Winter Growing

When temperatures and day length drop, your harvest season need not come to a full stop. As more growers construct high tunnels on their farms and participate in winter markets, we are frequently asked, "What can I plant to harvest in winter, and when should I plant it?"

To begin, it is helpful to distinguish between the two main winter growing strategies. The first group you harvest in winter, the second group you leave in place over the winter to produce an early spring crop.

• **Winter Harvest Crops** are planted in late summer or early fall, primarily in high tunnels, for harvest throughout the winter.

• **Overwintered Crops** are planted in the fall or winter, often outside in the field or under low tunnels, and left in place for the earliest possible spring harvest.

There is plenty of flexibility in the methods employed, including a combination of both strategies together.

Producing marketable crops in winter requires learning the correct planting window times for your location. Use the following guidelines while adjusting the techniques and timing to fit your practice. Remember to keep records, to determine what works best and improve upon your successes.

### Ten Hours Of Daylight

The key to scheduling your plantings is to identify when your winter days reach less than ten hours in length. It is during this darkest time of the year — referred to by Eliot Coleman as the "Persephone period" — that plant growth essentially stops.

The goal is to seed your plants so they are at least 75% mature by the time the Persephone period begins. Though plants may not grow appreciably thereafter, they can be harvested as needed while their maturity holds.

Careful scheduling allows you to control growth incrementally by planting at least two or three sowings at 7- to 10-day intervals. This will allow for crops to mature at different times and provide a longer harvest period. With well-timed, staggered plantings you can create a smooth transition from one harvest to the next for a steady supply through the winter. Multiple seedings also help you identify the best seeding dates for specific crops, and spread out the risk of crop failure due to unfavorable weather conditions.

### Two neat tricks to get plants ready for the darkest days in high or low tunnels

- Transplant crops like spinach that are normally direct-seeded. Start the plants elsewhere and grow them to transplant size before planting them in your high tunnel, after your summer-fruited crops have been removed.

- Establish hardy crops outside in late summer, then place a moveable tunnel over them, or construct a caterpillar tunnel over the crop as winter threatens.

### Squeeze in even one more crop

In late winter, before you have harvested your winter crops, anticipate open bed space and what could be planted once the bed is available. As the end of the Persephone period draws near, you can reseed the openings. These winter sowings will be ready for harvest by early spring, often long before the same crop when grown outside.

See our Winter Harvest Planting Chart (back cover) to use as a guide, staggering your plantings for a seamless winter harvest.
Winter Production in the High Tunnel

Fundamentals of high tunnel design need to be observed to construct a tunnel that will survive snow load, capture optimal sunlight, and allow for regulating heat and humidity when necessary. To learn more, attend a seminar on high tunnel construction or refer to the many resources available online and through schools, libraries, and universities.

A proven strategy in the north is the use of one or more layers of row cover over the crops inside the tunnel, for additional protection in colder months. This row cover (especially when lighter weights are used) is sometimes left in place all the time. Other growers leave the crop covered at night and remove it on warmer days, when the tunnel’s internal temperature has risen sufficiently. This results in increased solar gain, and ventilates excess moisture that can encourage certain diseases.

With some crops the row cover can be laid directly upon the crop. With others, some type of support is required, especially if multiple layers or heavier fabrics are chosen. From Quick Hoops™ and wire wickets to cables and metal suspension frames, various methods can be deployed to support row cover and make the daily process of removal for heat and humidity regulation more efficient.

From planting all the way through winter and into the spring, your plants will need to acclimate to cooler temperatures to prevent shock and necrosis. This is similar to hardening plants in the spring to transplant them out; at this time of year, you are instead heading into cooler temperatures, not warmer. Expose the plants to temperatures as close to freezing, 32°F (0°C), as often as possible. This can be done with careful temperature monitoring to know when to remove row cover or roll up the sides of the tunnel, or both. If you roll up the tunnel sides, keep a close eye on the weather for conditions that might cause damage to the plants, such as driving wind, rain, sleet, or snow.

Keeping your high tunnel warm is not as essential as preventing dramatic temperature fluctuations. The key is to maintain as steady a temperature within the tunnel as possible, to reduce stress on the plants. Disease pressure can develop if you do not provide good air circulation and venting of the high tunnel during the day.

After being properly acclimated, the cold-hardy plants should be able to tolerate a solid freeze at night, provided they are allowed to thaw incrementally during the day. The plants must be completely thawed in order to harvest them, so supplemental heat may be required in the tunnel on harvest days.

Thorough watering is necessary to get crops started, but they will generally require very little additional water during the season. Utilizing tools like a moisture meter can help avoid over or under watering. If you have to apply fertilizer, utilize mild, low-impact sources. Within the tunnel, salt build-up can pose a problem without the leaching action of natural rains. Some growers leave their tunnels fallow and uncovered periodically to allow rains to leach the salts.

“A Farmer’s View

“We try to transition into winter here…we use low tunnels for some crops into the fall, and go into high tunnels as the weather turns. That way we make best use of our total space and just use the most expensive real estate (High Tunnels) when it is absolutely necessary.

“High tunnels are your most expensive real estate and you should consider all the costs vs. the returns of winter crops.”

Jill Rendleman,
All Seasons Farm

Persephone Period

Here at Johnny’s Research Farm in Albion, Maine, the Persephone Period begins on November 5th or 6th, when daylight dwindles to 10 hours.

You can obtain exact dates for this period for your location using an app or website such as Rise, SunriseSunset, or Sundroid.

At Johnny’s Research Farm in Albion, Maine, the Persephone Period ends on February 5th or 6th, when day length reaches 10 hours in duration.
Scheduling Guidelines for Overwintered Crops

Overwintering entails establishing very young plants that can survive the winter and resume growth extra early the following spring. Once day length increases to 10 hours, these plantings will grow rapidly. Keep in mind that wide fluctuations in late-winter temperatures may cause bolting before your overwintered crops reach a harvestable stage.

The most calculated approach to schedule seeding for overwintered crops involves seeding in the late fall, so germination and the first stages of growth occur before the plant goes dormant during the Persephone period. Growth will begin again when days begin to lengthen.

Another method involves sowing just before the ground freezes, so germination occurs after deep winter, as day length increases and temperatures warm. This method can result in a lot of dead seed if conditions do not pan out. (There is a risk that a higher percentage of seeds will rot in the soil during cold, wet conditions.)

Protection Methods for Overwintering Using Low Tunnels

Quick Hoops™ made of bent steel conduit or EMT (electrical metal tubing) are positioned over crops to be overwintered. We developed the Quick Hoops™ Low Tunnel Benders specifically for creating hoops that support heavy winter snow loads. We have found that hoops made of other materials, such as wire or PVC, fall short in this regard.

The hoops are covered initially with row cover (Agribon+ AG-19 or heavier) to extend the crop into the fall. These coverings protect the crop from frost, but allow them to respires and self-ventilate as temperatures fluctuate throughout the day.

After a few frosts, and once the chance of warm days has diminished, a layer of 4-mil (100-micron) greenhouse film is added on top of the row cover. If warm weather does occur after the addition of plastic, the low tunnels may need to be manually ventilated by lifting the sides, to prevent internal temperatures from getting too high. In the dead of winter, the tunnels will effectively be sealed shut by the snow load on top.

Following the winter solstice, the tunnels may again need to be vented intermittently, to prevent overheating as days grow longer and warmer. After the danger of frost has passed, the plastic can be removed completely, with the row cover remaining in place to protect the crop until it is time for early-spring harvest.

See our Planting Dates for Overwintering for Spring Harvest Chart (back cover) to use as a guide, staggering your plantings for a seamless winter harvest.
Winter Growing Crop by Crop

Focus on Crops for Winter Growing

A recent New England growers’ meeting revealed a ranking of crops proven successful for winter growing regionally. In order of popularity, these crops fell into three tiers. Hardiness, adaptability to winter growing, and quality and quantity at harvest time also factor into the ranking.

**Tier 1. Most Reliably Successful:**
Spinach, Kale, Tatsoi, Claytonia

**Tier 2. Second Most Dependable:**
Arugula, Pac Choi, Mizuna, Cress, Cilantro

**Tier 3. More Challenging:**
Lettuce, Chard, Radishes, Turnips, Carrots

In addition, there are other crops which thrive in winter such as Sylvetta, Minutina, and Mâche. Depending on your experience, latitude, microclimate and growing methods, you may gain success with even more crops in the winter. Here are the top performers in our winter growing trials, crop by crop…

### SPINACH Tier 1

**Winter Spinach** is exceptionally sweet because the plant builds up sugars in response to cold, which protect its cells from bursting in freezing conditions. It’s also easy to grow for all skill levels, which makes it a good first choice if you are just starting out with winter growing.

Seed your winter-harvest spinach 35–50 days before the start of the Persephone period. Spinach does not germinate well under the warm conditions that often exist when seeding for winter. To optimize germination rates, irrigate before planting to cool the soil. You can also start spinach in plugs and grow to transplant size (two true leaves) to ensure your desired plant density.

Reliable choices for winter-harvest spinach include Red Kitten, Flamingo, and Emperor which can be seeded in late fall for winter harvest. Corvair performed very well in our recent caterpillar trials, and we have seen it overwintered very successfully at other farms. Seed so the plants are one inch tall when the hard freeze begins. They will grow quickly in spring and must be harvested before bolting.

### ASIAN GREENS Tiers 1 & 2

Asian Greens Pac Choi is a great candidate for winter growing due to the thickness of its stems, which can endure a measure of freeze damage. Other Asian Greens, including Komatsuna, Mizuna, and Tatsoi, should not be overlooked, as they too can deliver the winter results you’re looking for. Use caution with many of the mustard varieties, however; we have found them to bolt rather quickly following the winter solstice.

### OTHER GREENS Tiers 1 & 2

Other Greens Because they are all very cold-hardy, Arugula, Claytonia, Mâche, and Minutina can often be grown in an unheated hoophouse without a second layer of row cover. While they may not grow significantly during the Persephone period, they can be harvested during those darkest weeks. Cress makes another great addition to a winter growing program because of its quick growth cycle.

Kale, like spinach, is much sweeter in the coolest months of the year. All varieties of kale can be grown in the winter, but curled-leaf are a bit hardier, and make for bigger bunches more quickly — you will spend less time harvesting the kale and your bunches will look fuller.

Seed kale in late July or early August for transplanting in September. Cover with lightweight row cover if flea beetles or cabbage loopers are a problem. Harvest late October through March by clipping the leaves from the bottom up. Widely fluctuating temperatures can result in cold damage to the leaves.

Kale plants of varying size can be kept overwinter in low tunnels, for harvest in early spring. The quality of the large leaves remaining in spring will depend on the severity of the preceding weather. Surviving small plants will quickly begin producing new growth.

In addition, there are other crops which thrive in winter such as Sylvetta, Minutina, and Mâche. Depending on your experience, latitude, microclimate and growing methods, you may gain success with even more crops in the winter. Here are the top performers in our winter growing trials, crop by crop…

### KALE Tier 1

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Kale plants of varying size can be kept overwinter in low tunnels, for harvest in early spring. The quality of the large leaves remaining in spring will depend on the severity of the preceding weather. Surviving small plants will quickly begin producing new growth.
Greens for winter harvest should be planted from August through October for harvest from September through March. Soil temperature when seeding should be 70°F/21.2°C or lower, to optimize germination rates.

All of these greens will survive over the winter as very small plants for extra-early spring growth and harvest.

**Cilantro** should be sown mid September to early October in a protected structure, such as a high tunnel.

Cover plants with heavy-weight row cover when temperatures dip below freezing in the structure, but try to uncover when temperatures warm back up, to better expose the plants to sunlight and allow for air flow.

Plants will grow very slowly through the depths of winter, but take off in late winter to early spring, with harvests possible from March through May.

**Lettuce** is less cold-hardy than many greens, and fares best in a partially heated greenhouse or under a low tunnel within an unheated hoophouse. We suggest harvesting the lettuces before they're required to endure the coldest temperatures post mid winter. In addition, the young leaves of salad mix tend to be less susceptible to freeze damage than mature lettuce heads.

Recently, growers in the north have been reporting some success with Salanova® Lettuces grown for mini head production in unheated high tunnels. Salanova has also excelled in winter trials at our own research farm in Albion, Maine. Setting out transplants in late September, and covering them with two layers of supported row cover inside the tunnel, provides nice mini heads with minimal leaf damage for winter harvest.

One limiting factor in high tunnels is the filtering of sunlight that decreases the vivid red color of some lettuce varieties. For winter growing, we recommend Five Star Greenhouse Lettuce Mix for its downy mildew resistance as well as the ability of the red varieties to hold their red color. During winter months varieties in some mixes may have varying growth rates. Some growers prefer to plant each variety individually and mix them after harvesting.

**Radishes** should be sown September through October for harvest through December. They should be covered with lightweight row cover if flea beetles are a problem.

Although radishes are generally quite cold-tolerant, they will become spongy if frozen hard repeatedly.

All small, round radish varieties are good for winter growing, as are the long, slender French varieties d’Avignon and White Icicle.

**Turnips** You can direct seed turnips in the fall. Plant enough seed to provide for a long winter-harvest period, and lay row cover over the crop if flea beetles are a problem.

Be advised that turnips will not hold into the spring, and will bolt by March in the tunnel.

The best winter turnip is the white variety Hakurei. Scarlet Queen Red Stems and the more traditional Purple Top White Globe, also work.

**Carrots** Winter-harvest carrots are super sweet. In addition, they are orange—unlike most fresh winter-harvest crops—adding a welcome touch of color to what you offer for sale.

Carrots should be direct-seeded in early August for harvest from Thanksgiving through Christmas. If grown under row cover, their tops will be protected. Selling bunched carrots with attractive tops signals freshness to prospective customers.

Carrots can also be successfully overwintered as young plants, to grow and reach harvest size in early spring. Napoli, Nelson, and Mokum are the best varieties to plant in fall for winter harvest.

**Bunching Onions, Spring Onions, and Leeks**

Bunching Onions, which include scallions, are easy to grow for winter harvest, although some supplemental heat may be required if temperatures are extremely cold.

Direct seed scallions in August, and start harvesting when they reach the desired size. Select varieties of fast-growing onions can be overwintered in low tunnels.

Onions for overwintering should be sown in September, with the goal of having them reach the size of a pencil before the hard freeze in November. If they make it through the winter, you will have full-size spring onions by May.

In Quick Hoops trials at our research farm in Albion, we learned that Bridger is great for this application.

Many varieties of leeks are winter-hardy to varying degrees. Protection in tunnels or by row covers will further enhance their survival. Lexton and Bandit are particularly winter-hardy varieties.
Winter growing is not a simple process with a guaranteed return. If you have an interest and the resources required, it can be rewarding in many ways. Your winter harvests can command a premium price, being in higher demand than the same crop in the summer. Many growers find that fresh greens nicely augment a selection of winter storage crops at winter farmer’s markets and in CSA distributions.

If you complete construction of your first new high tunnel in late summer, you will likely want to plant something right away. That first winter harvest can be very inspiring.

For those with just one tunnel to utilize, the wisdom of ripping out high-return crops like tomatoes, cucumbers, and peppers from the tunnel in late summer may seem misguided, if they are still producing. But as winter draws closer, the quality and quantity of those crops will decrease. Your best decision may be to replace heat-loving summer crops with ones that perform well during the darkest time of the year. With clever succession strategies and the construction of additional tunnels, you can reap the benefits of fresh produce harvested even in the depths of winter.

The Bottom Line

With clever succession strategies and the construction of additional tunnels, you can reap the benefits of fresh produce harvested even in the depths of winter.
## Winter Harvest Planting Chart

Use our Winter Harvest Planting Chart as a guide, staggering your plantings for a seamless winter harvest. Keep in mind that the planting dates are back-scheduled from the last 10-hour day at your latitude. The number of weeks before the Persephone Period is calculated for each listed crop. The crops are grouped as outlined in the key to reflect their reliability for overwintering success.

### Planting Dates for Winter Harvest Crops

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### Planting Time

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<th>Tier 3</th>
<th>TIER 2</th>
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<td>Mache</td>
<td>Claytonia</td>
<td>Kale (Full)</td>
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<td>Swiss Chard (Full)</td>
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### Key

- **Tier 1.** Most Reliably Successful: Spinach, Kale, Claytonia.
- **Tier 2.** Second Most Dependable: Arugula, Pak Choi, Mizuna, Cress, Cilantro.
- **Tier 3.** More Challenging: Lettuce, Chard, Radishes, Turnips, Carrots, Bunching Onions.

### Overwintering Planting Chart

Use our Overwintering Planting Chart to time your planting dates for earliest spring harvest. Keep in mind that the planting dates are back-scheduled from the last 10-hour day at your latitude. The number of weeks before the Persephone Period is calculated for each listed crop. The crops are grouped as outlined in the key to reflect their reliability for overwintering success.

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