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Cereal Rye as a Winter Cover Crop

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Cereal rye (*Secale cereale*) is a winter annual cereal crop that has garnered a lot of well-deserved attention in the cover crop world. Cereal rye is much different than annual ryegrass (*Lolium multiflorum*) or Italian ryegrass which should not be used as winter cover crops. As far as cover crops go in the Mid-South U.S. region, cereal rye is a workhorse that is hard to beat in terms of the benefits that can be gained for the relatively low input cost required to establish and manage it as a cover crop. In most cases, the name of the game for cover crop success is biomass production. Cover crop biomass production is essential for achieving many of the benefits associated with cover crop use, which include erosion reduction, weed suppression, nutrient retention, soil crusting prevention and increases in soil organic matter (Table 1).

Table 1. Relative benefits of Cereal Rye as a winter cover crop (Adapted from *Midwest Cover Crops Field Guide*, 2014).

Cover Crop Benefit	Relative Rating†
Nitrogen Source	Very Poor
Nutrient Scavenger	Excellent
Soil Builder (Organic Matter)	Excellent
Topsoil Loosener	Excellent
Subsoil Loosener	Average
Erosion Preventer	Excellent
Weed Suppression	Excellent
Lasting Residue	Excellent

† Relative Cover Crop Benefit Ratings include Very Poor, Poor, Average and Excellent.

Cereal rye is a huge biomass producer (2,000 to 10,000 pounds of biomass per acre) with little to no input costs (mainly seed cost). In many cases, large amounts of biomass can be achieved by planting cereal rye without the need for additional fertilizer inputs. However, cereal rye is also an excellent scavenger of residual soil nutrients (N, P, K, S, etc.) and unlike tillage radish (*Raphanus sativus* L), cereal rye is not prone to decompose quickly. Therefore, most nutrients contained in the cereal rye biomass are not available to the successive cash crop. This nutrient scavenging ability can be great for retaining nutrients in the field and preventing nutrient runoff to surface waters, but the nutrients retained in the biomass need to be taken into consideration when managing fertility in the following cash crop.

When rice, corn or grain sorghum is following cereal rye, consider planting the cereal rye in a blend with a winter legume such as hairy vetch (*Vicia villosa* Roth) or Austrian winter pea (*Pisum arvense*). Blending cereal rye with a winter legume will add some N to the soil and lower the C:N ratio of the cereal rye, which will allow quicker decomposition of the cereal rye biomass and faster release of those nutrients back into the soil profile. Applications of P and K should also be delayed until the spring to prevent sequestering of those nutrients in the cereal rye biomass that will be slowly available to the following cash crop.

Cereal rye has broad adaptability and works well on most soil textures, even on what would be considered marginal or unproductive soils. One nice thing about cereal rye that allows it to fit so well in Arkansas is its ability to withstand waterlogged soils and even some ponded water. In addition, cereal rye can germinate at very low soil temperatures (approximately 34°F), allowing it to be planted and established late in the fall after commodity crops such as late-planted soybean have been harvested. Overall, cereal rye is a great cover crop choice for the Mississippi Delta region and can provide many excellent benefits with very little input cost.

One question often raised is "why is the seed cost for cereal rye so high?" The easiest answer is supply and demand: most cereal rye varieties are not very productive and only produce about 30 bushels per acre. Cereal rye can be purchased for $15 to $20 per 50-pound bag, which equates to a seeding cost of $12 to $24 per acre, based on your planting practices. This cost is relatively low when you consider the cost of other single-seeded cover crops and cover crop blends that can cost in excess of $45 per acre to establish.

Land Preparation

Similar to other cover crops, the primary benefits of erosion control, water retention and weed suppression can only be fully realized if the majority of the cover crop biomass remains on the soil surface following termination. Therefore, in most crop rotations, the best strategy is to complete all land preparation and pull beds in the fall prior to planting cereal rye with the intent of establishing your following cash crop using no-till or strip tillage equipment. Due to the large amount of biomass that can be generated when planting a cereal rye cover crop, it is important to be prepared to deal with this residue during planting of the successive cash crop. No-till planters are ideal for planting into these high density cover crop residue situations, but almost all drills and planters can be retrofitted to deal with these high residue situations. Row cleaners are often a simple fix that can be added to many planters to aid in the establishment of cash crops planted into high residue cover crops.

Planting Dates

Cereal rye is highly versatile and can be effectively established early in the fall following corn harvest (August) and very late in the fall following soybean harvest (November). Minimum soil temperature for cereal rye germination is 34°F, so it can be planted very late in the fall and still germinate and establish effectively. Many of the soils across Arkansas will remain warm enough for germination of cereal rye well into the winter (Table 2). However, for effective establishment and to aid in winter weed suppression and erosion, cereal rye should be planted as early as possible and within the windows listed below. Fall and winter growth of cereal rye can be quite significant and often times can put on more winter biomass than a typical winter wheat crop would. However, late-planted cereal rye may not tiller as well and have more winter-kill in unusually cold winters. Ideal planting dates for cereal rye in Arkansas are as follows (Figure 1):

Northern Arkansas (north of Highway 64) Optimum planting window is August 15 - Nov. 1.

Central Arkansas (south of Highway 64 to north of Pine Bluff) August 15 - Nov. 15

South Arkansas (south of Pine Bluff) August 15 - Nov. 15.

The planting window for cereal rye in Arkansas is quite large and makes it a great cover crop choice for a variety of production situations and crop rotations. Although cereal rye is not as prone to damage from residual herbicide activity as tillage radish or small-seeded winter legumes such as clover, this is

Table 2. Average monthly soil temperatures (4-inch depth of bare soil) during 2009 and 2010 for three sites in eastern Arkansas.

		Month											
Site	Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Rohwer (Gallion sl)	2009	40.8	43.2	49.5	56.1	64.7	73.8	75.8	75.8	71.8	56.6	49.4	42.0
	2010	37.8	37.5	42.5	61.7	72.2	83.6	82.3	md†	md	md	52.1	42.0
Marianna (Calloway sl)	2009	42.0	46.6	53.1	51.7	72.0	83.5	83.6	84.9	79.5	63.3	57.1	43.9
	2010	40.8	40.1	51.5	66.2	76.1	87.7	88.8	90.8	82.2	70.4	56.1	42.9
Keiser (Sharkey cl)	2009	38.3	44.1	50.1	58.4	69.7	78.3	81.6	81.0	75.9	60.6	53.8	41.3
	2010	38.3	36.2	49.1	63.2	72.5	85.5	87.7	90.7	80.1	67.5	52.5	40.1

† Missing data.

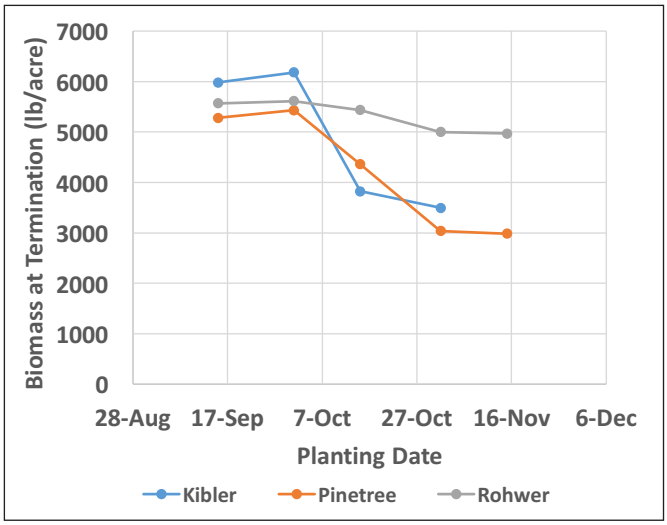

Figure 1. Cereal rye biomass as influenced by planting date at cover crop termination on April 1 of the following spring.

something that should be considered with all cover crops. Herbicide activity is a function of soil texture, moisture and microbial activity. If you are concerned about residual herbicide activity influencing your cereal rye establishment, you can easily gather soil from the fields of interest (both on beds and in-furrow) and do a simple germination test with your cereal rye seed to determine if there is a potential problem.

Seeding Rates

Precision planter – Not recommended

Drilled on 7.5"-9" row spacing – 35-45 lb seed/acre

Broadcast or aerial seeding – 55-65 lb seed/acre

Planting depth ¾"-1½"

Cereal rye seed is grayish brown in color and will be thinner and more elongated than the soft red winter wheat seed most often sown for grain in the Mid-South U.S. (Figure 2). Cereal rye seed looks very different than annual ryegrass seed which should not be planted in Arkansas as a winter cover crop. The most efficient establishment technique is using drills or planters similar to those used for the establishment of a winter wheat crop, but it can be accomplished with aerial or

Figure 2. Comparison of cereal rye seed size and color to soft red winter wheat.

Figure 3. Cereal rye cover crop at early boot stage planted at 40 pounds of seed per acre.

broadcast seeding and shallow incorporation with something similar to a Kelly Diamond Harrow.

Fertilization

In most of the soils in eastern Arkansas, cereal rye that is planted prior to Nov. 1 will not require N fertilizer in order for producers to get the full benefits of the cover crop. We do not recommend that you fertilize a cereal rye cover crop as it adds expense and often does not increase biomass production significantly. However, cereal rye planted after Nov. 1 can benefit from 30 units of N to aid in tillering and help prevent winter kill in extreme winters. For cereal rye following rice on silt loam soils, roughly 30 units of N are needed to aid in crop establishment.

While research has not yet been conducted on clay soils, 45 to 50 units of N will probably be needed for late plantings. There is no need to fertilize cereal rye with P or K for optimal results on the majority of our soils. Land that has been recently leveled will oftentimes benefit from the application of 1 to 2 tons of poultry litter per acre. Applying the litter prior to cereal rye planting could lead to the tie-up of these nutrients in the cereal rye biomass and lower the availability to the following cash crop. Research is ongoing to determine how P and K fertilization needs to be addressed in these high residue cover crops such as cereal rye; but to be safe, try to apply P and K fertilizers after cereal rye termination and prior to cash crop establishment. Banding of these nutrients during planting can help avoid any potential problems that might occur.

Burndown/Killing Cereal Rye

In the spring, cereal rye will break winter dormancy and begin rapid vegetative growth in mid to late February, depending on your location within the state (closer to early February for the southern portion of the state). Allowing the rye cover crop to grow until the first of March will provide sufficient biomass to realize many of the cover crop benefits

and still allow adequate time for burndown and desiccation prior to cash crop planting. The cereal rye cover crop should be terminated at a minimum of 28 days prior to the establishment of the following cash crop to ensure that there is no "green bridge" to harbor pests such as stink bugs and armyworms.

Cereal rye is one of the easiest cover crops to terminate and can generally be accomplished with 22 fluid ounces per acre of glyphosate applied prior to the boot stage. Earlier termination of the rye cover crop (prior to the boot stage) typically leads to better results. When cereal rye is planted in a cover crop blend, multiple herbicides will need to be added to glyphosate for effective control. Blends including vetch can be controlled with the addition of 2,4-D. Blends that contain multiple broadleaf species, especially winter peas, will typically require a three-way mixture of glyphosate, Sharpen and 2,4-D or glyphosate, dicamba and 2,4-D. If termination applications are made closer to planting, paraquat plus a PSII inhibitor such as metribuzin (soybean), atrazine (corn) or diuron (cotton) will provide effective control. Please remember that cereal rye can be a large biomass producer and earlier termination can help alleviate the large amounts of biomass at planting of the cash crop.

Figure 4. Headed cereal rye terminated at heading immediately prior to soybean planting.

Figure 5. Soybean planted into cereal rye cover crop.

Insect Pest and Disease Considerations

Cereal rye can harbor many insect pests which in turn can lead to undesirable effects on the following commodity crops. Any insect pests, such as armyworm and stinkbug, that might potentially congregate in winter grain crops may also be found in cereal rye. To prevent any negative effects of insect pests from cereal rye on the following commodity crop, it is recommended that elimination of the "green bridge," or burndown and termination of the cereal rye cover crop, occur at least four weeks prior to commodity crop planting. Figure 6 indicates the effects of planting commodity crops into green cereal rye cover crops which can be potentially devastating to the following commodity crop.

Figure 6. Corn planted into a green cereal rye cover crop that suffered from early season insect pest pressure.

Early planted winter cereals for winter cover crops, such as cereal rye, can be more susceptible to leaf diseases and may harbor diseases that could be transmitted to nearby small grain crops such as wheat (*Triticum aestivum*) and oats (*Avena sativa*). This is an issue that is strongly influenced by environmental conditions and overall disease pressure but should be considered if planting cereal rye in close proximity to a winter small grain commodity crop such as winter wheat or winter oats.

Cereal rye also appears to be susceptible to southern root-knot nematode. In a recent greenhouse screening, cereal rye appeared to be a better host for southern root-knot nematode than black-seeded oats but was less susceptible than either Austrian winter

pea (*Pisum sativum arvense*) or barley (*Hordeum vulgare*). Although winter conditions often limit nematode reproduction, if cereal rye is allowed to grow late into the spring there is the possibility that this cover crop could sustain higher populations of southern root-knot nematode for subsequent cash crops.

For commodity crops planted following winter cover crops, it is essential that both insecticide and fungicide seed treatments are used. Due to the dynamic nature of planting into cover crops, it increases the likelihood of above average potentially harmful insect and disease pressures. Therefore, it is highly recommended that producers use the labeled rate of commercially available seed treatments for the specific commodity crop.

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