

RYE

COOPERATIVE EXTENSION SERVICE • THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES • TIFTON

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INTRODUCTION

Rye is an important crop in Georgia, with more than 300,000 acres planted each year. It is used as a cover crop and for winter grazing, erosion control and seed production. Rye is the most winter-hardy of the small grains and is used extensively for winter grazing because of its good early-season forage production. It can grow on some of our poorest soils but still responds well to good soils and management.

Rye grain yields are not as high as those for the other small grains, so it is not widely grown as a grain crop in Georgia, averaging just 22 bu/ac on 50,000 acres over the past several years. Only in areas of the world where climate and soil are too severe for other crops is it grown as a grain crop. Despite the history of low rye seed yields, however, steps can be taken to improve yields.

While not widely grown for grain, rye is the most popular winter annual grazing crop in Georgia. With proper management it can produce three to four months of high-quality grazing.

CULTURAL PRACTICES

Variety Selection

Select rye varieties according to how you intend to use the crop. The variety will not be important if you're planting it as a cover crop or to control erosion. In that case, getting good quality seed will be more important than your variety choice. Rye varieties are developed by both public and private breeding programs. Several different varieties are sold in Georgia. Some are pure selections while others may be blends of several types. Most were selected as forage types but may vary in their peak forage production. Varieties are tested every year for both forage and seed production, and the results of the tests are published in the Small Grain Performance Test Bulletin. Rye varieties differ in seed yield, forage production and seasonal distribution of forage production. Base your variety choice on your individual needs.

Don't use rye varieties that have not been tested in Georgia, as varieties from other parts of the country may not be adapted to Georgia conditions and may be highly susceptible to the diseases and insects. These varieties often have high vernalization requirements and will not

produce enough forage or good quality seed in Georgia.

Rye seed can be poor quality, so take care to find and plant high-quality seed. Planting certified seed will ensure varietal purity, freedom from noxious weeds and high germination. If you plant noncertified seed, it should be tested by an AOSA approved lab to ensure that enough will germinate. The Georgia Department of Agriculture provides a germination test for free. Contact your local county extension agent to obtain a prelabeled shipping package. You may also contact an office of the Georgia Department of Agriculture in Tifton, GA or Atlanta, GA.

Planting Date and Rate

Planting dates for rye will depend on how you will use it and where you will plant it (*Table 1*). Planting normally is done earlier for grazing than for grain production. It's best not to plant earlier than the recommended dates because conditions can be hostile for germination and growth. Hot, dry weather during the early fall can reduce germination resulting in poor stand establishment. Planting too early will encourage excessive growth and cause flowering to occur during potentially freezing weather. This will result in severe seed yield loss. Planting later than the recommended dates unnecessarily limits early grazing and lowers grain-yield potential.

Table 1. Recommended planting dates for rye forage and grain in Georgia.

Location	Grain	Grazing
Coastal Plain	November 7 - December 1	October 15
Piedmont	October 25 - November 15	September 15
Mountains, Limestone Valley	October 1 - October 20	September 1

Rye for grazing should be seeded at 2 to 2.5 bu/A. For grain production, seed at 1 to 1.5 bu/A.

Seedbed Preparation

Rye is often planted into a seedbed prepared only by disking the old crop residue. This is an acceptable way to prepare a seedbed, but recent research has shown that rye forage production will respond to some form of deep tillage. This

response has been observed in wheat for many years. No-till and disking produced significantly less rye and wheat forage than did chisel plowing, turning or paraplowing. A similar response for rye grain yield is likely. Favorable responses to deep tillage may be due to:

1. Improved soil aeration.
2. Better internal drainage (rye is very sensitive to wet soils).
3. Better root development.
4. Better accessibility of roots to essential soil nutrients.
5. Better disease control due to destruction of old crop residue.
6. More uniform emergence and growth.

To get the most production and best establishment, use a grain drill. Grain drills are more accurate at placing seed at the proper depth and population than broadcasting and disking. Seed placed too shallow may germinate in poor soil conditions and die due to freeze damage or lack of moisture. Seed placed too deep will not emerge. With grain drills it's easier to get uniform stands with seeding rates lower than for broadcast planting. If seed must be broadcast and disked in, increase the seeding rate 20 percent and set the disk to run shallow (< four inches deep) at 5-7 mph.

FERTILITY

Soil fertility is one of the most important factors in rye production. A fertility program consisting of soil sampling, timely fertilizing and liming can greatly improve yield and quality of rye forage and seed.

Soil test results are only as good as the technique used to get the sample. Sample each soil type separately, and sample the entire plow layer. Shallow samples may result in lower lime and fertilizer recommendations than are actually required. When overseeding into an established pasture, use a three to four-inch soil sample since this more closely approximates the fertilized root zone.

Rye can be used as a cover crop, grazed, cut for hay or straw, or harvested as grain; each use or combination of uses requires a different fertilizer strategy. Removing straw or double-cropping requires more changes in fertilizer management.

Nutrient uptake and removal also vary with use (Table 2).

Table 2. Nutrient uptake and removal by rye grain.

Nutrient	Uptake (above ground)	Removal (grain only)
Pounds Per Acre		
N	103	46
P ₂ O ₅	37	22
K ₂ O	112	14
Mg	16	NA
S	14	NA

Fertilizer recommendations are based on nutrients removed in the grain. When rye is used as a cover crop or for grazing, most nutrients remain in the field, whereas removing hay or straw containing large amounts of nutrients can quickly deplete soils.

Soil pH

Good yields depend on balanced nutrient and a soil pH from 5.8 to 6.5. This prevents problems with manganese and aluminum toxicity and will usually ensure enough calcium, magnesium and micro-nutrients are available. When lime is recommended, use dolomitic lime to supply magnesium. Incorporate lime throughout the plow layer before seeding on prepared seedbeds.

Nitrogen (N)

Nitrogen provides rapid growth and increases the protein content of rye forage and can dramatically affect grain yields. Proper rate and timing of N applications varies with the intended use. As with most crops, putting too much N on rye can hurt growth, yield and the environment.

Prepared Seedbeds - When you grow rye as a cover crop or for seed production, a total of 80 lbs N is sufficient. Apply 20-40 pounds of nitrogen per acre at planting or after seedlings emerge. In February, apply another 40-60 lbs N/A to stimulate seed production. For grazing, apply 40-60 lbs N/A at planting or after emergence to stimulate forage production in the fall. In early winter, another 60-80 pounds will produce forage for late winter and spring grazing. Use the highest

N rates where grazing pressure is heavy. If you mix rye and ryegrass for grazing, you can apply another 40-60 lbs N/A in late March or early April. A pure stand of rye may be grazed closely until early spring (about February 15 in the Coastal Plain, March 1 in the Piedmont and March 15 in North Georgia), then fertilized with 40-60 lbs N/A for a final surge of growth to produce grain, but this is not recommended for seed production. Too much fertilizer at this time will result in lodging and a poor yield of shriveled grain.

Overseeding Established Pastures - When you overseed rye into bermudagrass or bahiagrass pastures, N may stimulate growth of the perennial pasture grasses, so delay N applications until seedlings emerge. If you use legumes in a mixture with rye, apply only 20-40 lbs N/A to prevent shading out legumes. Spring-applied N should not be required if you get a good stand of legume. Using ryegrass in a mixture, you will get longer forage production if you apply another 40-60 lbs N/A in late March or early April.

N Sources - Nearly any available N fertilizer is suitable for rye. As temperatures warm, urea applied as a topdressing may lose nitrogen as ammonia gas. However, the potential for loss is small during late winter and early spring when temperatures are cool, rainfall is frequent and the rye canopy is well developed. To decrease gaseous losses of urea, apply when rain is expected within a few days.

Phosphorus and Potassium

Phosphorus (P) strongly affects early plant development, vegetative growth and grain maturity. Strong reaction with the soil keeps P from leaching, even on very sandy soils. Potassium (K) strengthens stalks and makes rye more disease resistant and winter hardy. Rye takes up the most K between tillering and boot stages. When held by soil exchange sites, K moves slowly through the soil. However, K may readily leach from the rooting zone in sandy soils where the depth to clay is greater than 16 inches.

To ensure enough P and K throughout the root zone, incorporate the recommended P and K fertilizers before fall planting. When a spring-planted crop will follow rye, you can apply P and K for both crops before fall planting on most soils. On deep sands where K may be subject to

leaching, split K applications between the fall and spring crops.

Secondary and Micronutrients

A good liming program supplies enough calcium and magnesium on most soils. In deep sands, additional magnesium may be required. When lime is not recommended and magnesium levels are low, apply 25 pounds per acre in a water-soluble form such as potassium-magnesium-sulfate.

Sulfur leaches readily in sandy soil, but accumulates in subsoil clay. If the depth to clay is greater than 16 inches, apply 10-15 pounds of sulfur per acre in the fertilizer mixture. You get the best results when sulfur is supplied with spring topdressing.

Unless Georgia soils are overlimed, micronutrient levels are adequate for rye production. Manganese may be deficient in poorly drained fields (usually gray to black sandy soils) when pH exceeds 6.2. Correct deficiencies with foliar applications of 1-2 lbs Mn/A. During the growing season, monitor plant nutrient status using plant analysis. Take samples of the upper leaves for analysis. If nutrients are deficient, corrective treatments will be recommended.

RYE FOR FORAGE

Rye is widely used in winter forage programs in Georgia. It may be planted alone or in combination with other small grains (wheat or oats), ryegrass or annual clovers (crimson or arrowleaf). Rye should provide grazing from mid-November until mid- to late-December and from early February to early April. Actual production varies from year to year, depending on the severity of the winter.

Rye matures earlier in spring than wheat or oats and is a good choice for cropland that will be planted to a summer crop.

Rye for forage should be planted early to make the growing season longer and yields higher. Plant during the first part of the recommended planting period for your area.

Well-managed rye stands can provide excellent grazing. Limited grazing can begin in the fall as soon as the plants are well established and are four to six inches high. Limited early

grazing will increase tillering and improve stand density. ***Do not overgraze in the fall.***

After rye is well established, manage the grazing pressure to keep the stubble three to five inches high. Avoid overgrazing during cold, wet weather when the crop is not growing. Overgrazing during midwinter can weaken stands and reduce spring growth particularly in harsh weather.

Rye grows fast in the spring. Stock pastures heavily during the spring. When pastures are undergrazed, the plants will start reproductive growth and forage quality will quickly decline. Appropriate grazing pressure will keep pastures more productive for a longer period of time.

WEED CONTROL

Weeds growing in rye fields can reduce both yield and quality. Winter annual weeds that cause problems in fall-planted rye include wild mustard/radish and annual ryegrass as well as the perennial weeds curly dock and wild garlic/onion. Rye producers have few tools in their arsenal for controlling weeds. The primary drawback is that the producer can't mechanically remove weeds by cultivation.

The only herbicides now registered for rye are 2,4-D, MCPA, bromoxynil and prosulfuron. All three are applied postemergence to both rye and weeds, primarily to control broadleaf weeds (*Table 3*). No herbicides are registered to control grass weeds in rye.

Production practices that can help reduce weed infestations in rye are:

1. Avoid fields with a history of problem weeds.
2. Prepare land so that no weeds survive to compete with the rye. Prepare land and allow weeds to emerge. Kill weeds with a burndown and notill plant into a stale bed.
3. If broadleaf herbicides are to be used, apply them as soon as the rye is at the correct growth stage and the weeds are still small. This will control the weeds without hurting the rye.
4. Do not tank-mix 2,4-D and nitrogen to apply to rye. This tank-mix can cause severe crop damage.

Table 3. Application timing of herbicides for fall-planted rye.

Herbicide	Growth Stage	Weeds
Bromoxynil	Emergence to boot stage	3- to 4-leaf maximum
2,4-D	4 tiller to joint	refer to label
MCPA	3-leaf to boot stage	small (rosette)
prosulfuron* (Peak) 57wg	3 leaf to 2 nd node	small

NOTE: Always read and follow manufacturer's label instructions when using crop protection chemicals.

*Peak: do not plant soybeans, peanut, cotton or tobacco within 10 moths after application.

INSECTS AND THEIR CONTROL IN RYE

Insects can severely damage rye if high populations go undetected. It is, however, common to produce rye without having to treat for insects. Recent infestations of armyworms and aphids on rye are indicative that nature is constantly changing and that controlling insects is becoming a more important component of the production system.

The insects that damage rye can cause injury at any time during the growing season. Insect populations in rye can change fast, so monitor rye fields weekly. With good survey techniques to identify pests, weekly field examinations can prevent significant losses from insects. Damage symptoms and economic thresholds for control of the insects that attack rye are listed in Table 4.

Aphids

Aphids can severely damage rye as they suck sap and transmit diseases such as barley yellow dwarf. Heavy populations on seedling rye in early fall can severely reduce the developing stand. Heavy infestations during the grain-fill stage can cause poorly developed, low-quality grain.

Several different aphids feed on rye. English grain aphid, the oat bird cherry aphid, the greenbug and the corn leaf aphid are the most common. A field key for identifying the aphids is found on page the following page. Of these, the English grain aphid is commonly found in the greatest numbers in Georgia.

English Grain Aphid - The English grain aphid is slightly larger than most other aphids found in the field. It is yellow with some shades fading from orange to brown. The most obvious and distinguishing feature of this aphid is the long black cornices and antennae: longer than on any other species found in rye.

English grain aphids will build to very high numbers on rye in early spring. As the heads begin to form, large colonies of aphids can be found feeding on the developing heads. Heavy feeding causes the grain to be lightweight and germinate poorly.

Oat Bird Cherry Aphid - The oat bird cherry aphid is a rather small, pale-green aphid with a reddish patch at the base of the cornices. The cornices are short and often have black tips. It is very unusual for this aphid to build to damaging populations. It has not been found to inject a toxic into the plant as do some other species. Most often, beneficial insects will reduce their numbers to subeconomic levels. If treatment is necessary, treat when rye begins to show visible injury symptoms from feeding.

Greenbug - The greenbug can be the most damaging aphid. It is about 1/16 inch long and light green with a darker stripe running down its back. The legs are green with black tips, and the cornices are also usually black. The black cornices and green stripe down the back are the distinguishing characteristics of this insect.

Greenbugs suck plant juices and inject a toxin into the plant during the process. The toxin causes more injury than the actual physical injury during feeding, causing the plants to wilt, turn yellow and often die. Often, yellow spots of wilting rye, called "greenbug spots," can be found in the field.

Corn Leaf Aphid - The corn leaf aphid is about the size of the greenbug, but is greenish-blue with a darker color pattern around the base of the cornices. The legs and cornices are short and black. The cornices are often broader than in other species.

It is not uncommon to find hundreds of these aphids feeding on rye in late fall. Usually, their populations are killed by frost or beneficial insects. Treatment for corn leaf aphid is seldom required.

Armyworms

Armyworms vary in size and color. Lengths range from 1/8 to 1 1/2 inches, depending on age. They are generally pale green to brown with dark stripes along the side and back. The fall armyworm, beet armyworm and yellow-striped armyworm damage rye in the fall. They move into rye, especially planted stands, as other summer crops mature. Larvae feed and destroy leaves of seedling plants - small larvae often produce clear areas like "window panes" on leaves. Cool weather usually slows down armyworm activity. The true armyworm attacks rye during the spring, causing damage during cool, wet springs. Rank and lodged areas of a field often are more severely damaged. Many parasites and diseases attack armyworms.

Grasshoppers

Grasshoppers damage a wide range of crops by feeding on leaves and fruiting structures. They usually are abundant in the fall during dry years, damaging rye often only in the field margins where they move into the field from fence rows. Damage is highly variable and sporadic, but earlier-planted rye is more likely to be attacked than that planted later. Usually a foliar insecticide applied around a field margin is sufficient for control.

Chinch Bugs

Adult chinch bugs are 1/6 to 1/5 inch long and are black with white wings. Wings are marked with a triangular black patch on the outer margins. Nymphs are brown to reddish with a transverse, pale band. Both nymph and adult chinch bugs feed on grasses, including all small grain crops, by sucking sap. Feeding can discolor and stunt plants, but populations in Georgia usually are not large enough to cause economic damage. The insect overwinters as an adult. Its entire life cycle takes about 40 days. Chinch bugs avoid damp, shaded areas and are usually found in thinner stands where sunlight reaches the soil. Their population may increase in grass crops such as corn and sorghum in adjacent fields or in double-cropped plants in the same field.

Hessian Fly

Hessian fly is generally not a problem on rye but can cause problems on rye planted in late August or early September. The Hessian fly

recently has become a major factor limiting wheat production throughout the southern United States. Wheat is the primary host of the Hessian fly, but it also will infest triticale, barley and rye. Hessian fly does not attack oats. It will develop on wild barley and several other grassy weeds, too, but the relative importance of these weeds as alternative hosts is not known.

Adult Hessian flies are small black flies about the size of a mosquito. Adults live about two days, during which they mate. Females lay about 200 eggs in the grooves of the upper side of the rye leaves. Eggs are orange-red, 1/32 inch long and hatch in three to five days. Young, reddish larvae move along a leaf groove to the leaf sheath and then move between the leaf sheath and stem where they begin to feed on the stem above the leaf base. Maggots become white after molting and appear greenish-white when fully grown. The molt into a resting (pupal) stage which is often referred to as the "flaxseed" stage because it resembles seeds of flax. The entire life cycle requires about 35 to 70 degrees. Newly hatched larvae are prone to drying while they are exposed on the leaf surface, but once they move to the stem base, they are protected from weather extremes.

Maggots suck sap and stunt tillers, presumably by injecting a toxin into the plant. Feeding by a single larva for several days can completely stunt the growth of a vegetative tiller. Stunted vegetative tillers are dark green, do not elongate or produce new leaves and usually die after the maggots pupate. Infested jointed stems are short and weakened at the joint where feeding occurs. Grain filling of infested stems is reduced, and damaged stems often lodge before harvest. The relationship between Hessian fly damage and yield loss, however, is not clearly defined.

The Hessian fly is a cool-season insect, but freezes hurt adults. The insect over-summeres as puparia (flaxseed) in stubble, with the number of generations per year governed largely by temperature. Generally, three to four generations occur in the Piedmont region of Georgia, with four to five generations in the Coastal Plain and a sixth possible in the lower Coastal Plain. Adults usually emerge from oversummered flaxseed in wheat stubble about September 1. Since wheat has not yet been planted, the first generation develops entirely in volunteer small grains and weed hosts. A second, and some-times a third,

generation occurs in late fall and winter. In the spring, one generation occurs in the Piedmont region and one or two in the Coastal Plain. The fall and first spring generations stunt and kill seedling plants and vegetative tillers. The spring generation infests jointed stems as or after heads emerge. Not all flies, however, emerge at the following generation. A small portion of each generation (about 5 percent) will remain dormant and emerge later; consequently, emerging flies may represent the offspring of several previous generations.

DISEASES

Seed and seedling blights - These diseases are usually the most economically damaging rye diseases in Georgia. They can cause serious stand reduction.

Seed and seedling blights most commonly occur when rye is planted in hot, dry soil. Planting too early is the most common situation associated with this group of diseases.

Seed may rot before or soon after germination, and seedlings may emerge but die suddenly. Young plants may appear to become established and then wilt and die. These seedlings will have light to dark brown lesions at the soil line and/or root rot. Plants may be infected at this time but not die until weeks later. These plants will usually have rotten roots.

Seed treatment with a recommended fungicide will control seed rot. However, the fungi that cause these diseases are also soil-borne. Seed treatments can significantly improve emergence and stands when seed pathogens are a problem. However, this is difficult to judge. Therefore, it is recommended that an approved seed treatment be used on all early planted rye. Seed treatment will not control seedling blight.

Leaf Rust - This disease is often seen on rye during warm, wet winters. However, it rarely causes economic damage. The fungus that causes rust on rye is similar to the fungi that cause leaf rust on other small grains, but they are not identical. Rust produces rusty, red pustules on the leaf. Rubbing a leaf with a finger or handkerchief will produce a rusty deposit on the finger or handkerchief.

Anthracnose - This disease is common but seldom causes serious losses in rye. Diseased

plants ripen prematurely, develop a bleached appearance, and are susceptible to lodging. The fruiting bodies which develop as the plant matures contain small black clustered spine structures which can be observed with a hand lens. This disease occurs over a broad range of environments and may be more severe where soils are low in phosphorus and potassium. No fungicides are recommended in Georgia for control.

Other diseases such as halo-blight and Helminthosporium spot blotch cause various foliage disorders during the growing season. Crop rotation as well as insect and weed control will help reduce incidence of the common diseases of rye in most cases. Foliar applied fungicides are generally not recommended.

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Table 4. Damage Symptoms and Economic Thresholds of Insect Pest of Rye.

Insect	Damage Symptoms	Treatment Threshold
Aphids	Suck plant sap and may cause yellowing and death of leaves. Reduce grain size when heads are infested.	WHEN TO TREAT FOR INSECTS ON SMALL GRAINS APHIDS: Inspect fields at 30-45 days after planting, full tiller, and heading. Yield-reducing transmission of Barley Yellow Dwarf virus can occur during first two periods; transmission at heading is too late to reduce yield. Aphid treatment thresholds are: Seedlings (3/row ft), 6-10 inch plants (6/row ft), Stem elongation (2 per stem), Flag leaf (5/flag), Heading (10 per head to include flag), Soft/Hard Dough stages (Do not treat). ARMYWORM (True armyworm): Usually late winter and spring at boot/head stage. Treat when larval numbers exceed 3 larvae per square foot. FALL, BEET, and YELLOWSTRIPED ARMYWORMS and CUTWORMS: Usually in fall on seedling plants. Treat when larval populations (any one or any combination) of these insects exceed 3 larvae (1/2 inch long or larger) per square foot. CHINCH BUG: Treat during the seedling stage when an average of 1 to 2 adults are found per 5 plants, on larger plants treat when 75 percent of the plants are infested. Chinch bugs are difficult to control in headed wheat. GREEN JUNE BEETLE LARVAE: Treat before planting if populations average 1 or more larvae per square yard. MITES: Treat when infestations are causing leaf discoloration in large areas of a field. GRASSHOPPERS, FLEA BEETLES: Treat when populations are causing excessive (greater than 50%) defoliation. HESSIAN FLY: Plant Hessian fly-resistant wheat varieties. Granular systemic insecticides applied in-furrow at planting are recommended for susceptible cultivars and for resistant cultivars planted continuously in the same field. Pre- and post-plant, broadcast applications of liquid sprays or granules usually are not effective. Systemic seed treatments such as Gaucho may need higher rates for effective suppression.
Hessian fly	Vegetative plants—stunted tiller dark green, tiller death; jointed stems—stunted, weakening of stem at point of feeding injury. Reduced grain size and weight. Infested stems may lodge before harvest.	
Chinch bugs	Suck plant sap, causing discoloration.	
True armyworms and cutworms	Primarily occur in spring from stem elongation to maturity; foliage chewed and awns clipped.	
Fall armyworm, beet armyworm and yellow-striped armyworm	Primarily occurs in the fall; small larvae cause “window pane” feeding on leaves; larger larvae consume leaves and entire plant.	
Grasshoppers	Destroy leaves of seedlings during fall. Damage common along field margins.	
Flea beetles	Destroy leaves of seedlings during fall. Damage common along field margins.	
Mites	Suck plant sap; cause leaf discoloration.	
Wheat stem maggot	Maggots tunnel into stem in the fall.	