



## Perennial ryegrass potential in Michigan

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### Introduction

Ryegrasses are the most popular and best-adapted cool-season grasses in most of the world. Most of the ryegrass grown in the US is in the Pacific Northwest and Northeast; however, there are areas in the Midwest where it is also grown including Michigan. A 1995 survey estimated perennial ryegrass forage production at 110,000 acres each for the Pacific Northeast and northeastern US. For the Midwest, the estimate in 1997 was 20,000-25,000 acres. Estimated acreage in Michigan is less than 10,000 acres, used primarily in pastures.

Perennial ryegrass grows best in cool, moist climates. The crop grows well in early spring and fall, but during the hot summer months it becomes dormant. Even with irrigation or abundant summer rainfall, perennial ryegrass production suffers due to high temperature stress when day temperatures exceed 86° F and night temperatures exceed 77° F. It is more sensitive to temperature extremes and drought than annual ryegrass. Perennial ryegrass is less winter-hardy than orchardgrass and tall fescue and less drought than smooth brome grass.

Research in Wisconsin by Casler and Walgenbach in 1990 and Noverly et al., 1995), however suggest that perennial ryegrass is able to survive severe climates, even where snow cover is unreliable. Optimum growth occurs between 68-77° F. Perennial ryegrass grows best on fertile, well-drained soils but has a wide range of soil adaptability. It is tolerant of poorly drained soils and frequently is used in these environments. It tolerates both acid and alkaline soils, with a pH range of approximately 5.0 to 8.3. Similar to tall fescue, perennial ryegrass is adapted to shade in the warmer portions of a cool, humid climate where winter kill is not a problem. In Michigan grazing studies, we have found perennial ryegrass less persistent than other perennial temperate grass species such as orchardgrass, tall fescue, timothy smooth brome grass and Kentucky bluegrass.

In a co-culture study seeded in two locations in the spring and summer, one summer seeding was significantly injured by cold winter conditions at Lake City, Mich., while the remaining three seedings were not adversely affected by weather. Despite these limitations, the high nutritional value of perennial ryegrass makes it the pasture grass of choice for areas with wet, mild temperate climates like the Pacific Northwest and northeast U.S., Great Britain, and New Zealand. In grazing trials at Lake City and Chatham, Mich. perennial ryegrass was the preferred grass species by grazing cattle, compared to several other cool season grasses grown. In another grazing trial at the Kellogg Biological Station in SW Michigan, perennial ryegrass has persisted 4 years under rotational grazing systems with alfalfa and birdsfoot trefoil.

### Italian and perennial ryegrass

There are two important ryegrass species, Italian (*Lolium multiflorum* Lam.) and perennial (*Lolium perenne* L.). Italian ryegrasses are usually considered a short-lived perennial or annuals. In much of southern Michigan, Italian ryegrasses survive at least one winter. Italian ryegrasses are used primarily for cover crops or a single season forage crop. Italian ryegrass is not well adapted to Michigan as a forage crop because it lacks winter hardiness.

Perennial ryegrass is a cool-season bunch grass that has more winter hardiness than the Italian ryegrass. However, perennial ryegrass usually grows as a perennial in Michigan as it normally survives for several growing seasons, depending on the environmental conditions. Perennial ryegrass requires a dormancy period of cool temperatures before a photoperiod can induce flowering, thus allowing seed head formation once a year in the late spring. Some seed head formation does occur throughout the summer in Michigan as a result of plant stress such as drought. Perennial ryegrass will readily cross-pollinate. Natural hybrids with other *Lolium* species and intergeneric hybrids with *Festuca* have been formed, mostly to improve the forage quality of tall fescue or to improve perennial ryegrasses' persistence.

There are two different crops within Italian and perennial ryegrass forage species, the diploids and tetraploids. Tetraploids have fewer, but larger, tillers with wider leaves, which result in more open-type sods, and tetraploids are generally somewhat less persistent than diploids. Studies in Ireland with lactating dairy cows have shown significant increases in milk production while grazing tetraploids compared to diploid or by the more erect growth pattern of tetraploids.

### **Culture and management**

Perennial ryegrass can be seeded in the early spring or late summer in Michigan. Good stands have been established in Michigan seeding in late April to mid-May. Late summer seeding should be done by August 1 in Upper Michigan and by Sept. 1 in southern Michigan. Ryegrass can be seeded alone at 15-20 lbs. per acre or 6-8 lbs per acre with a compatible legume such as alfalfa, birdsfoot trefoil and white or red clover. Seeding depth should be 0.25 or 0.5 inches using press wheels or a cultipacker to obtain good soil to seed contact. Ryegrass has been successfully frost seeded at rates of 4-6 lbs. per acre. This was accomplished by over grazing in the fall prior to seeding followed by rotational grazing after spring seeding to reduce competition.

Perennial ryegrass requires high fertility levels for good production. Fertilizers should be applied based on a soil test. Perennial ryegrass will grow on soils with pH of 5 to 8, but forage production is best at pH of 6 to 7. Perennial ryegrass is very responsive to N, with some studies showing maximum yield attained between 535 - 1070 lbs. N per acre per year in Europe under ideal growing conditions. There is usually a linear increase in yield of between 20-30 lbs dry matter per lb.N, until the rate of application is between 223-356 lbs. N per acre per year. At higher rates, the response per lb. of additional fertilizer N declines until the maximum yield is attained.

Under Michigan conditions with less rainfall and higher summer temperatures than Europe, we expect economical responses from N applications up to 150-200 lbs. per acre in pure ryegrass stands under adequate rainfall or irrigation. Applications of total yearly N should be split, as evenly as possible to reflect the continuing need for nitrogen throughout the growing season taking weather conditions into account. The first application should be applied at the beginning of the season and the others after each harvest or grazing cycle except the last. This application system produces a greater annual yield and better quality forage than does a single, early spring application and results in better utilization of applied nitrogen.

Nitrogen (N<sub>2</sub>) fixation by rhizobia bacteria nodules found on legume root hairs can provide significant amounts of N to ryegrass growing with the legume. However, high levels of N<sub>2</sub> fixation rates per unit area of white clover/grass can be maintained only under very low soil mineral N level conditions, which limit grass competitiveness. This causes white clover (*Trifolium repens* L.) perennial ryegrass communities dependent on symbiotic fixation as the sole N source to be in chronic N deficiency and below their pasture yield potential.

The impact of applying fertilizer N to a well-managed grass and white clover pasture is to reduce N<sub>2</sub> fixation. Moderate rates of N up to 70 lbs. per acre usually reduce N<sub>2</sub> fixation about one half. Higher rates over 125-150 lbs. per acres are likely to eliminate N<sub>2</sub> fixation entirely. The size of the effect is influenced by factors such as the time of year of fertilizer application, the frequency of defoliation, soil moisture and other nutrients, and the form of fertilizer N. Frequent defoliation minimizes the effect by reducing the competition of the grass. In dry areas, irrigation can offset some of the effect by diluting the inorganic N in the vicinity of the nodules, encouraging rapid growth, and maintaining available energy supplies for fixation.

Manure, urine and less acid-forming types of N fertilizer minimize decreases in N<sub>2</sub> fixation. Thus, accommodating the competing objectives of high yields, high quality forage and optimizing N<sub>2</sub> fixation by forage legumes while maximizing the recycling of animal manure requires a balancing of fertility requirements and harvest/grazing management. Meeting but not exceeding soil, plant and animal needs is a continual adjustment process.

Perennial ryegrass is ideally suited for intensive sheep and cattle grazing systems as it can withstand close frequent grazing. New stands of perennial ryegrass should be well-established and approximately 10-12 inches tall before grazing or harvesting for silage or hay. Ryegrass plants are established when they have three or four leaves. Established stands can be grazed when 4-10 inches tall, but should not be grazed shorter than one inch.

When rotational grazing is used, pastures should be rested for a minimum of two weeks following grazing, but longer if growing conditions such as dry or hot weather cause slower regrowth. Some researchers suggested using three leaves per tiller as a convenient basis for timing defoliation. This recommendation was based on the onset of senescence and the restoration of water soluble carbohydrate reserves following the full expansion of three leaves on the ryegrass plant. Yields of perennial ryegrass have been shown to be higher under rotational than continuous grazing.

Frosted ryegrass is susceptible to damage by trampling livestock damage can be either temporary or permanent. Therefore, livestock and machinery should be kept off ryegrass pastures under late fall or early spring conditions when freezing occurs.

## Summary

Ryegrasses possess several desirable qualities as ag forage crop including excellent forage quality, response to fertilizers, ease of establishment, high yielding and flexibility of use as hay, pasture or silage. The less desirable qualities include less persistence than other cool season grasses as well as being more susceptible to dry and hot conditions during summer months. Supplemental irrigation can result in dramatically increases in ryegrass yields.

Although perennial ryegrasses may not fit into every situation, there are opportunities for utilizing this species as a forage crop in Michigan. A higher level of management is required to get the maximum out of the crop. If producers are willing to go the extra step, they will be rewarded with more profits from their perennial ryegrass in the forage mix. In addition, we need to learn more about the adaptability of perennial ryegrasses in Michigan to determine better where it is adapted.

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