Forever Green Initiative



Hybrid Winter Rye

NEW SMALL GRAINS FOR WATER AND SOIL HEALTH

Overview

Forever Green is developing hybrid winter rye as a “cash cover crop” that protects soil and water resources, provides new economic opportunities for growers and new food and feed sources for Minnesota communities and businesses.

Rye has a long history of use throughout the world in food, feed and beverages. Many are familiar with the German-style pumpernickel, a dark, densely textured bread made from crushed or ground whole rye grains. Distillers and brewers use rye in whiskey or beer, and with the recent interest in craft distilling, rye whiskey is enjoying a renaissance moment in the US. For farmers, rye is used in feed and, due to specific properties, early research in Europe is indicating that rye has the potential to reduce antibiotic usage and stress in swine production group housing systems.

In US production, growers use rye as a relatively inexpensive, effective, quick-to-establish cover crop. The allelophatic, or weed suppression, attributes of rye are valued in organic production systems while its drought tolerance and winter hardiness make fall establishment as a cover crop nearly fail-safe. It is common in annual cropping systems to till in, or bury, harvest residue leaving soil exposed in the fall, winter and early spring and unprotected from wind, heavy rain, and run-off. Winter cover crops, including hybrid rye, are planted shortly before or soon after harvest of the main crop in the fall and are harvested before next crop the following spring. This rotation keeps the soil in continuous living cover which protects and builds soil health, reduces nitrate leaching and enhances water quality.

The market challenge for rye is ergot, a fungal disease in which hard black nugget-like bodies grow in the ears of the cereal. Ergot is a challenge to remove from the harvested grain, but it is imperative to do so in order for it to be used in food or feed. Human and animal consumption of ergot can cause serious health issues. Rye is inherently more prone to ergot infections as it is a cross pollinator whereas wheat, barley, and oats are self-pollinators. Having good seed set combined with genetic resistance to infections greatly reduces the number of ergot infections.

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Researchers partnered with a MN distillery to analyze the flavor profiles of distilled rye varieties

The fact that rye is a cross-pollinating species makes it much more amenable to producing hybrid varieties. European breeding companies have developed a genetic system to produce hybrid rye varieties much the same way corn breeders develop corn hybrids. Hybrid winter rye is showing a significant jump in productivity when compared with open-pollinated varieties, as well as improved agronomics and resistance to diseases, including ergot.

The University of Minnesota reinstated a rye variety performance evaluation in 2014, including both the open pollinated and hybrid rye varieties that are commercially available. The agronomic data, including grain yield and disease resistance, are published annually in the *Minnesota Agricultural Experiment Station's Minnesota Field Crops Trials* bulletin. In addition, research is underway to determine or validate end-use quality of Minnesota grown rye in food, feed and distilling uses. Selected hybrid rye's grain yields have exceeded 150 bushels per acre in small plot yield trials and are seeing equally impressive results in larger field scale plots.

TIMELINE 2021 - 2025

Hybrid winter rye is already a commercially viable alternative with great upside potential and relative small downside risks. Piloting hybrid rye in rotations, working with growers to spur adoption and driving market demand are key activities for hybrid rye in the next five years. Markets exist and if the successes of rye as a feed in swine rations in Denmark and Germany can be repeated in Minnesota, hybrid rye can quickly become a fixture across Minnesota's landscape.

Photos: Cheri Reese, Far North Spirits

Research Status and Goals

Breeding and Genetics: Little to no variety development of rye has been done in North America in recent decades. A handful of European breeding companies have developed a system to produce hybrid rye seed. The University has and will continue to collaborate with European partners and will focus on testing new combinations of experimental hybrids across SD, MN, and WI, bringing the best combinations to market. Selection of new hybrids rather than evaluating hybrids that were developed for other markets may result in even greater yield gains.

Agroecology: A significant ecosystem benefit of hybrid winter rye is how easy it is to integrate into a summer annual cropping system and allow for double cropping in one phase of Minnesota's predominant two and three-year rotations. The advantages of rye as a cover crop are the same reasons why it fits as a grain crop-rye is the earliest to mature of all the small grains species – opening the door to more reliable double-cropping soybeans, growing warm-season forages, establishing alfalfa, or growing a legume to provide N fertility through N-fixation.

UMN-Extension small grains specialist, Dr. Jochum Wiersma (left), meets with a Minnesota grower and distiller to discuss hybrid rye production.

Historically rye has been grown on the least fertile and most drought stress prone ground. To fully exploit hybrid rye's potential requires it to be grown on well-drained but fertile soils with adequate water holding capacity. Current best management practices for fertility, disease, and pest management, and even seeding rates are based on the outdated paradigm of rye production and need to be revisited. Immediate research needs are to establish new guidelines for nitrogen management, better understand the interaction of seeding date and seeding rate to maximize grain yield of hybrid rye, and reduce the impact of Fusarium head blight (FHB) and ergot on grain yield and grain quality.

Food Science and Commercialization: The suitability of Minnesota grown hybrid rye for baking, brewing, and distilling are well underway. Selecting varieties for malting that will result in unique, flavorful beverages including whiskey and beer, is also underway, with exciting partnerships developing between Minnesota distillers and UMN researchers. Additionally, pork producers are evaluating whether hybrid rye can replace corn in their rations. Because of its improved genetics, hybrid rye will offer a raw commodity that performs reliably and consistently, thereby allowing more consistency in the finished products. This in turn will lower barriers to market adoption as consistency and predictability of functionality are critical in the food and feed industry.

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