Ruter's Highland Farm grows the only processing carrots in Pennsylvania.

On the Road: Ruter's Highland Farm and Hanover Foods Corporation

We met with Karen, Stacy, Ryan, and Adam Ruter at their farm in Potter County to discuss their processing carrot production. In general Potter County’s climate with warm days and cool nights in summer, favor carrot production. This and fall frosts promote sweetening and sizing up of carrots. Carrot yield increases by about 1 ton/acre a week when temperatures are cool late in the season.

Carrots the Ruters grow are destined for Hanover Foods for processing and freezing. The number of acres devoted to carrots depends on Hanover’s needs. This year they planted 40 acres. The two markets for processing carrots are dicing and coins. Dicing carrots are classified as 1.5 inches in diameter or larger and carrots for coins are less than 1.5 inches. Highland Farms grows for the dicing market. Large carrots are desired for this market to maximize return. Individual carrots are generally between 2 to 4 pounds in size. The Ruters’ record is 8 pounds for a single carrot.

One issue that many farmers in Pennsylvania face is rocky soils (for example, see On the Road: Huntsinger Farm – Potato Planting). Removing rocks from the soil is an endless task: from field preparation through harvest. Deep soils are desired to grow straight carrots; however, because these carrots are destined for processing, they do not need to meet aesthetic requirements demanded for carrots going directly to consumers.

One of the biggest challenges in carrot production is getting a good stand. With a goal of April, seeds are planted just under the soil line and require a lot of water for germination. They will not germinate with even a slight soil crust. High temperatures after planting can dry soils quickly and germination suffers. On the other hand, heavy rain after planting can wash out the seed.
The Ruters are experimenting with primed carrot seed. In years past they used pelleted seed. Primed seed has gone through a pre-germination process resulting in germination in about 4 days compared to up to 2 weeks, depending on the weather. Many rain events early in the spring last year were good for germination and the primed seed did not result in early germination compared to the pelleted seed. However, when conditions are not as wet, primed seed provides an advantage.

![Primed seed (blue) can provide an advantage over pelleted seed (white) in years when soil moisture is less than ideal. Photo: Elsa Sánchez, Penn State](image)

Fields are prepared by pre-shaping beds spaced 36 inches apart. Then, seeds are planted about 1.5 to 2 inches apart with a 4-row vacuum seeder for a plant population of about 160,000 plants per acre. Fertilizer and pesticides are applied in the same pass.

![Direct seeding a carrot field. Photo: Tom Butzler, Penn State](image)

Weeds are another big challenge in carrot production. Pre- and post-emergent herbicides are a large part of the weed management program. During the season beds are also hilled to help manage weeds.

![Managing weeds is a big challenge in carrot production. In this field, soil was pushed up around the base of the plants or hilled to manage weeds. Photo: Nicole Santangelo, Penn State](image)

Pre-season soil testing and foliar tissue analysis several times throughout the growing season are used to inform the fertility plan. In general, carrots use about 100 pounds of nitrogen per acre. This is supplied during planting with a portion being readily available and the rest in a slow-release form. Growth cracks are an issue with carrots that are often seen late in the season and processors accept some carrots with this imperfection. The fertilizer program and cultivar selection are important for minimizing growth cracks.

It can take a while for carrot plants to get large. Ryan mentioned it is about mid-way through summer before they fill the row. Because of this soil erosion can be a problem. The Ruters build soil dams through fields to minimize erosion. Regular scouting for diseases and insect pests is used to determine when pesticides are used. Not many insect pests are issues with carrots, but leafhoppers and tarnished plant bugs can be problems.
Another issue is deer. The Ruters use propane cannons to scare deer, but they quickly adapt to them. They just know that losses from deer feeding are a part of growing carrots. As Stacy says, “Deer have to eat too.”

Figure 7. Carrots showing deer damage. Photo: Elsa Sánchez, Penn State

Compared to snap beans (for example, see On the Road: Processing Snap Beans at Ulmer Farms ), carrots have a longer harvest window. This makes it easier to match harvest with the needs of the processor. Karen says that there have been years when carrots are harvested in November and December. We observed harvest in October.

Good yields are 30 tons per acre. This is highly dependent on weather and how much moisture fields receive because the crop is dependent on rainfall only. Yields in 2019 were about 32 tons per acre. In 2018, excessive rain resulted in many carrots rotting in the field. Despite this, yields were very good at about 40 tons/acre. In dry years, carrots don’t size up and can “look like hairballs coming out of the ground.”

Harvesting starts with two preharvest steps. The first step is shredding. For this step, a flail mower is used to remove the leaves from carrots. This exposes the carrot shoulders but leaves behind most of the crowns and green areas of the carrot shoulders. This step begins after frost evaporates and is done on the same day that harvest is completed to maximize yield and because the foliage provides some protection from the ground freezing.

The second step is crowning and topping. This can be tricky to accomplish because carrots can come out of the ground at different heights. The crowner is constantly adjusted to maximize carrot harvest and minimize green shoulders. Processors require 80% of the carrots to be fully crowned, 20% can have some green shoulders and still be accepted. Crowns and shoulders are thrown to one side by the crowner so that they will not interfere with the harvester.

Figure 8. During shredding a flail mower is used to remove carrot leaves. Photo: Elsa Sánchez, Penn State

Figure 9. A close-up of carrots after shredding. Photo: Elsa Sánchez, Penn State

Figure 10. A crowner is used to remove any remaining carrot crowns and green areas on the carrot shoulders. Photo: Elsa Sánchez, Penn State
The final step is lifting the carrots from the ground. Once out of the ground, carrots are sorted by four people looking for rocks, clods, and rotten and small carrots. After sorting, carrots are placed directly into dump carts. From there they are placed in a tractor-trailer heading for the processing plant. Carrots are not stored on the farm. The goal is to harvest eight tractor-trailer loads each day.

We also visited with Vaughn Barkley and Jason Jones at Hanover Foods in Centre Hall, Pennsylvania to see how carrots are processed. The plant specializes in freezing products. A common misconception is that it is a cannery. However, Vaughn says “Everything from this plant leaves frozen.” On the day we visited carrots were not being processed; however, sweet potatoes were. Vaughn and Jason said carrots run through the same process.

Once sweet potatoes come to the facility, they are moved by a stream of water into the plant. Then they are exposed to high temperature and pressure to loosen peels. Peels are rubbed off and sweet potatoes are pushed through a series of three cutting plates for dicing. At this point, they are blanched at 200°F to deactivate enzymes that decrease the quality and kill any disease-causing organisms.

Within minutes diced product goes from 200°F to -10°F. First, diced pieces move on a cooling shaker to start the process. Then, they are submerged in refrigerated water. These first two steps bring the temperature down to 50°F. Next, water is shaken from the product and it is moved down a series of freezing cold, shaking conveyor belts. As belts shake, diced pieces bounce. This exposes more surface area to the cold and brings down the temperature quicker. Within 8 minutes the product has gone from 50°F to -10°F.

About 70% of the sweet potatoes are recovered. The remaining is lost as peelings and pieces that did not meet grading standards. Larger sweet potatoes (and carrots) result in better recovery. This is a case of bigger being better. A sludge is made with the portion that is lost and applied as a source of organic matter and nutrients to nearby farm fields.

This Hanover Foods plant serves industrial clients. Once diced products are frozen, they are placed in large plastic-lined totes and shipped to another Hanover Foods plant for packaging and distribution. About 1,300 pounds of the finished product are processed in a single hour.

Green beans are this plant’s largest crop, and 10 to 12 million pounds are processed each year. During green bean season the plant runs 24 hours a day, 7 days a week. At other times of the year, the plant runs 24 hours a day, 5 days a week to process almost every vegetable imaginable including celery, potato, beet, cabbage, broccoli, cauliflower, pea, edamame, dry bean, and okra in addition to sweet potato and carrot. Pastas and entrees are also made at the plant. While we were there, they were making spinach artichoke dip and sweet potato kits for Thanksgiving dinners.

Thank you to the Ruter family and Vaughn Barkley and Jason Jones from Hanover Foods for visiting and sharing information about their operations with us!

Authors
Elsa Sánchez, Ph.D.
Professor of Horticultural Systems Management
ess11@psu.edu
814-863-2433