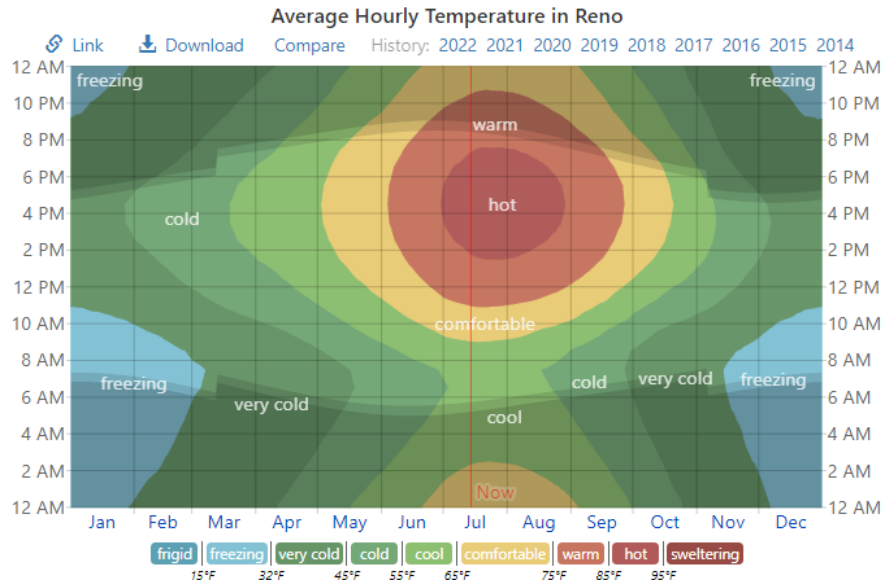




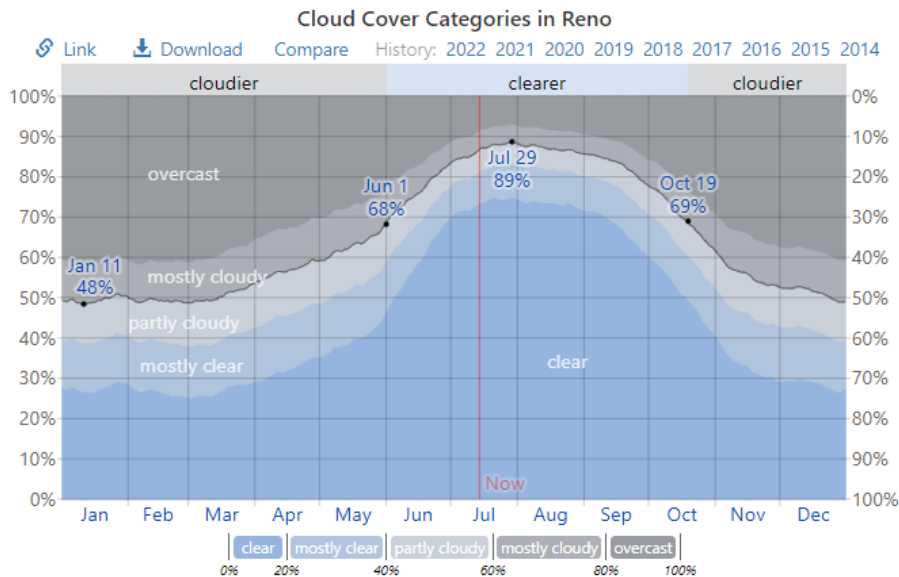
# RT Permaculture Low Tunnel Winter Garden Method for Greens

## Context

**Location:** Reno, NV  
**Latitude:** 39.56N  
**Elevation:** 5,000'  
**USDA Plant Hardiness Zone:** 6a  
**Average Last Frost:** ~Sept. 15-21  
**First and Last 10 hr day:** Nov. 15 - Jan 26  
**Snow:** up to 2', generally melts off within 1-7 days



The average hourly temperature, color coded into bands. The shaded overlays indicate night and civil twilight.



The percentage of time spent in each cloud cover band, categorized by the percentage of the sky covered by clouds.

Fraction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cloudier	50%	51%	49%	43%	37%	23%	13%	13%	17%	30%	44%	49%
Clearer	50%	49%	51%	57%	63%	77%	87%	87%	83%	70%	56%	51%

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## Garden Specs

**Location:** South side of house

**Soil texture:** Sand - Loamy Sand, Bare ground prior to garden

**Bed Size:** 2.5' wide beds with 1' wide paths, Main access paths 3' wide. 2.5' beds are easy to manage, straddle, and not step in when planting and harvesting. They are also easy to cover with wire hoops and 83" wide floating row cover (a standard width). While a 1' path is tight, it allows me to use one set of weights to anchor floating row covers for beds on both sides.

**Soil cover:** no perennial mulch (i.e. woodchips) because it creates habitat for earwigs which decimate annual gardens in Northern Nevada, no mulch on beds when planted, straw flakes on beds not used during winter to prevent soil from blowing away. I mulch with straw between beds so paths are easy to see. I consider the row covers to be the mulch since they protect the soil from sun and wind. Then the plants become a living mulch when full grown.

## Garden Prep

1. Layout bed locations with stakes and string to create square and parallel beds
2. Loosen soil in beds to a depth of ~12" and remove rocks, if any
  - a. I did this with a pick and garden fork initially. Now I would use a broadfork if I had one.
3. Apply 2-4" of compost on beds and minimum label rate of an OMRI vegetable garden fertilizer and mix into top 3-6". I purchase OMRI certified compost from a local producer, [RT Donovan](#), for \$38/cu. yd. plus delivery, which is the cheapest I've seen nationwide for organic compost. I used Down to Earth Vegetable Garden 4-4-4 for the past few years but it only recently became available again, so I have been using [Down to Earth Bio-Live 5-4-2](#).
  - a. Once rocks are removed, I use a [roto-tiller attachment](#) on my [electric Makita couple shaft powerhead](#). I'm sure there's drawback to tilling but it's fast, easy, mixes well, and I still find lots of red wigglers in my beds.
4. Build Drip Irrigation. I have fairly short beds  $\leq 16'$  long, so I use  $\frac{1}{4}$ " in-line emitter tubing. Generally I use 3 lines per bed with 9" spacing between lines. A 12" emitter spacing line in the center and 6" emitter spacing on the 2 sides. I use  $\frac{1}{2}$ " tubing as a header and build individual tails with  $\frac{1}{2}$ " tubing so I can easily pull the irrigation of an individual bed between crops so I can apply compost and fertilizer and mix it in. I use landscaping staples to secure the  $\frac{1}{2}$ " tubing on both ends.
5. Beds are now ready for use. They often need some work at startup to get them evenly moist using a hose and rake to mix the soil and get the water to soak in. Then drip irrigation keeps them moist.
6. For the first couple of years, I applied 1-2" of compost and fertilizer to each bed each time I replanted. Now they are deep rich compost soils, so I only apply fertilizer. I'll likely apply compost 1x per year or 1x per 2 years now that they are established.



## Low Tunnel Prep

1. Purchase and gather materials
  - a. [#9 Gauge Galvanized Fence Wire](#)
  - b. [Agribon Floating Row Cover](#): 83" x 250' roll is what I get, you might not need as much
    - i. AG-19: 85% light transmittance, 4F protection - I mostly use this in my high tunnel because it tears easily in the wind
    - ii. AG-30: 70% light transmittance, 6F protection - I mostly use this outside because it provides a little better frost protection and is more durable in the wind and snow.
  - c. Weights: I like things that are long and straight for the bed lengths and heavy and short for the ends. I use old 2x4s, t-posts (ideally without the flange because it catches on the covers), rocks, metal pipe, bricks, and rocks. Basically whatever I have laying around in surplus.
  - d. Totes or bags: I store my row cover when not in use to keep it dry and free of debris and animals. I have a few 30 gal totes, and organize them by location and length since I have 2 locations and a couple of bed lengths.
2. Cut materials to length
  - a. #9 wire: my hoops are ~80" long. I find this is tall enough for most crops and long enough to cover the 2.5' wide bed with ~9-12" in the soil on each side. Cut one and test in on your beds then cut more to the length that works for you. I use fence pliers to cut the wire. It's hard to cut, so you need fence pliers or bolt cutters. Wear eye protection and be careful whenever cutting wire, it springs back after cutting. Nice to do with 2 people so one person can hold both sides of the wire while one person cuts it. Especially if it's your first time working with the material.
  - b. Floating Row Cover: Roll out next to beds and cut to length. Make sure to add at least 1.5-2' extra on each end to allow for the height of the hoops and some extra to put weights on to secure it. Make one and test it, to find out how much extra works for you.
3. Organize a storage system for you materials
  - a. I keep my weights near the garden along a fence or wall so they're easy to find quickly and I don't have to move them far. They are durable outdoor materials.
  - b. I keep my wire hoops hanging on a tree branch near the garden for easy access. I used to lean them against a wall. You could also hang them from a hook. You may want to tie them in bundles by bed because they can get tangled. They are durable outdoor materials.
  - c. I keep my row covers in totes inside my storage shed to protect them and the totes from degrading in the sun and weather.
4. Build Low tunnels
  - a. I wait to build my tunnels until I've planted my beds because I find they get in the way when I'm planting, but you can build them prior and just work around the materials.
  - b. Insert wire into edges of beds 9-12" deep on each side. Position 1 hoop ~1-2' in from each end of the bed. Then add hoops ~3-5' depending on your snow load, wind load, and tolerance for maintenance. I usually skimp on the hoops and do 4-6' on center. So on a 16' bed I end up with 4-5 hoops. The more wind and snow load you have the better it is to add hoops.
  - c. Position weights around beds.
  - d. Roll out the row cover and anchor on one end of the bed, then work along one length and anchor, then do the other end length and end. This is easiest with 2 people on a calm day, but can be done with 1 person on a windy day with a bit of practice and patience;)

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# Plant propagation and management

## 1. Materials

- a. **Seeds:** cool season seeds like lettuce, kale, mustard, Asian greens (napa cabbage, pak choi, tatsoi, mizuna)
- b. **Seed starting mix:** I make my own but it may not be practical for many people, so you can purchase a [prepared seed starting mix](#)
  - i. I make mine with 2 parts coco coir, 1 part perlite, 1 part vermiculite, 1 part compost, plus a little fertilizer. I use a 5 gallon bucket and mark it at  $\frac{1}{2}$  so  $\frac{1}{2}$  full is 1 part. I add  $\frac{3}{4}$  cup of the fertilizer listed above to this and mix it all up in a concrete mixer.
  - ii. Coco Coir is becoming more difficult to find due to supply chain issues that began during COVID. I've now found an organic product that is significantly more expensive than my previous material. I'm unsure what I'll do over the next couple years as availability and cost of this material changes.
- c. **Seed flats:** I use [17" square seed flats](#) because I salvaged a bunch and got familiar with using them. I don't like the little cell trays because I just break them.
- d. **Labels and markers:** I purchase and reuse plastic labels. You can also make them from yogurt containers. I find wooden labels lose their label too fast. I like these [4- \$\frac{1}{2}\$ " labels](#). You may find others preferable. I use [Milwaukee INKZALL permanent markers](#) or these [Garden Markers](#) which are tolerant of getting wet and far superior to sharpies (which are ruined if you get water on them once).

## 2. Start Seeds in Seed flats ~Aug 15-Sept 1

- a. Ideally seeds are started Aug 15 - Sept 1. I've had success seeding up until about Sept. 15, but the crops don't get quite as big before they stop growing due to <10 hr day lengths which begin Nov. 15
- b. It's hot this time of year and lettuce in particular doesn't germinate well at high temperatures. I place my seed flats in a shady location that stays cooler to germinate. You can also protect them from sun and drying out with some floating row cover.
- c. I have butter fingers and am guilty of overseeding. Try to space your seeds  $\frac{1}{2}$ " to 1" apart in the seed flats, so they grow well and are easy to pinch out for transplanting.

## 3. Identify beds for planting your winter garden

- a. Select beds with great S sun exposure
- b. I like to have enough to eat greens all winter long, so I plant ~200 plants in my winter garden because my family eats ~1.5-2 plants per day for 120 days. This fills ~60' of 2.5' wide beds. My beds are ~15' long so I need 4 beds. These are not always the same 4 beds because I rotate beds and sometimes I have beets and carrots and summer greens where I planted my winter garden last year. I also make sure I save a bed for garlic which I plant in Oct 15 - Nov 1.

## 4. Wait until hard frost and clean out beds as frost sensitive crops die. Sept 15-Oct 1

- a. Generally I get a hard frost Sept 15 - Oct 1, so seeds have germinated and are large enough to transplant (3-6 weeks from seeding) the day after a frost if I started my seeds early enough.

## 5. Add fertilizer and mix in

- a. I pull off the drip irrigation, apply the minimal label rate of fertilizer (~3 lbs/100 sq ft), mix in with my Makita roto-tiller, and rake smooth, then put the irrigation back on the bed. Sometimes I'll also top dress with  $\frac{1}{2}$ -1" of compost.

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6. Transplant seedlings ~Sept 15-Oct 15
  - a. I like to space my winter garden greens seedlings ~12" apart. Since my emitters are on 6" and 12" spacing I can just put a plant on an emitter every 12". This means they'll get water when small and can grow pretty large. I plant 3 rows per bed and offset the center row by 6".
  - b. Water in with a hose.
  - c. Note: if the first frost isn't until October, I generally uppot my seedlings into 2.5" pots Sept 15-21 so they continue on their growth curve until planting in the soil.
7. Build low tunnels
  - a. Put wire hoops in and add covers and weights as specified above.
  - b. Leave covered except for maintenance and harvest.
  - c. To uncover, I remove the weights from both ends and one length of the bed, then fold over the hoops and lightly weigh it down if windy.
8. Irrigate and monitor soil moisture
  - a. This time of year it's still hot, so I'm watering my annuals 2x per day for 8-10 minutes with the drip setup I specified.
  - b. As it cools and plants get established, I decrease the irrigation to 1x per day for 8-10 minutes
  - c. Once hard freezes set in, most people winterize their irrigation. At this point, you'll want to **check soil moisture when you harvest and irrigate lightly as needed**. Particularly if we have a warm dry winter. If you turn on your irrigation to water your trees, water your winter garden then too. If your soil is dry, and you don't turn on your irrigation, you can water with a watering can or hose. Generally 1x per week is the max you need to water in Reno for a winter garden and many times 1x per month. It will just be a few gallons (1-2 watering cans). If you use your hose, make sure to disconnect it and drain it when you're done. I have a frost-free irrigation system, so I don't need to winterize it and just run it for ~7 minutes every 14 days or so.
9. Weeding and added transplants Sept 25-Oct 15
  - a. I check for weeds 7-10 days after transplanting. This lets the transplants grow and get established and weeds germinate. I remove all the weeds by hand. You can also use tools like a [collinear hoe](#)
  - b. I keep my seed flats until now, so I can add in any additional transplants needed if some from the first round died.
  - c. I do a second round of weeding 7-10 days later. Then I spot weed if needed during harvests
10. Checking on Row covers
  - a. After any really windy day, rain, or snow, I check on the covers and make sure the weights are secure and adjust as needed.
  - b. If snow cover, I try to remove by hand (with soft gloves) or with a soft brush the morning of the snow, so the snow doesn't melt then refreeze to the covers. If it does refreeze, I wait until the next warm day and try to remove it gently and not tear the covers.
11. Harvest Nov 1 - March 1 and beyond
  - a. I start harvesting when the plants reach near full size. They stop growing ~Nov 15 in Reno, NV, and most take ~45-60 days to reach full size, so my first harvest is between Nov 1 and Nov 15.
  - b. I generally harvest enough to eat for 3-7 days because they stay fresh in the fridge for that long easily and it minimizes the # of times I have to fuss with the row covers to 1-2x per week.



- c. I start by harvesting a mixture of lettuce and asian greens. Asian greens don't tolerate low temperatures as well as lettuce or kale, so I harvest them first in general, but I also love lettuce salads, so I harvest it as soon as it's ready. I really like Butterhead lettuce like Pirat and Buttercrunch. I also really like Red Sails leaf and Devil's Ear and Rouge D'hiver romaine lettuce.
- d. Except for Mizuna and Kale, I harvest whole plants because this is quick and easy both for harvesting and washing, and it allows me to easily see how much I have harvested and how much I have left.
- e. I harvest Kale last because it stays good all the way through to spring and actually tastes amazing in Jan-March because the cold temperatures make it sweeter and less bitter. White Russian Kale is my favorite variety currently. Generally I have some extra Kale because I harvest leaves rather than full plants and I let it go to flower during spring then clean it out in early June when I plant that bed with warm season, frost sensitive crops.