



Figure 1. 2021 carrot harvests of 'Black Nebula' (A), 'R.C. Chantenay' (B), and 'Scarlet Keeper' (C).

Growing Carrots at High Elevations Using Season Extension Covers

Introduction

In high elevations, it is suggested to gardeners that cool season crops like carrots will be the crops that could do well in the climate conditions. Because they are cool-season crops, there often is not any advice on additional techniques to use to increase yield or quality. The CSU Extension office in San Miguel Basin wanted to test this advice by using season extension practices. Season extension is the practice of extending the frost-free growing season length and creating better growing conditions (like warmer temperatures) that a specific crop needs to produce good yield. Locations at high elevations, such as Telluride, CO (8,750 ft.), experience shorter growing seasons and cooler nighttime temperatures, so they could benefit from these season extension practices. To test different methods of extension we grew seven varieties of carrots under different covers in 2015 and 2021. The carrot varieties included 'Scarlet Nantes', 'Atomic Red', 'Pusa Asita', 'Red Core Chantenay', 'Black Nebula', and 'Scarlet Keeper' and the covers included a control, 17% and 30% row cover material, a Solexx roof, and Diobetolon (Figure 1). The San Miguel Basin CSU Extension office has provided literature of the advantages and disadvantage of these different season extension covers which can be found here or on their website. The average ounces per root was calculated for each of the varieties and each of these treatments.

How We Grew High Elevation Carrots

In areas where temps drop below freezing and soils freeze, growing in a raised bed can help you keep plants alive longer. The benefits of these raised beds can also be increased by utilizing a season-

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extension cover over the crop like fabrics, hard plastics, or plastic sheeting. In our study we chose materials for our covers for the best light permeability and aeration for the crops.

Our raised beds were filled with [native soil](#) and amended with compost and/or peat moss. We also used straw as a ground cover or mulch because this helps with weeding and insulates the temperature of the soil. By growing in raised beds with the combination of a season extension cover you can also see benefits in pest prevention whether it is disease, insects, or some of the larger pests seen in higher elevations such as rabbits and deer.

Our Planting Dates

For our trials we chose to grow a diverse selection of carrot varieties. In 2015, carrots were planted by broadcasting the seeds in rows across the soil of our raised beds (Figure 2). In 2021, we planted 2-3 seeds 1.5 inches from each other within the rows with 6 inches between rows. We thinned a few weeks after planting to allow for our carrot roots to have room to grow. It is important to plant once the ground is no longer frozen. Cool season crops like carrots can be planted several weeks before the average last frost. We planted in 2015 around the middle of May. In 2021, we planted in the middle of May followed by a second planting in the middle of June. Germination cloth was kept on tops of the seedlings to retain moisture and help them establish and then removed when they had a second set of true leaves. We thinned a few weeks after planting to allow the carrot roots room to grow.



Figure 2. Carrots being grown under row cover material.

How We Fertilized

Our trials were focused on organic production, so we chose to use organic sources of fertilizer for our carrots. We fertilized our plants twice during their growing cycle, once at planting and again at the midway point around 30 days after planting. They can also be fertilized every 3-4 weeks throughout the growing season. Blood meal is a dry nitrogen fertilizer source and was placed in the root zone of the plants. We treated the plants at half strength because carrots are light feeders.

How We Harvested

Our carrots were harvested in two rounds with one harvest per planting. They were harvested at 101 days after planting in 2015 and 88 days after planting in 2021 to allow for proper root development. With our planting dates, this made our harvests take place in early to mid-August and early September. First, we watered our beds and then we took a trowel and loosened the soil around the carrot root before pulling the carrot out. This prevented the tops from being detached when pulling it out and leaving the roots remaining in the ground. For our data collection, we removed the tops from the roots



to get accurate root weights. The average weight in ounces per root was calculated for each of the varieties in each of the treatments.

Pro Tips/Observations

- Carrot seeds are small so there is a balance between overseeding and requiring extra thinning and the effort it takes to plant seeds in individual positions.
- Thinning is important whether you broadcast seeds or plant a couple per position because if they are too crowded, they will be limited in the size they grow or may have deformed roots.
- They are difficult to germinate so a germination blanket or sheet laid on top of the seeds will help increase the germination rate.

Differences in Crop Covers

The control in our study was a raised bed without a crop cover and the four other covers that we tried were a rigid Solexx cover, a fabric cover called Diobetalon, a 30% fabric row cover material (2015), and a 17% fabric row cover material (2021). The fabric covers were applied on a hoop structure placed on top of the raised bed edges. The control also had a hoop structure with plastic chicken wire over the top for protection from pests like deer and rabbits. Our Solexx treatment had a rigid structure closer to a cold frame greenhouse with a top panel that allowed access to the plants inside.

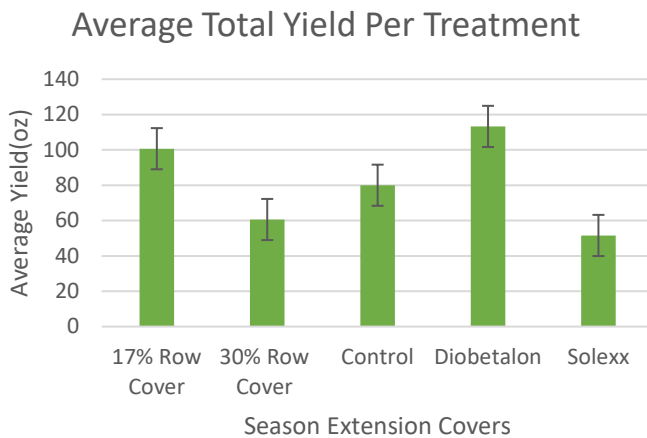


Figure 3. Average carrot yields for each season extension cover.

carrots prefer season extension covers with high light permeability and will not succeed under covers with lower light permeability. Either of our top two treatments could be used in high elevations conditions to increase total carrot crop yields.

Another way to maximize the yields from our covers is to select varieties that work for the climate. Most of our varieties performed equally, but Scarlet Nantes was a strong winner and Pusa Asita struggled (Figure 4). You can grow any of these

Our results were an average between the two seasons with the control 2015 data omitted. Between these seasons, Diobetalon was the most successful season extension cover with the 17% row cover performing only slightly less. Our Solexx and 30% treatments performed worse than our control (Figure 3). The percentage of the row cover refers to the amount of shading that the fabric creates with 30% having higher shading than the 17%. With the best performance coming from our 17% and Diobetalon, we can see that

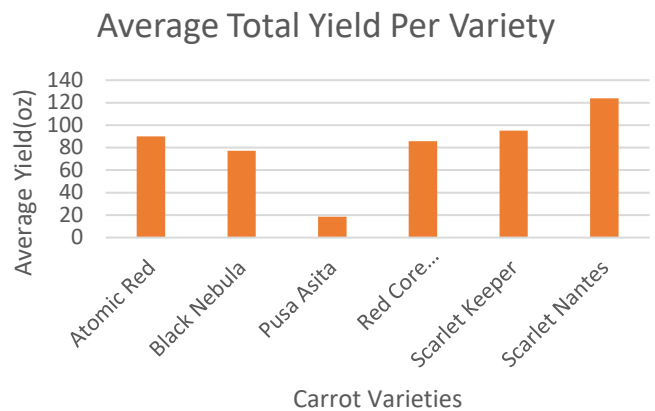


Figure 4. Average carrot yields for each variety.



depending on your preference for flavor and color, but we would not suggest growing Pusa Asita in a high elevation climate. The size of the carrots varied per year as well with the carrots grown in 2015 being bigger than 2021. This is because we did not thin the plants enough, so we got many small carrots. Thinning is an important step in growing carrots and should be done to maximize your yield and quality of carrots grown under season extension covers.

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