

Season Extension Tools & Techniques

Introduction

Season extension techniques can be as simple as selecting early maturing varieties; or they can be a more complex combination of multiple methods. Regardless, the objective is to extend the growing season by producing earlier crops in the spring and/or push production later into the fall and early winter.

Marketing and Market Outlook

Growers able to provide the earliest locally grown fruits and vegetables frequently capture premium prices. The same can be said for those who harvest crops well into fall and winter. A longer production season may place Kentucky growers in a better position to compete with producers to the south. Some season extension techniques can also result in higher yields and improved product quality. Extending the season has the potential of spreading out cash-flow, increasing overall farm profits, and gaining new customers.

Marketing avenues include roadside stands, farmers markets, U-pick, restaurants, locally owned grocers, community supported agriculture (CSA) subscriptions, produce auctions, and wholesale markets. Growers primarily selling their produce via farmers markets may find they have to locate alternative markets for products available outside the regular season. However, some farmers markets in the state operate year round by using indoor facilities during the winter.

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Specific Tools and Techniques

Planting site

The location of the growing site can have an impact on the length of the growing season available for production. Selecting a site with a southern exposure, especially a south-facing slope, can help increase the earliness of certain crops. Avoid the top of a hill, where wind exposure can be a problem, as well as the bottom of a slope where cool air will settle.

Factors that affect soil warming, such as soil type and soil color, can impact earliness, as well. Darker soils will warm up more quickly in the spring; the addition of organic matter can help to darken light-colored soils. Loam and clay soils absorb and hold the heat better than sandy soils. Soil warming is also improved in raised beds and with the use of dark mulches.

Transplants

The use of transplants is another way of getting an earlier start to the season. Harvests of transplanted crops tend to be as much as 3 to 4 weeks ahead of direct-seeded fields. In addition, transplants

are generally better able to compete with weeds than young seedlings are.

Windbreaks

Various windbreaks can be used to protect sensitive crops from cooling winds. Brush piles, fences, fence rows, shrubs, stone walls, and snow fences can effectively block winds. Some windbreaks can perform double duty. For example, certain types of willows can serve as a windbreak while also providing woody cut material for the floral industry. Likewise, brambles can provide wind protection with the bonus of a crop of blackberries/raspberries. Perennial grass strips or small grain cover crops can act as windbreaks in the spring. Commercial windbreak materials are also available.

Windbreaks should be placed perpendicular to the prevailing winds. The goal is to provide wind protection without obstructing air circulation or forming frost pockets.



crops, such as lettuce and spinach, further into the growing season.

Irrigation

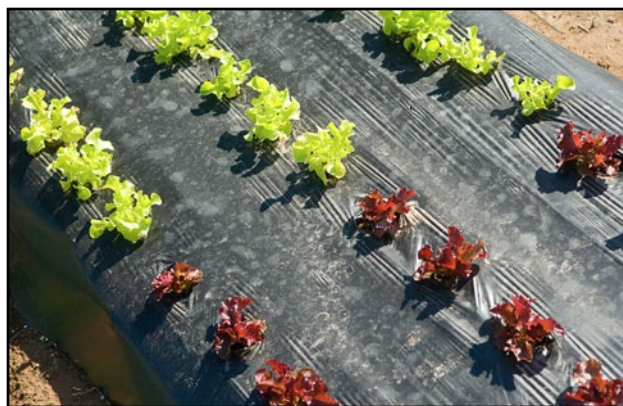
Irrigation systems, especially overhead sprinklers, may provide some protection against frost in early spring or fall.

Cultivar selection

Selecting early-maturing cultivars may result in harvests of a week or two earlier than standard varieties. Additionally, selecting cold-tolerant varieties for spring plantings and heat-tolerant ones for summer can help get the most out of the growing season. To get a range of harvest dates, use varieties with different “days to maturity” and/or stagger the planting dates.

Mulches

Plasticulture has become a widespread practice with many benefits, one of which is increased soil warming in the spring. Crops grown with black plastic mulch can be as much as 7 to 21 days earlier than those grown on bare ground. Plastic mulches are often used in combination with other season extension techniques, such as raised beds, row covers, low tunnels, and high tunnels. Irrigation is necessary when using plastic mulch.



Black is the most commonly used plastic mulch color; however, the effect of various other colors has been investigated. Clear plastic has been found to be the most effective in raising soil temperatures. Unfortunately, weeds grow under clear plastic, negating the weed control benefit generally associated with mulches. White plastic has been found to be effective in reducing soil temperatures, making it possible for cool-season crops to be planted when soils would otherwise be too warm for establishment. However, depending on its opacity, white mulch may also allow light penetration and weed growth. White-on-black mulch will still provide cooling while preventing most weed germination. Red mulch performs much as black does, but research indicates that it enhances the yields of certain crops, such as tomatoes. New innovations in plastic mulch are continually being investigated.

Black plastic mulch has its disadvantages. Some plants can overheat as the season progresses; even leaves in contact with the plastic can be damaged. Another drawback of plastic mulches in general

is the difficulty of removal and disposal at the end of the season.

Organic mulches, as well as various paper mulches, can provide some of the benefits of plastic mulches. The fact that these mulches are also biodegradable eliminates the removal and disposal problem inherent with plastic. However, organic mulches may have a cooling effect on the soil and result in the delayed emergence of spring crops.



Floating row covers

Floating row covers consist of large sheets of lightweight fabric placed over single or multiple rows of a crop to provide some protection against frost. The covering may be made of clear polyethylene, spunbonded polyester, or spunbonded polypropylene. The fabric comes in different weights; the heavier the material, the greater the frost protection. Row covers can be used in fall, as well as early spring, to extend the season. When used to protect spring crops, covers are removed before the plants mature, while fall frost protection necessitates leaving the covers on mature plants.

The fabric, which basically “floats” on the crop as it grows, allows rain, air, and sun to penetrate. In addition to frost protection, row covers may provide a barrier to some insect pests and wildlife. Covers need to be removed from fruiting plants during bloom to facilitate insect and/or wind pollination. Row covers can also cause abrasions of some crops as the fabric rubs against the foliage and tender growing tips.

Low tunnels

Low tunnels are wire or PVC hoops covered with clear plastic or fabric row covers. The covers are generally in place for only three or four weeks and



then removed. Besides providing an excellent means of extending the growing season, low tunnels also offer wind protection.

Low tunnels with a plastic covering do not permit rain to penetrate so they are often used in conjunction with black plastic mulch and drip irrigation. Low tunnels also trap heat so that daytime temperatures can rise to dangerous levels within the tunnel, making ventilation essential. Various modifications to the original low tunnel design and covering have been made to allow for increased air circulation. These include pre-cut slits in the covering material, a “seam” running down the center top of the tunnel that can be opened on hot days, raising one side of the tunnel covering, and the double-hoop system that allows for raising and lowering both sides.

High tunnels

The field greenhouse of the past is now generally called a “high tunnel” or “hoophouse.” A high tunnel is a hooped frame of walk-in height covered with plastic. Tunnels may have a rounded Quonset shape or they may have the peaked roof of a Gothic style high tunnel; they may be a single stand-alone house or form multi-bay tunnels. High tunnels can be erected as moveable structures that are relocated to a new site each season, or they may be placed in a more permanent location. If the tunnel is to remain in one location, it is important to remember that salts can build up in the soil from fertilizer applications. Plan on removing the plastic cover

as needed to allow natural precipitation to flush the salts from the soil.



The frames, which can be constructed of metal pipe, wood, or PVC pipe, are covered with one or two layers of greenhouse-grade polyethylene; those covered with two layers of plastic have an air layer in between, thus offering better insulation and, consequently, more cold protection.

Tunnels are generally ventilated by manually rolling up the sides each morning and rolling them back down in the evening. However, a system that is becoming more common has drop-down side walls. Some designs feature removable or hinged end walls so a small tractor or tiller can be driven in. Covering the entire soil surface under the tunnel with plastic mulch makes tilling unnecessary. While high tunnels do not have a permanent heating system, a portable heater can be used when unexpected drops in temperature occur. When vented properly, serious foliar and fruit diseases are often fewer since plant surfaces remain dry while in the protective environment of the high tunnel.

A wide variety of crops can be grown in irrigated ground beds within the tunnel. These include vegetables, small fruits, and flowers. In addition to extending the season earlier into spring and later into fall, high tunnels can be also be used for the winter production of various cool-season crops, such as greens and herbs.

Yields have been reported to be as much as double the amount that could be produced in the

field without the tunnel. A combination of an earlier planting date, along with the more rapid ripening that occurs within the tunnel, can result in mature tomatoes as much as one month earlier than field tomatoes.

Economic Considerations

A number of season extension techniques are relatively inexpensive and require little capital investment. Even the more costly techniques, such as row covers and tunnel structures, can be relatively economical.

The approximate cost of a floating cover is less than a penny per square foot, excluding labor costs. The approximate construction cost of a low tunnel may range from \$0.25 to \$0.50 per square foot. Excluding labor, material and equipment costs for high tunnel construction may range from about \$1.00 to \$2.50 per square foot; the use of more expensive irrigation and heating technologies are reflected in higher costs per square foot. Plastic mulch and irrigation costs are approximately \$0.20 per square foot.

Because of their simple design, tunnel structures are not difficult to construct and manage. However, since they are not automated in any way, high tunnels will require daily attention and labor to ensure proper ventilation. This can also be the case with low tunnels. Row covers and tunnels could also require monitoring during heavy storms. The additional management/labor requirements of some season extension techniques, not to mention the increased demands of a longer growing season, can result in higher production costs. However, growers able to obtain price premiums for their early and/or late season crops may be able to at least recoup these costs, possibly even receiving higher profits.

Growers should carefully weigh the costs of season extension techniques against the potential profits. Costs may be spread across multiple crops during different times of the year. For example, overhead irrigation equipment used for fruit frost protection could be used for other crops during

the summer. Evaluating the economic effects of season extension upon the whole farm production and marketing plans will help gauge the total costs and benefits affiliated with different levels of investment in materials and equipment.

Selected Resources

- Extend Your Vegetable Season (University of Kentucky) 5.71 MB file
<http://www.uky.edu/Ag/Horticulture/seasonextension.pdf>
- Plastic Tunnels Provide Expanded Production Opportunities (University of Kentucky, 2004)
<http://www.ca.uky.edu/AGC/NEWS/2004/Jan/tunnel.htm>
- Bumper Crops Early And Late: Season Extension Using Plasticulture (Kerr Center for Sustainable Agriculture, no year) 3.21 MB file
http://www.kerrcenter.com/futurefarms_08/presentations/upson.pdf
- Center for Plasticulture (Pennsylvania State University)
<http://plasticulture.cas.psu.edu>
- Extending the Production Season for Vegetables and Small Fruit (University of Maryland, 1999)
<http://extension.umd.edu/publications/PDFs/FS760.pdf>
- High Tunnels (Kansas State Research and Extension, University of Missouri Extension and University of Nebraska Cooperative Extension)
<http://www.hightunnels.org>

- Marketing Strategies for Farmers and Ranchers: Season Extension (SARE, 2004)
<http://www.southernsare.org/Educational-Resources/Bulletins/National-SARE-Bulletins/Marketing-Strategies-for-Farmers-and-Ranchers/Text-Version/Season-Extension>
- Midwest Season Extension (Midwest Organic and Sustainable Education Service)
<http://midwestseasonextension.org/default.htm>
- Season Extenders (Virginia Tech, 2009)
<http://pubs.ext.vt.edu/426/426-381/426-381.html>
- Season Extension Techniques for Market Gardeners (ATTRA, 2005)
<https://attra.ncat.org/attra-pub/summaries/summary.php?pub=366>
- Sustainable Season Extension: Considerations for Design (ATTRA, 2011)
<https://attra.ncat.org/attra-pub/summaries/summary.php?pub=370>
- Use of Different Colored Mulches for Yield and Earliness (University of Connecticut, 1999)
<http://www.hort.uconn.edu/ipm/veg/htms/colrmlch.htm>
- Use of Plastic Mulch and Row Covers in Vegetable Production, F-6034 (Oklahoma State University, 2007)
<http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1099/F-6034%20web.pdf>

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For additional information, contact your local [County Extension](#) agent