

International Herbage Seed Group

Feature article: **Annual Ryegrass and the Value of Cover Crops in the Midwestern US**

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Annual ryegrass (*Lolium multiflorum* Lam) is a cool season grass that, prior to 1995, was used primarily for “over-seeding” large areas during winter in southern US states. Seeded in the fall, as warm season native grasses begin to go dormant, annual ryegrass provides both basic ground coverage and livestock forage.

About 90 percent of the US supply of annual ryegrass seed is grown in the west coast state of Oregon. In 1995, Oregon growers were experiencing annual ryegrass seed surpluses and lower than desired sale prices. That’s when the Oregon Ryegrass Seed Growers Commission began a modest, grower-funded research and education project to develop new markets and boost sales of annual ryegrass seed. The area selected was the “Midwest” states of Indiana and Illinois, in the heart of the “corn belt,” but also important for soybean farming.

The idea for this new market was to help re-introduce a “no-till” agriculture practice combined with use of annual ryegrass as a “cover crop” each winter. Harkening back to an older tradition, when farmers had greater biodiversity in the field, cover crops provide valuable nutrients and organic matter to the soil, while reducing the loss of topsoil to erosion.

Background

After World War II, American agriculture embraced greater mechanization and the use of synthetic fertilizers. That period is also characterized by improved yields, larger farms and less crop diversity. For the next 50 years, tractors became more powerful, plows dug deeper and fertilizer inputs increased. Much of this once-fertile Midwest soil lost a lot of its vigor, lost substantial organic matter and microorganisms, and has experienced natural and machine-caused compaction. Using what is called “conventional” tillage and limited crop rotation, farming became increasingly reliant on specialty seeds and fertilizers to retain highly productive corn and soybean yields. Consequently, these lands have become very susceptible to topsoil losses and - as seen this past summer - crops have little tolerance for drought conditions. Because of these and other factors, no-till agriculture in the Midwest began to attract notice in the 1980s but few farmers employed cover crops before 2000.

The Oregon Ryegrass Commission’s limited budget prescribed a targeted, small-scale effort. At first, organizers sought the cooperation of a few universities and a dozen farmers in two Midwest states (Illinois and Indiana) to develop some test plots using annual ryegrass. There was some doubt whether the grass would even survive in the Midwest climate, known for its cold, snowy winters. For maximum effectiveness, it was important that the cover crop be able to withstand the winter. Coming out of dormancy in springtime, the annual ryegrass would then grow until sometime in April (depending on weather and geographic location), when it would be eradicated with herbicide (usually glyphosate) prior to planting corn or soybeans.

Key to the success of the effort was Mike Plumer, an Extension educator at the University of Illinois, who had many years of experience with no-till on his own farm and took a keen interest in annual ryegrass as a cover crop. Because of the region’s lack of modern experience with no-till and cover crops, the early successes and failures with annual ryegrass gave Midwest agronomists and farmers important lessons about planting other

cover crops as well. Major components in any cover crop program include the variety used, the planting date, seeding rate, method of planting, proper fertilizing, winter survivability and killing the cover crop in the spring before planting corn or beans.

Ideally, annual ryegrass is seeded with a drill after harvest, but the window of above-freezing weather is small, so many farmers now establish their cover crop earlier with



airplanes or “high-clearance” equipment modified to seed from wide booms (see photo) into a standing crop. Annual ryegrass has a better chance of surviving the winter if it has more than 50 days of growth beforehand. Having established at least 3 leaves prior to cold weather improves its survivability rate considerably. The best condition is for a blanket of snow over the annual ryegrass all winter, to insulate it from bitter wind chills. While the Midwest states have been a focus of attention, reports from farmers in states to the northwest, as well as some in Canada’s southern Great Lakes region also report reliable success with annual ryegrass.

Part of the Commission’s program included university-controlled, replicated trials in different states using numerous varieties of annual ryegrass. At present, there are about seven proprietary varieties that are hardy enough to withstand average Midwest winters. Growers are advised to select the seed based on their farm’s location and farm management objectives. The nonprofit Midwest Cover Crop Council has a cover crop decision making tool online to help farmers select based on a variety of factors.

<http://mcccdev.anr.msu.edu/VertIndex.php>

Benefits of Annual Ryegrass

1. Drought Resistance. The first discovery about annual ryegrass value as a cover crop was its dual capacity for deep rooting and breaking up compacted soil. In Oregon’s Willamette Valley, annual ryegrass roots grow quite shallow because the normal water table is near the surface. In the Midwest, it surprised everyone that while top growth quit in the fall at less than 6 inches (15 centimeters (cm.)), annual ryegrass roots continued to grow all winter below the frozen soil (provided the grass did not succumb to harsh conditions.)



2. Breaking Soil Compaction. Natural hardpan (fragipan) or manmade compaction prevents corn and soybean roots from getting deep moisture. In the Midwest, these soils are found predominately in southern Ohio, Indiana, Illinois, and in Kentucky and

Missouri. The depth of crop rooting depends on factors including compaction, soil type and the number of years the land has been in cultivation or no-till.

Annual Ryegrass creates small channels, or macropores, as they grow. When killed in the spring, the roots decay, allowing corn and soybean roots to use the same channels



to reach moisture under the hardpan (see photo). It takes approximately four years of continuous no-till with annual ryegrass to get through 4 – 6 in. (10 – 15 cm.) of hardpan.

Also discovered in those early years was that the older, public varieties of annual ryegrass, like Gulf, will not do as well as the newer winter-hardy varieties in the Midwest, unless ample snow insulates the vegetation all winter. Lack of snow coupled with sub-zero (Fahrenheit) temperatures and brisk wind can kill off the young grass.

3. Increased Yields. One of the consistent farm cooperators since the start of the cover cropping project in 1995 is Ralph “Junior” Upton, whose hilly, erodible Illinois farm (1,800 acres; 728 hectares) has had annual ryegrass and other cover crops on about half of those fields since the mid 1980s. By reducing or eliminating erosion and compaction, corn yields have improved

considerably, as has the percentage of organic matter in the soil. In the first year (with “normal” rainfall) of a replicated university study (2005 – 07), Upton showed a 50 bushel per acre difference (3.13 Metric tons/hectare (Mg/ha) between plots traditionally planted in annual ryegrass and those conventionally tilled. The following year, exceptionally dry, those same acres showed an even larger differential (4.39 Mg/ha). In the 2012 drought, Upton’s farm produced less than half the normal yield. And yet, his corn harvest averaged 80 bushels/acre (5.01 Mg/ha) with a high of 130 bushels/acre (8.15 Mg/ha). Meanwhile, neighbors around him using conventional tillage averaged 0 – 30 bushels/acre (0 – 1.88 Mg/ha). Since the 1990s, organic matter on his farm has increased from less than one percent to about 3.5 percent on cropland where annual ryegrass is planted in the winter.

4. Nutrient Recycling. While alive, annual ryegrass scavenges available nitrogen from the soil. After it is killed in the spring with herbicide (glyphosate), the residue releases that stored nitrogen to corn in late June or early July. Using annual ryegrass can provide up to 90 lb/a (90 kg/ ha) of nitrogen. Over time, the deep rooting also enhances the translocation and availability of phosphorus and potassium from deeper soils.

With the cost of nitrogen (NH₃) estimated to reach \$1,000 (US) or more per ton (about 900 kg) growers see cover crops as an economic asset. Planting annual ryegrass can reduce nitrogen inputs, and the savings will more than pay for the cost of the seed and planting. Additionally, cover crops require fewer equipment passes through the fields, thus saving fuel and additional compaction.

Farmers who have livestock are increasingly required to apply manure in a more environmentally friendly fashion. Using annual ryegrass helps to keep the nitrogen in

the soil profile instead of washing off the land and into nearby streams, rivers and lakes. A combination of governmental regulations and cash incentives are in place, part of a long-term effort to reduce eutrophication and hypoxia, caused in part by nutrient leaching off farmlands.

5. Quicker Transition to No-Till

When converting land to no-till, it commonly takes about five years for key soil properties (aggregate stability, organic matter, increased infiltration, pore space, microorganism population, fungi, etc) to return. Adding annual ryegrass or other cover crops reduces this transition period by about half.

6. Weed Control. Planted in the fall, before winter annuals have germinated, annual ryegrass grows vigorously to form a dense cover that competes successfully with winter annual weeds, thus eliminating the need for herbicide use at that time.

7. Soybean Cyst Nematode Control. High populations of soybean cyst nematodes result in lower soybean yield. Preliminary research studies indicate that with a healthy annual ryegrass crop after harvest, cyst eggs will hatch in the fall. Annual ryegrass is not a host plant, thus the nematodes starve. This results in a very low count, if not elimination, of this pest the following year. Fields in the southern half of Illinois, Indiana, Ohio, and Missouri are likely candidates because there is ample time in the fall to develop a healthy stand of annual ryegrass before freezing weather.

8. Grazing. Growers who plant annual ryegrass after wheat or corn silage may be able to take a cutting of haylage in the fall and possibly in the spring, then no-till plant beans or corn into the annual ryegrass. Growers in southern Ohio, Indiana Illinois, Kentucky and Missouri may be able to graze the annual ryegrass over winter or take a cutting of haylage in the spring.

9. Pollination. Corn normally pollinates in early July, but in 2012 Midwest temperatures were consistently above 100°F (37°C) for weeks during that time. That, coupled with no rain, stressed the corn plants and diminished pollination significantly. Because of its deep rooting, corn grown on land with annual ryegrass was able to find deep moisture and increase the odds of at least a partial pollination occurring. Another theory being studied is that natural plant respiration during that time kept the temperature of the ambient air, plant vegetation and surface soil lower, allowing more plants to pollinate.

10. Land Reclamation. In a recent study of coal strip mine reclamation in the Midwest showed that use of cover crops dramatically reduces the time needed for soil recovery. In that study, for example, “bond release” normally takes about 12 years, after which the land is deemed suitable for agricultural and other purposes. Using cover crops, this study showed a reduction in bond release time to only four years, three times faster.

Summary.

In the historically significant drought last summer, Midwest farmers sustained substantial crop losses. While an estimated 80 percent of farmers had insurance against crop loss, some of those who didn't lost everything.

While farmers employing no-till with cover crops were not exempt from reduced yields, their harvest far exceeded those of farmers still using conventional tillage. After planting deep-rooting cover crops, like annual ryegrass, in the fall of 2011, farmers watched in appreciation last summer as corn and soybean plants used those same root channels,

extending to depths of 6.5 - 9.8 feet (2 – 3 meters), thus withstanding withering heat and lack of rainfall.

The added values of soil health, drought protection and higher yields have made cover crop investment very popular in recent years. Midwest acreage planted in cover crops has doubled and tripled every year since 2008, according to industry estimates. While promising, the total (about 2 million acres; 800,000 hectare) still represents less than one percent of all Midwest cropland.

Changing traditional farming ways takes time, and the Oregon Ryegrass Commission's strategy continues to emphasize education of farmers, seed dealers, governmental agencies and industry associations. Oregon seed growers also continue to invest heavily, including the investment of their own time to work on the ground with growers in the Midwest, believing that continued education is needed to sustain the growth in use of cover crops. Meanwhile, larger seed growers and seed dealers continue to develop new cover crop varieties for this market. Likewise, they're developing marketing campaigns and hiring Midwest agents to both sell product and educate the buyers.

At the start of the cover crop effort, in the mid 1990s, there was very little annual ryegrass seed sold into the Midwest for cover crop purposes. Those experimenting with the crop were given seed and sometimes small cash incentives to plant it in the fall.

In 2010, about 15 years into the campaign, an estimated 5 million pounds (2.2 million kg) of annual ryegrass seed was sold there. Last year, that amount tripled (15 million lb; 6.8 million kg) and estimates are that the volume of seed could double again next year.

Meanwhile, the price for the seed has also increased, good news for growers in Oregon. But among the many cover crop choices, annual ryegrass continues to be among the most popular, because of its lower cost (\$0.70 - \$1.25 US/lb.) and its valuable properties: deep rooting, nitrogen scavenging and soil building.



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