

# A Winter Rye Cropping System for Farmers in Northern Wisconsin

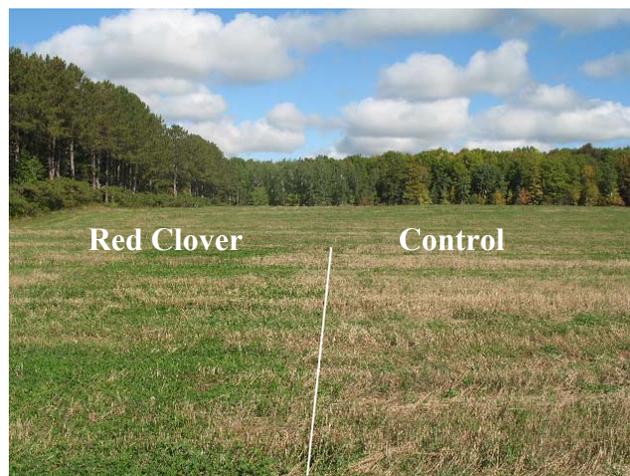
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## Introduction

Winter rye has been around for a long time and is used as a cover crop, green-chop forage, spring-seeded nurse crop, grain, and straw crop. In cooperation with three farmers in Ashland County, a 2-year research project was conducted to figure out if the many uses of winter rye could be rolled into one cropping system. In other words, is it possible to plant rye in the fall, interseed a legume in the spring, harvest the rye as a green-chop forage in May, harvest the rye regrowth for grain and straw in the fall, and then have a nice stand of legumes to use as a forage crop or plow-down?



**Photo 1.** Underseeded red clover stand in August after the June 27 rye harvest. Clover was broadcast seeded into winter rye in April.



**Photo 2.** Underseeded red clover strip (left) compared to an unseeded control strip (right) on September 18, 3 weeks following the winter rye grain harvest.

## Underseeding Rye with Legumes

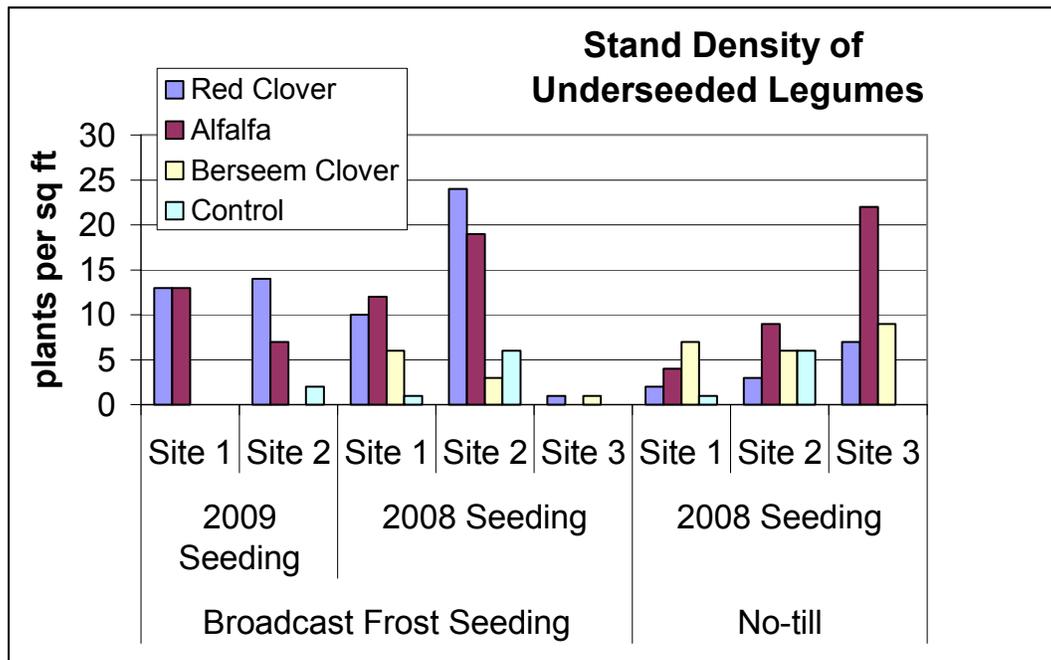
### Early-April Frost Seeding

Winter rye was seeded at three locations near Marango in the fall of 2007 (Table 3). Red clover, alfalfa, and berseem clover were broadcast seeded the following spring (April 2008) at a rate of 20 lbs PLS/ac. The underseeding trial was repeated in 2008/2009 at two locations with the winter rye seeded in September of 2008 and red clover and alfalfa broadcast seeded in early-April of 2009.

The results of the broadcast seeding were variable (Figure 1). For the 2008 seeding, the red clover

and alfalfa established well on the sandier site (Site 2, Photo 1), but did poorly on Sites 1 and 3. It is likely the poor germination (Site 3) and poor vigor (Site 1) of the legumes was due to the heavy thatch of the over-wintered rye at both sites. At both Sites 1 and 3, the winter rye was seeded early in the fall and at a high rate (2.4bu/ac). This resulted in vigorous stands with no bare soil in the spring. As a result, there was poor soil-seed contact for the broadcast legumes.

For the 2009 seeding, red clover and alfalfa established well on both the sandy and clay sites, but red clover had more vigorous stands (Photo 2). At



**Figure 1. Legume stand counts (plants/sq ft) for the 2008 and 2009 under-seeding trials in July (2008) or September (2009), respectively.**

both locations, there was only 50% soil coverage at the time of underseeding due to less vigorous rye stands (Photo 3).



**Photo 3. Key to successful frost-seeding of legumes into winter rye in the spring is having enough exposed soil to allow for good soil-seed contact. Frost-seeding legumes into stands such as shown on the left side of the photo resulted in better establishment than into stands with little or no exposed soil. (Photo from Stute et al.)**

Based on two years of data, it appears red clover or alfalfa can be successfully frost-seeded into winter rye in the early-spring, particularly on sites with lighter soils and when the winter rye is seeded at lower rates or later in the season.

### No-Till Seeding

Another option for interseeding legumes into rye is no-tilling after the rye is harvested. In 2008, the rye was harvested at early boot at Site 3, early heading at Site 1, and at milk at Site 2. Red clover, berseem clover, and alfalfa were no-till drilled at 20lbs PLS/ac immediately after each harvest. Figure 1 shows the stand counts at the end of 2008. Although there was some germination at all three sites, the legumes had poor vigor and were unable to grow due to the shrink-swell of the no-till planting slits.

### **Forage and Grain From Winter Rye**

Winter rye grows rapidly in the spring and is usually the first forage crop ready in the spring. It can also take advantage of spring moisture and residual nitrogen to produce a low-input, but high-yielding grain and straw crop. But can it be managed for both? In other words, if rye is harvested very early in the spring to reduce competition for the underseeded legumes, for example, and used as a forage can the regrowth then be harvested for grain?

In 2008, the rye was harvested at either the early-boot or milk stage at Site 3, at early-heading at Site 1, and at milk at Site 2.

At Site 3, the first cutting at early-boot yielded 2.2 tons DM/ac compared to 7.4 tons DM/ac when first



**Photo 4. Regrowth from winter rye first harvested on May 27. Picture taken July 25.**

harvested at milk stage (Table 1). The green-chop forage at early-boot had surprisingly high forage quality with crude protein at 14.4%. At Site 3, there was no regrowth from the milk harvest, but there was considerable regrowth from the early-boot harvest with 1.9 tons DM/ac at the heading stage. Allowed to mature, the same regrowth yielded 27 bushels of grain per acre (Photo 4).

At Site 1, the first harvest occurred roughly two weeks later than at Site 3 and had a yield of 5.1 tons DM/ac. The regrowth vigor from the later harvest was reduced with a yield of 0.6 tons DM/ac and, when allowed to mature, less than 10 bu/ac of grain.

At Site 2, the winter rye was seeded much later in the fall and at only 1.0 bu/ac (Table 3). Even so, the rye yielded 5.6 tons DM/ac at the milk stage and 30 bu/ac of grain when mature.

	cutting	harvest date	growth stage	Yield (tons DM/ac)	%CP	%ADF	NEL	RFV
Site 3	1st	27-May	early-boot	2.2	14.4	26.3	70.3	143
Site 3	regrowth	17-Jul	heading	1.9	8.4	41.7	65	83
Site 3	1st	19-Jun	milk	7.4				
Site 1	1st	11-Jun	early-heading	5.1				
Site 1	regrowth	22-Jul	heading	0.6	10.9	43.4	64.4	79
Site 2	1st	27-Jun	milk	5.6				

**Table 1. 2008 forage yield and quality of winter rye harvested at various maturity stages at three locations.**

At all three sites, some of the rye was not harvested and allowed to mature. The rye yielded 52.5, 50.5, and 30 bu/ac for Sites 1, 3, and 2, respectively (Table 2).

For all Sites, the underseeded legume growth was more vigorous when the rye was harvested at early-heading or early-boot compared to when the rye was harvested at milk or at maturity, but timing of the rye harvest had no effect on establishment of the legumes.

### Putting It All Together

The research done here suggests that legumes can be successfully interseeded into winter rye in the

spring. The systems explored in this research could be used in place of the more traditional approach to establishing a forage crop the year after corn silage. Here's how it could work:

1. Seed winter rye after corn silage is harvested (no later than October 1) at a rate between 1 and 2 bu/acre. The goal is to have a well-established rye stand with 50-75% ground cover to increase the chance that the spring-seeded legumes will establish.
2. Frost seed red clover, alfalfa, or a mix as soon as possible in the spring at a rate of 15 lbs PLS/ac.

3. Harvest the rye at early-heading for a high-quality green-chop forage or silage, at early-heading for higher-tonnage heifer feed, at milk for bedding, and/or at maturity for grain and straw. The earlier the rye harvest the better the chances of legume establishment.
4. In September, evaluate the underseeded legume stand. If density and vigor are sufficient, allow the legumes to grow into the next year. Most likely there will be volunteer rye mixed in with the legumes that will over-winter and add to the tonnage of the first cutting the following year. If the legume establishment is poor or spotty decide whether to manage the stand as is or start over with something else.
5. Alternatively, the established legumes can be tilled-in and used as a green manure crop and weed control for the following year's crop.

The method described here is first and foremost an option for growing winter rye. If the goal is to establish a legume stand with as little risk as possible, a spring seeding with a small-grain nurse crop is probably the better option.

Growing winter rye is a good option because it provides an early forage source, it scavenges for nitrogen and requires little fertility, it chokes-out winter annual weeds, and it protects soil during the fall, winter, and spring. Another advantage of rye is that it can be seeded very late in the season and still produce a nice crop the next year. Seeding legumes in the fall along with the winter rye, particularly when the rye is planted late, is likely to result in winter-kill of the legume seedlings. Frost-seeding into the rye in the spring can be done with an ATV and can basically be done for the cost of the seed. If it works, the legume can be managed as a forage crop or plowed down for green manure. If it doesn't, the producer is out the cost of the seed.

	<b>grain yield (bu/ac)</b>
<b>Site 3</b>	50.5
<b>Site 3*</b>	27.3
<b>Site 1</b>	52.5
<b>Site 1**</b>	<10
<b>Site 2</b>	30
* From regrowth from the May 27 forage harvest, **From regrowth from the June 11 forage harvest	
<b>Table 2. 2008 winter rye grain yield.</b>	

	<b>Site 1</b>	<b>Site 2</b>	<b>Site 3</b>
<b>Soil Type:</b>	580B Silt Loam	226A Loamy Sand	1280B Silt Loam
<b>pH:</b>	5.9	6	6.4
<b>Organic matter:</b>	3.8	2.7	4.7
<b>Phosphorus:</b>	11 (very low)	12 (very low)	17 (low)
<b>Potassium:</b>	122 (very high)	60 (low)	95 (high)
<b>2007 Crop</b>	mixed hay (30% alfalfa)	Corn silage	mixed hay (20% legume)
<b>2007 Tillage</b>	plow, disc, digger	light digger	plow, disc, digger, drag
<b>Planter:</b>	grain drill	4-wheeler broadcast	grain drill
<b>Seeding Date:</b>	2-Sep	5-Oct	15-Aug
<b>Seeding Rate:</b>	2.4 bushels/ac	1.0 bushels/ac	2.4 bushels/ac
<b>2007 Fertilizer:</b>	N/A	None	200 lbs (19-19-19)
<b>2008 Fertilizer:</b>	None	None	None

**Table 3. Site details for the winter rye trials.**

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