

# High Tunnel Planting Tips for Alaska



## What is a Seasonal High Tunnel System?

A seasonal high tunnel system is a plastic-covered structure that allows growers to increase production of certain crops, grow some crops that could not otherwise be grown in their area, and extend the growing season.

High tunnels often look similar to greenhouses, but are usually only single walled and are typically not temperature controlled. The plastic covering traps sunlight to raise temperatures inside the structure for the plants growing inside. The growing season can be extended by up to four weeks by protecting crops from potentially damaging weather conditions. Crops grown inside high tunnels tend to be of higher quality and produce higher yields.

Because crops within a high tunnel are sheltered from the elements, the grower is able to control the environment, reducing disease incidence, improving crop quality, and potentially increasing cost benefit per square foot of growing space. However, growing multiple crop types in a semi-sheltered environment can be challenging since every crop has unique needs that all must be met under uniform growing conditions within the high tunnel space.



High tunnel styles: Gothic style above, Quonset style below.



## Alaska Crop Management - General Techniques

In Alaska four crops immediately come to mind as benefitting from extended seasons, warmer temperatures and high market return. These are tomatoes, cucumbers, corn, and peppers. They are currently the most popular, as well as profitable, crops for high tunnel production. Of course, this does not rule out other crops/plants, nor does it rule out the opportunity for sequence planting by starting earlier in the season with plants tolerant of cooler soils. These can be harvested early in the summer, with a second crop planted in their place which matures later in the season. High tunnel efficiency is increased by planting two or more crops in a growing season. Succession planting can also be used as a tool to overcome shading issues from taller plants. Altering the spacing between crops or crop location within the tunnel can offset any difficulties from crop shading. Some seasoned Alaska high tunnel growers plant taller crops on the north side of the high tunnel so they do not cast shade on shorter plants as the sun sinks lower to the south.

Another factor to consider when intercropping or companion planting in a high tunnel is that some plant species produce chemicals sent into the air or soil that can help or hinder another plant species. For example, the mustard family produces a chemical that defends the plant against microorganisms, animals and even encroachment by some other plants.

## Companion Cropping

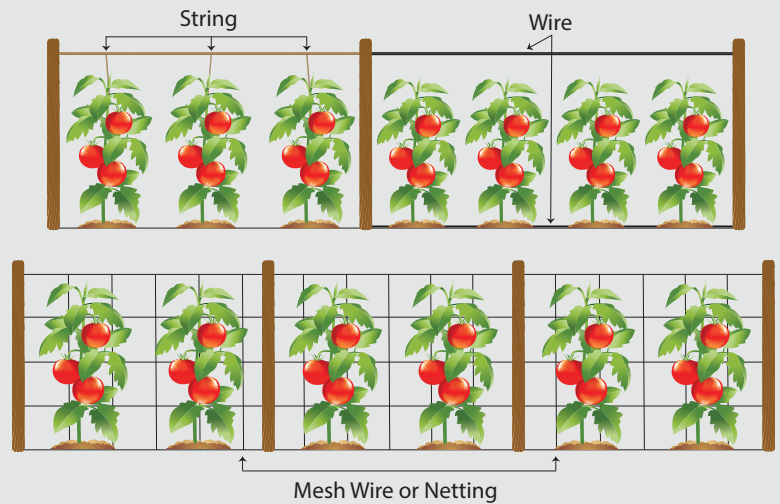
Some plants benefit from being around certain plants and do not like being around others. The table below lists the five most common plants that benefit from a high tunnel and their preferences for neighbors.

Vegetable	Compatible	Incompatible
Tomatoes	Chives, Onions Garlic, Parsley	Cabbage family, Potato, Fennel
Corn	Beans, Legumes Sunflower, Potato Parsley	Tomato Celery
Peppers	Tomato, Geranium, Petunia	Beans, Kale, Cabbage Brussels sprouts
Cucumber	Beans, Lettuce, Radish, Sunflower Peas, Beets, Carrots	Potato Aromatic herbs
Baby Greens	Onion, Garlic Beets, Cucumber	Spinach Sunflower

### Trellis

By definition, a trellis is a simple framework of vertical supports and horizontal crosspieces that is flat and usually trains plants like shrubs, small or young trees, or vines to grow up and against an object. In a high tunnel where space can be at a premium, trellises allow the grower to maximize ground space by increasing production vertically. For some plants it allows them to do what they naturally want to do, and for others it serves as a structure where the grower can guide the plants. Trellises can be as elaborate or as simple as you wish to make them.

### Types of Trellises



### Soil and Air Temperatures in a High Tunnel

Crops have different soil temperatures that favor seed germination and different air temperatures that favor growth and quality. These temperatures greatly influence when you plant or transplant into the high tunnel. The following two tables are for reference.

### Soil Temperature Conditions for Vegetable Seed

Vegetable	Minimum (°F)	Ideal Range (°F)	Maximum (°F)
Corn	50	60 to 95	95
Cucumber	60	60 to 95	95
Lettuce	35	40 to 80	75
Pepper	60	65 to 95	85
Tomato	50	60 to 85	85

*Compiled by J. F. Harrington, Department of Vegetable Crops, University of California Davis.*

### Approximate Air Temperatures for Best Growth and Quality of Vegetable Crops

Minimum (°F)	Optimum (°F)	Maximum (°F)	Vegetable
45	60 to 65	75	Artichoke, cardoon, carrot, cauliflower, celeriac, celery, Chinese cabbage, endive, Florence fennel, lettuce, mustard, parsley, pea, potato
50	60 to 75	95	Sweet corn, southern pea, New Zealand spinach
60	65 to 75	90	Cucumber, cantaloupe
65	70 to 75	80	Sweet pepper, tomato
65	70 to 85	95	Eggplant, hot pepper, okra, sweet potato, watermelon

## Soil Testing

NRCS recommends getting a soil test for each raised crop bed in your seasonal high tunnel. Testing will reveal the availability of plant nutrients in the soil and provide useful information to develop a nutrient management plan. This will help you determine which fertilizers or nutrients you may be over-applying or under-applying to achieve a desired crop yield or crop quality.

Areas that are managed separately should be sampled separately. Many gardeners in Alaska use raised beds, and often each bed has a separate crop or separate soil properties. When using raised beds with one type of crop in each, it is important to sample each bed separately, because the soil will have different nutrient characteristics with different crop history. If all raised beds are treated exactly the same and generally contain the same crops or else a mixture of crops, it is sufficient to sample each bed and combine the soil into one sample for the lab. The general rule for sampling is that each area should be analyzed separately if it is going to be treated differently. The reason is that each type of crop will have different nutritional needs and will leave the soil with different characteristics.



Handful of soil (above); taking a soil test in a raised crop bed (below); and comparing soil to Munsell soil color chart (right).



## Alaska Soil Test Requirements

The following methods are the standard soil test protocols used to make fertilizer and lime recommendations for Alaska. They are based on research conducted at the University of Alaska Fairbanks Agricultural and Forestry Experiment Station.

- ◆ Nitrogen: nitrate (NO<sub>3</sub>-N) and ammonium (NH<sub>4</sub>-N) 2 Normal KCl extraction method
- ◆ Phosphorus: Mehlich-3 extraction method
- ◆ Potassium: Mehlich-3 extraction method
- ◆ Soil pH: 1:1, soil: water method
- ◆ Lime Requirement: SMP Buffer method

For more information on soil testing, including best practices for how to collect samples, contact the University of Alaska Fairbanks Cooperative Extension Service at [www.uaf.edu/ces](http://www.uaf.edu/ces) or 1-877-520-5211.

Source: University of Alaska Fairbanks Cooperative Extension

## Where to Send your Soil Samples

### Soil Test Farm Consultants

2925 Driggs Drive  
Moses Lake, WA 98837  
1-800-764-1622 - [www.soiltestlab.com](http://www.soiltestlab.com)

### A & L Eastern Agricultural Laboratories

76221 Whitepine Road  
Richmond, VA 23231  
1-804-743-9401 - [www.al-labs-eastern.com](http://www.al-labs-eastern.com)

### Brookside Laboratories Inc.

200 White Mountain Drive  
New Bremen, OH 45860  
1-419-977-2766 - [www.blinc.com](http://www.blinc.com)

When sending an Alaskan soil sample, remember fertilizer recommendations are compiled by the University of Alaska Fairbanks and are based on a set of standard tests with specific extraction techniques for Alaskan soils. Above are commonly used labs. Other labs are available. NRCS does not recommend any specific vendor.





## Which Tomato Variety is for You?

Things to consider when choosing a tomato variety:



- ◆ Varieties with a continuous ripening season (indeterminate or vining) continue to grow and produce until frost. They require trellising (see page 2).
- ◆ Varieties that ripen all at once (determinate or bush-type) grow to a certain height, produce all their tomatoes at once, and then die. They allow 1 or 2 harvests a season. They may be less rampant in high tunnels.
- ◆ Do not start indoor tomatoes too early because root bound transplants may remain stunted all season.
- ◆ Do you want to grow beefsteak, cherry, or roma tomatoes? Heirloom varieties sell well at farmers markets but are more susceptible to diseases.



*Tomatoes growing in a high tunnel in Homer, Alaska. The tomatoes have been trellised against string mesh.*

## Starting Transplants

- ◆ In Alaska, tomatoes should be transplanted into high tunnels or green houses for optimal production.
- ◆ Seed 6 to 8 weeks before transplanting into high tunnel.
- ◆ Transplants should have well developed root systems and 5 to 7 mature leaves.
- ◆ Going from your warm house to the outdoors (even in a high tunnel) can be a shock for tomatoes. You need to gradually get them used to the outdoors. Set them in the high tunnel, gradually increasing the time each day (by an hour or so) for a week before transplanting them. Bring them inside at night.

Growth	Varieties
Indeterminate	Black Plum, Tropic, Vendor
Determinate	Bush Early Girl, Ultra Girl

## Spacing

- ◆ Depending on the variety, tomatoes in a high tunnel should be spaced 18 to 24 inches apart within a row, and rows should be spaced 36 to 48 inches apart.

## Site Selection

- ◆ Tomatoes like well drained sandy to loamy soil with a pH between 6.0 and 7.5.
- ◆ Be aware of the organic matter in your soil. Organic matter breaks down during the season and releases nitrogen to plants.

## Preparation

- ◆ Have your soil tested by a soil testing laboratory. It is hard to fix something if you do not know what needs fixing.
- ◆ After having your soil tested you can amend with high quality composted material if the test results indicate you need added nutrients.
- ◆ Make sure you know the nutrient content of your composted material.
- ◆ The composted material should be tilled into top 4 to 6 inches of your tomato bed before transplanting.

## Pruning

Tomatoes produce axillary shoots (suckers) just above the axis of a leaf branch and the main stem (crotch). To grow the strongest tomato plant possible, prune side stems below the first fruit cluster. These should be pruned to promote early tomato production and improve air circulation.





Sweet corn in Alaska can fetch a grower from \$1.50 to \$2.00 an ear, so it is not surprising to see growers putting at least part of their high tunnels into corn production.

Maturity	Varieties
Early	Yukon Chief
Mid to late season	Earlivee, Seneca Horizon



*Corn growing in a high tunnel in Homer, Alaska.*

## Site Selection

- ♦ Corn needs full sun and well drained soil.
- ♦ Soil should have a pH of 5.8 to 6.6 so you may wish to add limestone to bring it to that level.

## Preparation

- ♦ Prepare the garden bed by using a garden fork or tiller to loosen the soil to a depth of 8 to 15 inches.
- ♦ Have your soil tested by a soil testing laboratory. Follow any nutrient level changes the laboratory suggests. You do not want to under or over fertilize.
- ♦ Mix in a 2 to 4 inch layer of compost and/or aged manure into the top 6 inches of soil as per laboratory suggestions.
- ♦ You can also start sweet corn in small biodegradable pots indoors and transplant them when the soil temperature in the high tunnel is adequate for growth.

## Planting and Spacing

- ♦ You can lay down plastic mulch and plant into it when soil temperature is above 60°F (see page 2).
- ♦ Space rows 24 to 30 inches apart and plant 9 to 12 inches apart within the row.
- ♦ Plant corn in rows or blocks in the center of the high tunnel (the highest point in the high tunnel).
- ♦ When corn tassels, gently shake plants to aid pollination.



*Corn planted into plastic mulch in the center of a high tunnel.*

## Fertilization

- ♦ Fertilize according to the results of your soil test. You do not want to skimp or over fertilize.
- ♦ You can fertilize through drip irrigation. (Monitor your drip emitters as they can become clogged).
- ♦ Also, monitor your water as corn is known to be a heavy water user and you cannot depend on rains in a high tunnel.



*Sweet corn harvested from a high tunnel.*



"If the Holy Grail of gardening is the perfect tomato, the perfect pepper cannot be too far away." (Jeff Lowenfels, gardening columnist for the Anchorage Daily News, March 21, 2013.)

Sweet Peppers	Hot Peppers
Blushing Beauty, Carmen	Hungarian Yellow Wax
Giant Marconi, Gypsy	Thai Hot
Italian Sweet, Mohawk	Senorita
New Ace, Park's Early Thickset	Super Chili
Redskin	Super Cayenne



*Pepper transplant spacing on left and trellised tomatoes on right.*

## Site Selection

- ◆ Peppers prefer a well drained soil in the 5.8 to 6.5 pH range.

## Preparation

- ◆ Make sure you have the soil into which you plant tested for any lime and nutrient deficiencies you will need to address.
- ◆ Apply high quality compost (of known nutrient content) as per the results of your soil test.
- ◆ Incorporate this compost into the top 6 inches of soil.
- ◆ Peppers often require a pre plant application of nitrogen, but only if your soil test suggests it may help.
- ◆ Follow soil test recommendations.



## Start Transplants in Your Home

- ◆ Start peppers indoors 8 to 10 weeks before transplanting into the high tunnel.
- ◆ The seed germinates best at 85°F so you may need a heat mat to germinate the seed.
- ◆ You will also want to keep temperatures between 75°F in day and 65°F at night.
- ◆ Apply a complete soluble fertilizer (20-20-20) diluted 1 ounce to 3 gallons of water once or twice a week.
- ◆ You will want to harden them off for a week by decreasing their day temperatures to 60°F to 65°F before transplanting them into the high tunnel. You can do this by moving them into the high tunnel each day, like with tomatoes.

## Planting and Spacing

- ◆ When you transplant, be aware that plant space is valuable and spacing will depend on the pepper variety.
- ◆ In general, transplants are spaced 12 to 18 inches apart within a row and 15 inches between rows.

## Fertilization

- ◆ Your soil test recommendations may require additional nutrients be added after planting. They may even suggest splitting your nutrient additions into two applications. Follow their recommendations.



What can be said about cucumbers except that people love them, they are high yielding if treated right, but are extremely sensitive to cold temperatures. They will grow well in a high tunnel and allow you to maximize vertical production.

In a high tunnel setting, cucumbers are normally grown in raised beds covered with black plastic mulch. This minimizes weed problems, increases heat, and reduces nutrient leaching.



*Trellised cucumbers in a high tunnel.*

## Site Selection

- ♦ Cucumbers like a sunny site with drained soil.
- ♦ Soil pH between 6.0 and 6.5.

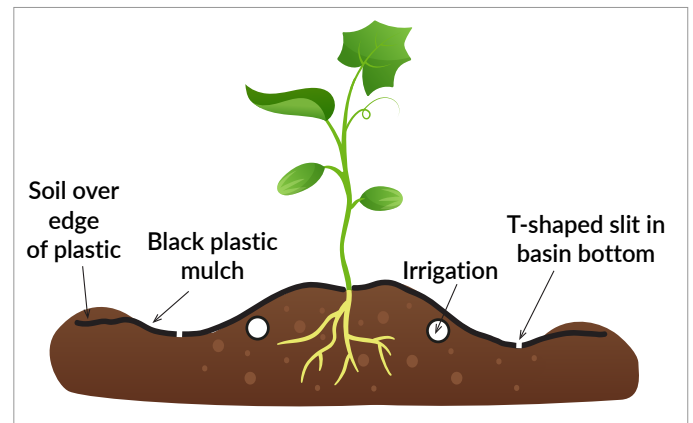
## Preparation

- ♦ In our shorter summers, make sure you start cucumbers inside where you can control heat.
- ♦ Have your soil tested by a soil testing laboratory. Follow any nutrient level changes the laboratory suggests. You do not want to under or over fertilize.
- ♦ Depending on your soil test results, mix in a 2 to 3 inch layer of rich compost along with a light application of an organic fertilizer.
- ♦ Cucumbers require low nitrogen and high potassium and phosphorous for good fruit development. The amounts should be determined by your soil test recommendations.

## Planting and Spacing

- ♦ Cucumbers, as well as other cucurbits, suffer from transplant shock so you must be very careful when you transplant.
- ♦ Start seed in pots indoors and pay very close attention to soil and air temperatures. Cucumber seed will not germinate below 60°F and will rot.

- ♦ Cucumbers grow best at air temperatures between 65°F and 95°F.
- ♦ You can use black plastic mulch to heat the soil faster and to irrigate (see below). Install plastic anytime prior to planting. Mound the soil and form a 3-6 inch trench around the mound. Place the plastic cover over the mound. Edges of the plastic should fall into the trench with soil to cover the edges of the plastic and hold it in place.
- ♦ As shown, you will transplant into a hill (much the same as potatoes are hilled later in their season).
- ♦ Transplant cucumbers at 12-inch spacing within the row with at least 36-inches between rows.



*Figure of cucumber planted into black plastic mulch.*

## Fertilization

- ♦ Assuming you have already added compost to your bed, you will probably not need to add a whole lot more to your cucumbers.
- ♦ If you over fertilize with nitrogen you will get “leggy” vines and slow fruit growth.

## Pollination

Since each cucumber flower is open only one day, pollination is a critical aspect of cucumber production. One or more pollen grains are needed per seed, and insufficient seed development may result in fruit abortion, misshapen, curved or short (nubbin) fruit, or poor fruit set.

## Trellising

- ♦ Most growers allow cucumbers to trail along the ground, but in a high tunnel where space is limited, this is not the most efficient way to grow cucumbers.
- ♦ Cucumbers love to climb. Trellising your plants conserves space and keeps the fruit off the ground.



## Examples of greens:



Looseleaf lettuce



endive



mizuna



cress



mache



arugula



butterhead lettuce



radicchio



romaine



escarole



baby beet greens



tatsoi



Leafy greens planted in raised beds, but still in contact with the soil.

- ◆ Another option for leafy greens is to plant them into raised beds. This option warms the soil faster, conserves moisture, and reduces weeds if plants are spaced properly.
- ◆ Salad green seeds are very small so the seed bed must be very finely tilled. You can till it with a regular tiller and then come in with an upturned rake and tamp down the larger soil clods.

## Site Selection

- ◆ Salad greens are planted as soon as the soil can be worked. They will germinate in soil temperatures as low as 35°F but the optimum is at least 40°F.
- ◆ Sandy loam soil with a pH of 6.5 to 7.5 is best.
- ◆ Because greens are shallow rooted, balance drainage with moisture retention in the top 1 inch or so. In other words, have good drainage but not so fast the soil water just runs through that top 1 inch.

## Preparation

- ◆ Have your soil tested by a soil testing laboratory. Follow any nutrient level changes the laboratory suggests. You do not want to under or over fertilize.
- ◆ Plant into a well drained soil that heats up quickly.
- ◆ Prepare the bed by mixing in well composted organic matter (of known nutrient level) in accordance with the results of your soil test. Repeat this if you put in a second crop.

## Planting and Spacing

- ◆ Most of the lettuce greens are planted about 60 seeds per foot in a 4 inch to 6 inch wide band.
- ◆ Seeds germinate best at 60°F to 65°F (lettuce).
- ◆ Plant radicchio 8 inches apart in rows with rows spaced at 12 inches.
- ◆ Endive is planted 9 inches apart in rows with rows 20 inches apart.

## Fertilization

- ◆ Follow your soil test recommendations. If you notice deficiencies, talk with your NRCS nutrient manager who may suggest a complete fertilizer can be added to supplement compost if needed.