeds at www.seedswestgardenseeds.com