FIELD TESTED

Tomato Grafting for Increased Yield

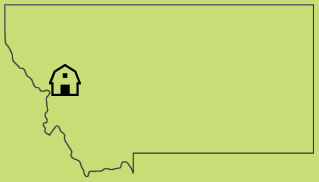
Field Tested is a series of reports about farm tools that have been tested by Montana farmers to enhance their specialty crop production. The reports describe these farmers' findings to help others make informed decisions about their specialty crop businesses. Visit FarmLinkMontana.org/fieldtested to read more Field Tested reports. This project is administered by the Community Food & Agriculture Coalition with funding from the Montana Department of Agriculture Specialty Crop Block Grant Program.

COUNTY RAIL FARM | HUSON

Arlyce Rosko, Production Manager
countyrailfarm@gmail.com

County Rail Farm Snapshot

Location: Missoula, MT
Operator: Tracy Potter-Fins
Acres: 10 acres, 2.5 in production
Crops: Mixed Vegetables, Flowers, and Garlic



INTRODUCTION

Arlyce Rosko was the Production Manager at County Rail Farm during the 2020 growing season. The farm grows a wide variety of crops, but sees a significant part of its revenue come from a few crops. One of these crops is tomatoes, and increasing yields of this crop would have a significant impact for the farm. At County Rail, high tunnel production space is a limiting factor for tomato production and simply increasing the number of plants is not an option. In 2020, Arlyce grafted tomato plants to vigorous rootstock to see if yield could be increased, on the same number of plants, in the same growing space. They produced the same tomato varieties side-to-side so they could compare the yields of grafted and non-grafted tomatoes. They hope this project will increase the amount of information available to other tomato growers in Montana.

COUNTY RAIL FARM

Country Rail Farm is a small organic vegetable farm located in Huson, MT. Previously run in Dixon Montana, County Rail Farm was moved to permanent land in Huson in 2016. The 2.5 acre operation is run by Tracy Potter-Fins, a queer farmer who has been farming in Montana since 2011. Arlyce Rosko worked at County Rail Farm for two seasons, in 2020 as the Production Manager. The farm employs one more full time staff, and two part time staff. County Rail Farm is run on the traditional lands of the Ktunaxa (Kootenai & Salish) people and the farmers acknowledge and honor with gratitude the land itself and the people who have stewarded it throughout the generations. Primary crops are salad, arugula, cherry and heirloom tomatoes, garlic and diversified vegetables. Produce is sold at farmers markets in Missoula and distributed to various locations in town through the Western Montana Growers Co-op. In the 2020 season County Rail added marketing channels including a farm stand.

GRAFTED TOMATOES

Grafting tomatoes is, simply put, connecting the upper growing portion of one tomato plant to the lower stem and root of another tomato variety. The upper plant is referred to as the scion, and the lower portion is the rootstock. When done correctly, the two plants heal together and become one. The resulting grafted tomato grows the traits and tomatoes of the upper plant with the vigor of the rootstock.

Grafting is a delicate process that relies on

Project Supplies

- Miter-cut grafting knife from Johnnys
- Twine
- Grafting clips (two sizes)
- Tomato seed (Mark Twain, Ruby Gold, Yellow Brandywine, Prudence Purple, Green Zebra, Cherokee Green, Pink Brandywine, Purple Cherokee, Jet Star, Sun Gold, and Sakura)
- Root stock seed (Estamino)
- Digital Food scale
- Healing chamber materials (plant transport cart + humidity controller+ plastic covering)
- Pots and trays
- Row cover and black ground cover

precise cuts and connections and careful plant care while the cuts heal. For complete details of the process Arlyce found the book, “The Greenhouse and Hoophouse Growers Handbook,” to be a useful resource throughout the project.

Grafted plants in the healing chamber.

The scion and rootstock plants must be grown to the appropriate size. Arlyce planted both at the same time and found that they grew at a consistent rate in the early stages. When the plant stems were precisely the size of the grafting clip opening, it was time to make cuts. Arlyce tested the size by simply placing the clip on the growing plants to test the size. In their healing chamber it took about 21 days for the tomatoes to be grafting size.

The stems are cut with a special grafting knife that cuts each at a set angle, so that the cuts will align perfectly while the graft heals. The plants must be placed in the sealed healing chamber as quickly as possible, so that temperature and humidity can be held perfectly steady. Arlyce conducted a test round and suffered total loss of plants due to small gaps in their healing chamber seal. For the first few days in the chamber, light should be excluded to stop photosynthesis and encourage the plant to focus it’s energy on healing the graft cut. When light is introduced, plants should be monitored for any wilting. If wilting occurs, immediately exclude light again.

Arlyce carefully grafting tomatoes. Gloves reduce the risk of disease for cut plants.

Arlyce recommends thinning your batch size to make sure that you aren’t trying to make too many cuts before you put plants in the healing chamber and leaving the freshly grafted plants sitting out while you work. Once plants are placed in the chamber, it is best to leave it sealed, rather than opening and closing to add more plants. Arlyce completed all of their grafts in one session and had a 55% success rate. Arlyce was prepared for a lower success rate and was really pleased with this outcome.

Greenhouse Production

The grafted tomatoes were transplanted in an unheated high tunnel at 18” spacing. Each plant was pruned to a single leader and trellised on a string system. Plants of the same variety were planted side by side in adjacent rows, one row grafted and the other row non-grafted. This allowed Arlyce to observe and compare the plants growth throughout the season.

OBSERVATIONS AND RECOMMENDATIONS

In the greenhouse, Arlyce found it useful to have two sizes of grafting clips ready to accommodate multiple stem sizes. Having two sizes allowed them to complete all of thier grafts in one session, despite grafting 11 different scions and one type of rootstock. In future seasons they would grow out the plants for grafting and set up their healing chamber indoors, rather that using a heated greenhouse. They found the greenhouse temperatures to be too variable for the healing chamber to hold steady temperatures, and believes this phase would be easier to manage and observe in the farmhouse.

The difference in growth rate was easy to see in the early stages, grafted on left.

Arlyce observed a clear and visible difference between the grafted and non-grafted groups in their early growth stages in the tunnel. The young grafted plants grew thicker stems and did not tip over prior to their first trellising as the non-grafted plants did. As the plants grew, the difference in height and sturdiness became less noticeable, though Arlyce feels this may have been largely due to their trellising choice. As mature plants, Arlyce did notice that the grafted plants are visibly more vigorous, and have more leaf mass and fruit set than the non-grafted varieties. The one exception being the Jet Star variety which, as a hybrid is already pretty vigorous on its own.

In future seasons, Arlyce would choose a two leader trellis system for grafted tomatoes. The intensity of the growth that Arlyce observed seemed to be too much for a single leader, and Arlyce felt like they spent a large amount of time cutting away the increased growth to maintain the single leader. New growth sprouted from unusual places on the plants (see photo to the right), which made pruning slower because the whole plant had

to be examined. Arlyce felt the plants would have exhibited much more growth had the pruning regimen allowed for more outlets.

All of the grafted tomatoes seem to produce slightly more fruit as the plants matured and had more fruit higher on the plant for potentially more later season yield.

As far as disease resistance, Arlyce did not notice any disease presence on the plants besides some leaf curl (likely a micro nutrient issue) that affected all plants, but has not seemed to affect their health. However, they saw slightly less blossom end rot on the grafted tomatoes, but about the same amount of splitting in the heirlooms.

Final yield data was not collected before the finalizing of this report, but County Rail Farm hopes to gather more at the end of the 2020 season so they can make decisions on how they will grow their tomatoes in the 2021 season.

Multiple new leaders sprout from the top of a leaf stem in the single leader grafted tomatoes.

Tomatoes trellised using a single leader string system.

GRAFTED VS NON-GRAFTED TOMATOES

	Grafted	Non-grafted
Stronger, thicker stems in young plants	X	
More vigorous mature plants	X	
Slightly higher yields	X	
Less time spent on propagation		X
More blossom end rot		X
Leaf curl disease pressure	X	X
Splitting on heirloom tomatoes	X	X
Later season production	X	
Less pruning due to vigorous leaf growth		X

Additional Resources

Montana Department of Agriculture Specialty Crop Block Grant Program: The purpose of this program is solely to enhance the competitiveness of specialty crops in Montana. Visit their website to find funding opportunities and more information. Search Montana SCBG.

Field Tested Reports and Videos: Find more reports about other projects and see videos of tools in action at the Field Tested webpage, under Resources on FarmLinkMontana.org

Farm Link Montana: A project of the Community Food and Agriculture Coalition to connect Montana's beginning farmers and ranchers with the tools they need to succeed: farmlinkmontana.org