

Cereal Rye Production Guide

Cereal Rye in Vermont

Why grow rye?

Rye is a cereal grain gaining in popularity in the Northeast and across the United States for its unique flavor characteristics. It is being used primarily in breads and spirits, though there are other food and beverage uses as well. Some brewers are experimenting with rye beers and rye is finding its way into a number of pastries and other baked goods beyond bread.

Rye grows well in Vermont and could be a beneficial grain crop on Vermont farms. UVM Extension's Northwest Crops and Soils Program has been experimenting with rye for several years to better understand its growth habit, best management practices, and quality parameters for food and beverage end-uses. This guide describes what we have found so far. For more details of specific results, please refer to our trial reports posted on www.uvm.edu/extension/nwcrops/research

Growth Habit

Rye is a fall-seeded winter grain. Like winter barley and wheat, it germinates and begins tillering in the fall, goes dormant over the winter, and resumes growth early in the spring. It is extremely cold-hardy and can usually withstand Vermont's winters. It is often considered a good crop for new grain growers because it is forgiving under variable or suboptimal growing conditions or management practices. It also grows better on poor soils than many other grains and may be a good choice for rehabilitating degraded fields. Rye is taller than most other grains and outcompetes weeds quickly if well-established. Rye is typically ready for harvest in late July to early August, usually after winter wheat and barley.

Rye can also be grown as a cover crop. The green cover over the winter can help trap snow and retain soil moisture, keep living roots in the soil which keeps airways open and provides early-season ground cover. Rye cover crop can be grazed in late fall or early spring and generates large amounts of biomass for soil nutrients when rolled or plowed into the soil. Proper termination timing is important due to rye's ability to recover if plowed too early. Rye straw is a good, light bedding material.



Cereal rye in the field

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Variety Selection and Seed

To begin with variety selection, there are two primary types of cereal rye: hybrid and open pollinated. Rye cross-pollinates with other rye plants and needs a large quantity of plants in the vicinity to develop grains. This cross-pollination makes it difficult, if not impossible, to retain varietal purity, especially if saving seed from one year to the next. Hybrid rye varieties continue to be developed which self-pollinate, thus minimizing the risk of crossing with other varieties in the field or from neighboring farms. Hybrid rye is also generally higher yielding.

Rye does not retain its germination potential very well after several years of storage so it is best to use seed from a recent harvest year. Ensure seed is clean and is properly stored to ensure good viability.



Grain contaminated with Ergot.

Ergot is a common cereal disease in the Northeast so it is best to inspect the grain for obvious signs of ergot contamination (large black masses). Ergot is toxic to humans and livestock and contaminated seed should not be used for food or feed. A gravity table is the



Band seeder planting grain.

best method for cleaning ergot out of infected rye. A screen cleaner can be effective for larger sclerotia, but some are kernel-sized and will pass through a screen along with the rye kernels.

If growing for a particular buyer it is best to communicate during the variety selection phase. Flavor, milling, baking, malting, distilling and brewing characteristics can vary by variety, with some characteristics being more favorable than others depending on the intended use.

Field Preparation

Prepare the field in September or early October for October planting. Rye can be planted directly into most crop residues with minimum to no tillage. It performs well in soils with low mineral content or organic matter, but higher yields occur with higher fertility. Soil temperatures at planting depth (0.75 inches) should be below 59° F. Rye performs better on more acidic soils than other small grains with an optimal pH range of 5.5-7.5.

Planting

Ideally, cereal rye should be planted at similar dates to winter wheat. In Vermont, late September/early October provides for best establishment and subsequent yields the following year. Seeding rates vary and depend largely on seeding date and planting equipment. A grain drill will provide the most uniform stands. Most rye is planted between 75 and 100 lbs per acre. However, later planting dates or broadcast planting methods may warrant higher seeding rates.

Grazing

Rye can be lightly grazed if it is planted early and the crop has good establishment and biomass in the fall. It stays green later in the season than several other forages and can tolerate some grazing before going dormant in the winter. It is best if the soil surface is dry so that livestock do not disturb the root systems too much.

Livestock feed

Being high in protein and fiber, cereal rye can be incorporated into livestock rations. Due to its bitter flavor though, it is not a preferred grain for most animals. 20-30% of the ration is the suggested maximum.

Cultivation and Fertilization

Rye may require some cultivation in the fall if annual weeds are present. Any annuals present will be terminated once heavy frost and winter sets in. If planted early and large amounts of biomass are established, cultivation may not be necessary in the spring, either. Rye breaks dormancy and begins growing in the spring earlier than other winter cereals. It is highly competitive against spring weeds and typically grows several feet high, but a pass with a cultivator may be required if weed pressure is high. Nitrogen application can improve rye yields, but timing on application is inconclusive based on our recent experiments. Fall applications improved yields slightly but, there was not a significant difference over spring-applied or applications split between fall and spring. For more information about our Rye Fertility Trial please see the trial report at www.uvm.edu/extension/nwcrops/research



Cereal rye in early spring



Cereal rye nearing harvest

Harvest

Rye is typically ready for harvest in late July or early August. It is common for rye to be harvested after barley, and about the same time as wheat, even though it grows more quickly in the spring. Like other cereals, rye can be harvested once it is below 18-20% moisture, though it is important to dry it down below 13% moisture for storage. The main disease affecting cereal rye in the Northeast is ergot. Inspect a field prior to harvest to assess ergot incidence. If sections of the field are heavily infected, consider harvesting those sections separately to avoid contaminating the whole crop. Ergot sclerotia can oftentimes be cleaned out of grain due to their large size with the use of gravity table seed cleaners or other similar equipment.



Harvesting rye at Thornhill Farm (photo: Todd Hardie)

Cleaning and Storage

Like other small grains, it is important to clean rye thoroughly. There are several pieces of equipment which can be utilized, including rotary cleaners, gravity tables, and fanning mills. A rotary cleaner turns on an axle while grain is fed through. It is an effective method of cleaning grain coming right off the field, removing small weed seeds and blowing out plant debris. Gravity tables shake the grain and separate kernels and contaminants by weight. Fanning mills shake grain across a screen with air blowing across to remove plant debris and separate out weed seeds. Color sorting is a relatively new cleaning method that uses optical sorting technology to separate kernels by color.

Cleaning grain on the farm is a great way to immediately add value to the crop, ensure it is ready for market and does not take up excess space in storage. Sticks, stones, husks, stems, and weed seed can decrease the quality and market value of the crop. Some weeds, such as ragweed, can impart an off-odor in storage rendering it unusable in food or beverage products. Use aerators or fans to bring the moisture content below 13% so that it does not spoil in storage. If saving seed (check with your seed supplier to ensure this is allowed) select the cleanest, highest quality grain you have to avoid planting seed contaminated with weed seeds or disease.



Cleaning rye for storage at Edgefield Farm (photo: Jeff Leavitt)



Before and after seed cleaning at Butterworks Farm (photo: Jack Lazor)

Quality Parameters

Rye has less stringent quality parameters compared to other grains, depending on end-use. For human consumption, first and foremost, it has to be disease free. The primary disease affecting rye is ergot, which is easily identifiable by its large black masses called sclerotia. Rye can also become infected with fusarium head blight, which can turn into the mycotoxin deoxynivalenol (DON) and should test below 1 ppm for human consumption.

Protein and moisture are not typically strict parameters, though it must be less than 13% for storage purposes, as noted above. If the crop is going to be used for malting, it must have a high germination rate, above 95%.

Research is underway to understand ideal and acceptable falling numbers for rye that is going to be used for baking bread. Falling number is an indicator of enzyme activity in the grain and pre-harvest sprouting damage. Bake tests have been performed to evaluate bread quality with high versus low falling number (correlating to harvest date) but an effort to evaluate and understand results is ongoing. Our Harvest Date Trial Report can be found on our website: www.uvm.edu/extension/nwcrops/research

It is encouraged to communicate with intended buyers, preferably during the variety selection phase, about necessary quality parameters.

Malting

Rye is gaining in popularity as a distinctive grain type for malt and certain beers. Some brewers enjoy its bitter, spiced flavor. Rye stands out and allows for some differentiation from barley and wheat. Due to its high quantity of pentosan starches that bind to water, draining the mash can be difficult. For this reason, beers including rye typically do so at a relatively low proportion.



Malting rye



Distillery

Distilling

Rye used for beverages stands out in distilled spirits. Craft distilleries in the Northeast have been producing high quality rye whiskeys for several years. A group of distillers in New York have established an “Empire Rye” designation which allows a New York distillery to label their product if, among other requirements, it includes at least 75% New York grown rye aged in charred new oak barrels for at least two years. Varietal differences in spirit yield have been noted across unique cultivars in UVM trials, yet further information is required to determine impact on flavor profiles.



Rye whiskey

Baking

Rye is experiencing a resurgence among bakers in the Northeast, and across the country, due to its unique flavor characteristics. Bakers are producing many different styles of breads and pastries with varying proportions of rye. It has a slightly bitter, spiced flavor, that pairs well with strong cheeses, meats, fruits, and chocolate. Rye is high in soluble and insoluble fiber which supports a healthy metabolism and provides a feeling of fullness for a long period of time. Artisan bakeries are potential buyers of high quality rye.



Rye bread bake test at Red Hen Bakery



Rye bread bake test (photo: Jeffrey Hamelman)

Quality Testing

Quality testing is available for rye or other cereal crops including wheat, barley, oats, and corn at the UVM Grain Quality Testing Lab in Burlington, VT. For more information, or to submit a sample, please visit www.uvm.edu/extension/nwcrops/cereal-grain-testing-lab, email uvmgrain@uvm.edu, or call (802) 656-5392.

Hartwick College Center for Craft Food and Beverage offers malt quality analysis for small grains including rye. For more information or to submit a sample, please visit www.hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/ or call (607) 431-4232.

The UVM Plant Diagnostic Clinic assists in the identification of pests, disease, and weeds. For support with pest identification and remedies based on IPM principles, please visit www.uvm.edu/extension/pdc or call (802) 656-0493.

More Information

Aaron MacLeod's March 2020 webinar on distilling quality testing rye from UVM's 2019 Rye Variety Trial can be found on the NWCS YouTube page: www.youtube.com/watch?v=R5aEFjzFH0c

For more information about falling number please see the Falling Number Factsheet on the UVM Cereal Grain Testing Lab website www.uvm.edu/extension/nwcrops/cereal-grain-testing-lab

For more information about cereal crops and cropping systems in Vermont, including research results, trial reports, and upcoming events please visit the Northwest Crops and Soils Program website www.uvm.edu/extension/nwcrops or call (802) 524-6501.



Perten Falling Number machine at UVM Cereal Lab



Cereal rye in the field



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