

Education for Farmers, by Farmers

SEASON EXTENSION FOR HIGH-VALUE SPECIALTY CROPS

Growing Washington
Everson, WA

Monday, July 10, 2017

FARMWALK2017

presented collaboratively by:



Food Systems

WASHINGTON STATE UNIVERSITY

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CONTENTS...



Growing Washington plants, tends & harvests it's organic produce & livestock on many plots of land:

- TEN parcels totalling just over 100 acres
- 6 total greenhouses
- over 30 high tunnels



Farm Manager and Executive Director of Growing Washington, Clayton Burrows, hosts this Farm Walk in Everson, WA. He will focus on the efforts to raise crops on the shoulder seasons in a climate that gets quite cold in winter and often has late, wet Springs.

FARMWALK2017

ABOUT GROWING WASHINGTON...



Growing Washington is a diversified, certified organic farm with fields in Whatcom and Skagit Counties. The farm operates year-round, employing up to 60 employees during peak season and maintaining a smaller staff all year. The farm grows a wide variety of small fruits, vegetables, greens, herbs, and also grows pastured broilers and turkeys, but specializes in berries, salad greens, and row crops. In addition, the farm is a WSDA processor, and operates a small commercial food facility that produces value added products like jams, vinegars, tomato-based canned goods, simple syrups, and pestos.

Growing Washington got its start 10 years ago when the owner-operators of Alm Hill Gardens, Ben Craft and Gretchen Hoyt, were looking for a succession plan. The initial match between Clayton Burrows and Ben and Gretchen was arranged through FarmLink, which at the time was ran by Mary Embleton and the Cascade Harvest Coalition. Ben and Gretchen were instrumental in getting Growing Washington going, helping the young group of farmers understand the realities of running a diversified organic farm, and were also instrumental in helping Growing Washington get initiated into the farmers markets in Seattle and the greater Puget Sound Region. Ben and Gretchen also maintained a strong staff of Latino farmers, many of whom continue to manage and work the fields today. While Ben and Gretchen have retired from commercial food production, they still grow and sell cut flowers in the winter and spring—specializing in tulips and peonies. Growing Washington still leases land and infrastructure from Ben and Gretchen, including the original Alm Hill site, and still benefits from the knowledge and experience from two of the state's first organic and direct-market farmers.



The products raised by Growing Washington are sold through a variety of avenues. The farm attends roughly 15 farmers markets per week during the growing season, most of which are located in Seattle. Growing Washington also runs the state's largest locally powered CSA (The Local Choice Food Box), delivering nearly 1,500 customized CSA boxes per week to customers in King, Snohomish, Skagit, and Whatcom Counties. The CSA has over 125 pickup locations throughout Puget Sound, and also delivers to many of the major employers in the region including Microsoft, The Seahawks, Vulcan, Boeing, Expedia, and Google. The CSA program is a multiple farm model, meaning that on any given week several producers from all over the state contribute items to the boxes. Each year the CSA generates roughly \$1,000,000 that goes directly to over 50 local farmers. The CSA has expanded to include local specialty food producers who make a variety of different products, including things like bread, pasta, dairy, meat, tortillas, drinks, value-added canned goods, and a host of other locally sourced and produced items.

GROWING WASHINGTON CONT..

The farm has been named Washington State Farm of the Year by its peers at Tilth, has been named one of Washington's top 50 Green Employers, and has been recognized with a number of awards and accolades over the course of the last decade. It has also been an incubator for innovation and new businesses, and has been instrumental in the beginnings of Growing Veterans, Sunny Honey, Raven Breads, and other Washington-based operations. Many of Growing Washington's former employees have gone on to start their own thriving farms. Though operating for a decade now, Growing Washington is still learning the fundamentals of farming a diversity of crops in an organic system, and each year learns more from mistakes than from successes. The ability to run such a diversified operation in multiple counties has taught the farmers a lot about the challenges of maintaining soil health, succession planting, irrigation, functioning infrastructure, proper cultivation and weed control, season extension, pest control, and maintaining a staff capable of keeping up with the logistics necessary to attend the farmers markets, run the CSA, maintain wholesale accounts, and run a business at the same time. Each season is different, and each one brings its own challenges and successes.

The farm walk today will focus on the efforts to raise crops on the shoulder seasons in a climate that gets quite cold in winter and often has late, wet springs. With extreme weather becoming the norm now, the ability to bring food to market early and to have it late comes with its own sets of challenges, risks, and necessary planning. This topic is particularly poignant this season as the farm had several greenhouses severely damaged by heavy winter snowfall and shortly after had a significant winter flood. This spring was also the wettest on record, so the farm is particularly late in getting crops in the ground and to market. So, the topic of resiliency and acclimating to extreme weather and fluctuations in weather patterns is both a timely and important topic for farmers who seek to grow and offer food year-round.





Section **2**

Related Publications & Helpful Tools

CONTENTS

This bulletin is a companion to SARE's High Tunnels and Other Season Extension Techniques Topic Room, an online collection of select, mostly SARE-based resources on season extension. Information on the following topics is available at www.SARE.org/Season-Extension:

TYPES AND CONSTRUCTION

CULTIVAR SELECTION AND VARIETY TRIALS

FERTILITY MANAGEMENT

PEST MANAGEMENT

WATER MANAGEMENT

TEMPERATURE MANAGEMENT

MARKETING AND ECONOMICS

SARE's Topic Rooms contain dozens of publications, videos and other educational materials on a wide range of topics, including cover crops, local food systems, small ruminants and more. Visit www.SARE.org/Topic-Rooms.

Written by Vern Grubinger,
Northeast SARE



High Tunnels and Other Season Extension Techniques



Photos (clockwise): Drip irrigation is used in this solar-heated greenhouse on Santa Cruz Farm in Espanola, N.M. - Santa Cruz Farm String beans in Mississippi farmer Hattie Thompson's high tunnel. - USDA To adjust temperature, high tunnel covers can be raised so that air may flow in and out. - Jerry DeWitt

SPURRED BY ENTHUSIASM FOR FRESH, local agricultural products, farmers are increasing the availability of their crops beyond the traditional outdoor growing season. Premium prices and an extended income stream are some of the advantages farmers pursue with season extension techniques. Main strategies for creating extended-season sales include: growing in greenhouses, high tunnels (or "hoop houses") or under temporary row covers; storing non-perishable crops for sale in the off season; or minimally processing crops.

Commercial high tunnel production has increased rapidly in recent years because these structures promote increased crop quality and productivity, and extend the growing season. This leads to rapid payback on investment. The growing environment inside a high tunnel is different from the field, and thus crop management differs in many key areas. The *High Tunnels and Other Season Extension Techniques* topic room includes information to help you explore and implement season extension strategies on your farm.

TYPES OF STRUCTURES

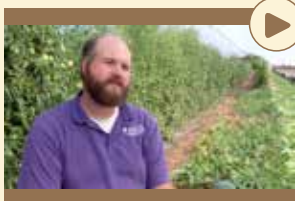
SEASONAL STRUCTURES THAT PROTECT crops from cold temperatures and inclement weather vary widely in size, shape, materials and purpose. The following are common types.

Row covers are sheets or strips of synthetic, breathable fabric of various weights and mesh diameters. Sometimes greenhouse plastic is also used. These materials are placed over individual rows, with or without supporting wire hoops, or over entire fields. "Floating" row covers are unsupported, laying directly on the plant leaves as the crop grows.

Low tunnels and **caterpillar tunnels** are seasonal structures covered with the same materials as row covers, but with rigid supports such as metal or plastic tubing, or electrical conduit. Low tunnels are typically 2 to 3 feet high and cover the width of a growing bed. Like row covers, they protect cold-hardy crops in winter and spring plantings from cold and wind. Low tunnels are increasingly used for pest management also.

Caterpillar tunnels are three-season structures and are typically 6 to 8 feet high and 10 to 20 feet wide. They are usually held in place with ropes anchored to the ground. Ventilation must be managed manually. Caterpillars and low tunnels differ from high tunnels in that they are removed when not in use, are much less durable and are much more portable. They represent a lower investment than high tunnels.

High tunnels, or **hoop houses**, are simple greenhouse-like structures over bare ground,



without the elaborate heating and cooling systems of a greenhouse. They rely primarily on passive solar heating and passive ventilation. High tunnels generally have steel pipe frames set into the ground and are covered with one or two layers of greenhouse-grade plastic. They are irrigated using drip systems, hand watering or small sprinklers. Roll-up sidewalls, usually hand cranked but sometimes automated, provide ventilation in a high tunnel. They may also have end-wall vents (louvers) or ridge vents. Crops grow in the ground, raised beds or containers. The ground may be bare, or it may be covered with landscape fabric, plastic mulch or an organic mulch such as straw. Guides for high tunnel design and construction are abundant; check out the Types and Construction section of the topic room for Extension guides with detailed high tunnel plans, including photos and designs.

Smaller high tunnels may be Quonset shaped (half-circle frame) while larger tunnels are Gothic shaped (peaked frame). Gothic frames shed snow well. Both designs are best with internal bracing to provide stability during wind or snow. Ground posts must be securely anchored to ensure structural stability. Multi-bay high tunnels are built side by side to cover more acreage with less exposed surface area. They require gutters and structural reinforcement to handle rain and snow shed from the top of the bays. Multi-bay high tunnels are generally not considered four-season structures in regions with snowy winters, as they cannot bear a snow load.

Greenhouses tend to be similar in size to high tunnels or larger, often with more structural strength. They may or may not have a permanent foundation. They are covered with one or two layers of greenhouse plastic, rigid polycarbonate or glass. Greenhouses have supplemental heat from a furnace or boiler, and automated ventilation with fans and/or louvers. As greenhouse heating, cooling and irrigation are automated, full electrical service is required.

SPECIAL CONSIDERATIONS FOR HIGH TUNNEL PRODUCTION

THE GROWING ENVIRONMENT INSIDE A high tunnel varies in many important ways from field production, and those differences will influence the way crops are managed.

Cultivar Selection and Variety Trials. The desirable characteristics of crop cultivars/varieties for high tunnel production are much the same as field production: good yield, high quality and pest tolerance. However, depending on the season, high tunnel cultivars/varieties must be able to thrive in higher temperatures and relative humidity, tolerate freezing, or have their day-length requirement met. Thus, the best field cultivars/varieties are often not ideal for use inside a high tunnel. Pest pressure is also different, so tolerance to diseases or insects that are not prevalent outdoors may be a consideration. In the Cultivar Selection and Variety Trials section of the topic room, a good primer is the video *What to Plant*, part of a Kansas State series on high tunnel vegetable production (see sidebar).

Fertility Management. In a high tunnel, plant growth may start earlier, last longer and/or lead to a significant increase in biomass and yield. Thus, nutrient needs may vary from field production, so plan fertilization accordingly. In addition, salt accumulation is a greater concern in a high tunnel because rainfall does not leach nutrients from the soil. Carefully monitor soil fertility status, including soluble salts, and conduct plant tissue analyses when making fertility decisions. Soil test annually, as pH can rise quickly in the absence of rain.

Pest Management. Many foliar diseases are eliminated from high tunnels, as rain and soil splashing are eliminated. However, due to higher



Kansas State's high tunnel series includes videos on designing a high tunnel, what to plant, basic and intensive management considerations, and additional high tunnel resources.

Visit www.SARE.org/Season-Extension/Kansas-High-Tunnels.

Photo courtesy Santa Cruz Farm in Espanola, N.M.

PHYSICAL PEST EXCLUSION IN GREENHOUSES

Insect pests love Alabama, with its hot, humid climate and long growing season. For vegetable growers who want to use fewer pesticides but face the risk of major crop losses, and especially for organic growers, who cannot use conventional chemicals at all, pests are a huge problem.

But help is coming in the form of new pest management techniques and improved outreach, being delivered to farmers by Alabama Extension Entomologist Ayanava Majumdar.

Physical pest exclusion is one new tool Majumdar is bringing to farmers. Typically accomplished by growing crops inside structures covered with a shade cloth akin to mosquito netting, the strategy showed promise on Will Mastin's farm, where he tested it

in 2013 with a SARE farmer grant. Inside the protected structures he lost less than 20 percent of a tomato crop to pests, whereas in the open field his loss was nearly total.

"We almost don't even have to worry about caterpillars inside of these structures anymore. It used to be a constant scouting routine," says Mastin, who grows produce for local markets around Baldwin County. "And so it saves us labor, it saves us pesticide usage and we can focus on planting, harvesting and doing the things that we need to be doing instead of just trying to take care of our crops from the bugs constantly."

Visit www.sare.org/mastin to hear Will Mastin describe his experiences with shade cloth and share some tips.



humidity levels, a handful of diseases become more severe inside; thus proper ventilation is critical. Higher temperatures, the exclusion of rain and a humid microclimate inside the plant canopy can promote certain insect pests, especially if there is little or no fallow period. Aphids, thrips, spider mites and whiteflies are common insect pests inside high tunnels. The good news is that high tunnels are an excellent setting for using biological control agents due to the high value of the crops, the enclosed space (if ventilation openings are covered with mesh screens) and controlled environmental conditions that improve persistence. The Pest Management section of the topic room includes resources on such high tunnel pest management strategies as tomato grafting for disease resistance, beneficial insects, physical pest exclusion and biofumigation.

Water Management. To take full advantage of a high tunnel, one must precisely control the supply of water to crops. Use drip irrigation to deliver water directly to the root zone, without wetting the foliage. This helps avoid foliar diseases and the washing off of foliar bioinsecticides. When there is plenty of light, high temperature and low humidity, crops will use a lot of water, but be careful not to overwater, as excessively wet soil can be difficult to dry out. Use soil-moisture monitoring devices to match the amount and timing of water to the crop's needs. Consider providing soluble fertilizers through the drip system to "spoon feed" crops.

Temperature Management. In some high tunnels, the sun may satisfy all energy needs, with the soil acting as a nightly heat reservoir. Other high tunnels may have supplemental or emergency heating systems. High tunnels in colder climates where heat-loving crops are produced on the "shoulders" of the growing season will typically have furnaces

or boilers to maintain the optimal temperature for growth. Understanding the temperature requirements of the crop, and then ventilating or heating to maintain that temperature, is critical. Important energy conservation measures for high tunnels range from sealing cracks around doors and ventilation louvers to installing night-time heat curtains. Low tunnels can be instrumental in retaining heat stored in the soil during the night. Some high tunnels are also using renewable fuels to provide heat, such as biodiesel, shell corn, wood and solar hot water collectors. For low-growing crops, heating the soil with circulating water pipes below ground may be more efficient than heating the air inside the tunnel. The Temperature Management section of the topic room includes resources on the important topics of energy conservation and alternative energy strategies.

Marketing and Economics. Thousands of commercial high tunnels are in use around the country because they make economic and marketing sense for many growers. High tunnels generally allow for improved pest control, making them a good option for organic production. However, carefully consider the potential costs and returns prior to getting into high tunnel farming. A possible avenue of support is through the USDA Natural Resources Conservation Service, which offers financial assistance for high tunnel construction. The net profit from high tunnel crops ranges from just a few cents per square foot up to several dollars per square foot, depending on yield, production expenses and grower skill. Labor is a special consideration. Be aware that high tunnel farming is relatively labor intensive and requires skill, and that such labor must be available to perform tasks in a timely fashion to ensure profitability. The

Will Mastin stands inside one of his high tunnels that he covered with shade cloth to protect his crops from certain pests.

- Photo by Candace Pollock, Southern SARE



Use SARE's *Building a Sustainable Business* to help you plan for season extension on your farm.

Download the book for free at www.SARE.org/Business.

Find guides on building a walk-in cooler and retrofitting an existing structure, developed by a Massachusetts nonprofit at www.SARE.org/season-extension/MA-cooler.

Photo by Lewis Jett,
West Virginia University

Marketing and Economics section of the topic room includes resources on both high tunnel production and general business planning, which may be of help.

STORING CROPS

STORING FIELD CROPS SUCH AS CARROTS OR potatoes can lengthen their marketing window, which is another approach to season extension. The length of time that crops can be stored is a function of their postharvest physiology as well as pre-storage activities, including how they are produced, harvested and handled. Optimal storage conditions vary among crops. Five common sets of storage conditions for vegetable crops are:

- Cold and moist = 32°F and 90-95 percent relative humidity (RH).
Ex: beets, cabbage, carrots, parsnips, turnips.
- Cold and dry = 32°F and 65-70 percent RH.
Ex: garlic and dry onions.
- Cool and moist = 45°F and 90 percent RH.
Ex: potatoes for table stock.
- Warm and moist = 57°F and 85-90 percent RH.
Ex: sweet potatoes.
- Warm and dry = 55°F and 50-70 percent RH.
Ex: winter squashes, including pumpkins.

Storage options include cold cellars or root cellars, walk-in coolers and cold rooms fitted with air conditioners and temperature-override controllers. Cold cellars are a low-cost, low-energy-use option, but may lack the environmental control of other options. Walk-in coolers use refrigeration systems and are widely found on wholesale farms, supermarkets and other places that handle large volumes of fresh produce. Cold rooms are widely used on farms with small volumes of storage produce.

Air conditioner temperature-override controllers such as CoolBot™ units allow residential air conditioners to provide cooling in small-scale storage units. These units require a sealed, well-insulated storage room to be effective, and they may have trouble cooling down produce with a lot of field heat in it.

LIGHT PROCESSING OF CROPS

FIELD CROPS CAN BE PRESERVED AND SOLD in the off-season through light processing techniques such as canning, dehydrating or freezing. To learn more about processing, see the Food Safety and Food Processing sections of the *Farm to Table: Building Local and Regional Food Systems* topic room (www.sare.org/local-food/processing).

HIGH TUNNELS PROVIDE A COMMUNITY BOOST IN WEST VIRGINIA



For years, high tunnels have been popping up throughout many cold Northeastern states but in West Virginia they were not as common.

Until 2008 that is, when West Virginia University Extension Specialist Lewis Jett and his colleagues turned their attention to the technology, which has since proved invaluable not just for local farmers, but for local communities as well.

That year, Jett received a SARE grant to begin a four-year project that taught hundreds of farmers

and Extension educators how to use high tunnels successfully. The grant was a major impetus for the leap in adoption the state has recently seen: Whereas no more than 20 high tunnels were in use in 2007, there were more than 150 by 2012.

A state benefits from having a hundred new high tunnels because it means more healthy, locally raised food options are available to consumers. In West Virginia,

schools have been particular beneficiaries. “It’s really helped our farm-to-school program,” Jett says. “That used to be an unattainable option for growers, but now that we have tunnels in place, it’s really an option.”

Jett, who provides technical assistance to the West Virginia Department of Education’s Farm to School program, says that the majority of the 75 to 100 participating farmers are now using high tunnels to help them meet cafeterias’ seasonal demand.

Terry Hudson, who uses two high tunnels on a two-acre vegetable farm outside Charleston and collaborates with Jett on education projects, has fully embraced the potential of high tunnels to support local schools. One of his two tunnels is essentially a classroom, where he hosts both periodic field trips and regular visits from small groups of children with mental and physical disabilities. In his second tunnel, Hudson grows commercial crops year-round, using intensive, carefully timed rotations: He raises high-value crops like tomatoes, peppers and eggplants in warmer months and leafy greens and root vegetables through the winter. By selling at farmers’ markets and to restaurants, he nets about \$13,400 per year from that high tunnel.

“We have unique micro-climates here—early and late freezes and frosts, strong winds and heavy snow,” Jett says. “These tunnels have really demonstrated that you can buffer the crop against our erratic climate and consistently grow a good crop.”



Section 3

Additional Online Resources

ADDITIONAL ONLINE RESOURCES...

Growing Washington's Website: <https://www.growingwashington.org>

Cost Estimates of Producing Strawberries in High Tunnels in WA
<http://cru.cahe.wsu.edu/CEPublications/FS093E/FS093E.pdf>

Cost Estimate of Producing High Tunnel Tomatoes in Western WA
<http://cru.cahe.wsu.edu/CEPublications/FS090E/FS090E.pdf>

Cost Estimate of Producing Head Lettuce in High Tunnels in Western WA
<http://cru.cahe.wsu.edu/CEPublications/FS092E/FS092E.pdf>

Berries for the Inland Northwest

<http://cru.cahe.wsu.edu/CEPublications/MISC0253/MISC0253.pdf>

Cost Estimates of Establishing and Producing Red Raspberries in WA
<http://cru.cahe.wsu.edu/CEPublications/TB21E/TB21.pdf>

NRCS EQIP PROGRAM

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/>

SARE - Season Extension: Cultivar Selection and Variety Trials

<http://www.sare.org/Learning-Center/Topic-Rooms/High-Tunnels-and-Other-Season-Extension-Techniques/Season-Extension-Cultivar-Selection-and-Variety-Trials>

Suggested Reading:

The Greenhouse and Hoophouse Grower's Handbook: Organic Vegetable Production Using Protected Culture
by Andrew Mefferd

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Do your own general search at (<https://pubs.wsu.edu>)



Food Systems

WASHINGTON STATE UNIVERSITY



Supporting thriving Washington farms, ecosystems, and food economies to provide communities with equitable access to sustainably produced and healthy foods.



Our food systems work is guided by an interdisciplinary team of WSU Faculty, Staff, and critical non-WSU partners. Team members collaborate on initiatives that promote research, implement change, and provide unparalleled educational opportunities for communities, graduates and undergraduates. All of this work is supported through the Center for Sustaining Agriculture and Natural Resources (CSANR) which convenes extension, research, and academics. Find us at foodsystems.wsu.edu

working together to build an equitable and sustainable local food future for all



tilth

ALLIANCE

earth

A healthy environment is the foundation for growing healthy food. We enable community members to build healthy soil, restore the environment, manage pests naturally, protect water quality and teach others.

soil and water stewardship training | Garden Hotline Master Composter / Soil Builder training | restoration projects

farm

All farmers need support to thrive. We provide Washington's farming community with peer-to-peer education, connect them with the land they need and support their business enterprises.

farmer-to-farmer education | farm business incubator FarmLink | Tilth Conference | Tilth Producers Quarterly

garden

People who know how to grow food have better health, a stronger connection to the land and more resilience. We teach people of all ages and incomes to grow food.

adult classes | school tours | mobile classroom children's camps | community learning gardens teacher workshops | Tilth Alliance Youth Garden Works

market

Farmers need secure markets, and everyone has a right to food that is good for them and for the environment. We help consumers find local products and get produce into their hands through farmers' markets, community supported agriculture (CSA) and subsidized access for low-income families.

Farm Guide | CSA | Good Food Bags

kitchen

People who know how to cook and understand nutrition are empowered to eat well every day. We share cooking skills, nutrition knowledge and food traditions through classes, events and youth programs.

community dinners | youth cooking clubs | senior meals

tilthalliance.org