

Rye Production and Utilization



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Rye (*Secale cereale*) is a cool season cereal grass. Both spring and winter types are grown in North Dakota, with the winter type planted on more acres.

Winter rye is the most winterhardy of cereal grains and is grown at the most northern latitudes. Winter rye, after germination, must be vernalized by a period of cool, near freezing temperatures in order to initiate head development.

Adaptation and Growth Characteristics

Rye is adapted to all sections of North Dakota. Currently, recommended winter rye varieties are more winterhardy than commonly grown winter wheats. Rye will usually make considerable growth during the cool temperatures of late fall and early spring. Late spring frost during flowering may occasionally result in reduced seed set.

Rye heads seldom fill completely. Rye florets are self sterile and cross pollination accounts for most of the seed set. Rye florets remain open for several days, and if conditions for cross-pollination are not favorable, florets will be empty.

North Dakota Rye Production

North Dakota winter rye averaged nearly 1.2 million acres annually from 1930 to 1942. During World War II, planted acreage decreased, reaching a low of 150,000 acres by 1945. During 1981-1990 an average of 124,000 acres have been planted annually.

Estimated state average yields during 1975-1984 were 31.8 bushels per acre for rye and 27.0 bushels for all wheat (North Dakota Agricultural Statistics). This data reflects

positively for the yield capacity of rye, considering that the crop is often grown on more weedy and less productive fields and in the lower yielding regions of the state. Production costs for rye are lower than for spring wheat due to reduced seed and herbicide costs. Even with a slightly higher average yield per acre, rye has produced less gross income than wheat because of lower market prices.

Winter Rye Varieties

Current available adapted varieties are described in Table 1. Only varieties with good or very good winterhardiness are recommended for production in North Dakota. Varieties with only fair winterhardiness should always be seeded into standing stubble or flax strips to provide snow cover. Recent variety performance is available in NDSU Extension Circular A-574 (North Dakota Small Grain and Flax Variety Performance) available from your local NDSU Extension Service office.

Spring Rye

Spring rye usually yields about 20 percent less than winter rye (Table 2). It should be sown early, similar to spring wheat or barley. Spring rye does not have the advantages of labor distribution, weed control and erosion control that fall-sown winter rye has, but can be used as a spring-sown crop. Gazelle is currently the only available variety. Kernels are medium sized and blue-green. Spring rye matures at about the same time as spring wheat.

Seed Quality

Even though rye is competitive with weeds, seed should be cleaned to remove weed seed and ergot sclerotia

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bodies and should be graded to uniform size before planting to assure uniform stands. Most ergot can be removed by using gravity tables and other modern seed cleaning equipment. Rye seed germination decreases more rapidly over time than other cereal seeds. Germination tests on both new and carryover seed are recommended.

Since rye is cross-pollinated, varieties can become mixed if not isolated from other varieties. To assure varietal purity, maintain seed purity by purchasing certified seed for which isolation is required.

Seeding Date and Rate

Seed winter rye during the first two weeks in September if soil moisture is sufficient for germination. Planting at this time period will maximize winter survival and provide good weed competition. **Do not seed winter rye in August.**

II The recommended seeding rate for winter rye is 60-75 pounds per acre. Higher seeding rates should be used for large-seeded varieties and late seeding. Spring rye should be sown in late April and early May. A seeding rate of 60-75 pounds per acre is often used.

Weed Control

II Winter rye is probably the most effective small grain crop for cultural weed control. Alternating intensive summer fallow with winter rye and repeated fall tillage after rye harvest over a period of three to five crop years is effective on a field infested with perennial noxious weeds such as leafy spurge or field bindweed. One season of fallow, followed by winter rye and cultivation after harvest, is effective in the control of other troublesome weeds such as perennial sowthistle, Canada thistle and wild oats. Sowing rye on fallow is the best available cultural control method for wild oats.

Herbicides are not always needed for rye production because rye is a strong competitor with weeds. Several studies have found significant weed suppression and control from growing different crops in rye residue. Considerable plant biomass production in the spring was shown as a competitive factor. Numerous studies indicate that rye interferes with the growth of other plants, including weeds. Some weeds that have been shown to exhibit reduced growth from rye residue include rye, wild oats, dandelion, crabgrass, common ragweed, common lambsquarters and redroot pigweed. Two chemicals, B-phenyllactic acid and B-hydroxybutyric acid, that are produced by rye have been shown to be responsible for inhibition of weed seed germination and weed growth. For

additional information on weed control using winter rye residue consult NDSU Extension Circular A-199, Weed Control With Winter Rye.

If herbicides are needed for control of other weeds, including tough to control perennials, there are only a few options. There are no herbicides registered for grass control in winter rye production, including wild oats and pigeongrass. For broadleaved weed control 2,4-D, MCPA, Buctril (bromoxynil), or Bronate (bromoxynil + MCPA ester) may be used. MCPA amine or MCPA L.V. ester are the only herbicides labeled for fall application.

Apply herbicides within the recommended growth stage indicated for winter wheat or spring wheat. Failure to do so will result in increased risk of crop injury.

For additional information and comments about weed control with herbicides consult the most recent issue of Circular W-253, Agricultural Weed Control Guide, offered through the NDSU Extension Service.

Field Selection

The purpose for which rye is grown is usually a deciding factor in field selection. Winter rye can be included in the regular crop rotation, may be grown due to a temporary shift in crop acreage, or can be grown for weed control proposes on a specific field.

Winter rye should not be grown on fields which will be sown later to winter wheat as shattered seed volunteers freely. In addition, rye will tend to increase in wheat because of its superior winterhardiness and greater seedling vigor. Wheat containing rye plus other foreign material in excess of 5 percent will be classed as sample grade.

II **Fallow Ground** - Rye yields best when sown on summer fallow. The combination of fallow and winter rye is very effective in weed control. Rye has a vigorous growth habit and provides good protection against wind and water erosion from seedling until harvest.

No-till - Winter rye is often sown into clean stubble fields. Rye stubble should be avoided. If a non-rye cereal grain stubble field is relatively free of weeds and if moisture supplies are favorable, satisfactory yields can be obtained. For most suitable stand establishment, no-till or minimum till drills should be used. Preplant herbicides should be used to destroy weeds and volunteer grain.

In some cases, cultivation of the stubble may be advisable to provide a suitable seedbed. Tillage implements which will leave as much standing stubble as possible should be used.

Table 1. Winter rye variety descriptions.

| Variety | Origin-Year | Height | Straw Strength | Maturity | Seed Color | Test Wt. | Winter Hardiness |
|-----------|-------------|--------|----------------|-----------|------------|----------|------------------|
| Dacold | ND-1989 | Med | Fair | Very Late | Blue-Green | Low | Very Good |
| Prima | Can.-1984 | Tall | Good | Med | Blue | Medium | Very Good |
| Frederick | SD-1984 | Tall | Fair | Late | Tan | High | Good |
| Musketeer | Can.1980 | Tall | Good | M. Early | Blue | Medium | Very Good |
| Rymin | MN-1973 | Tall | Very Good | Late | Green-Gray | High | Fair |
| Puma | Can.-1972 | Med | Good | Medium | Green | Medium | Very Good |

Table 2. Rye Variety Trials, Dickinson, 1983.

| Variety | Type | Average yield bu/acre | Test weight | Heading date |
|-----------|--------|-----------------------|-------------|--------------|
| Cougar | Winter | 56 | 55 | 6-7 |
| Musketeer | Winter | 74 | 56 | 6-6 |
| Puma | Winter | 68 | 55 | 6-6 |
| Gazelle | Spring | 46 | 55 | 6-26 |

Fall Plowing - Fall plowed fields ordinarily will be less satisfactory than either fallow or clean stubble for maximum rye production. Lack of reserve moisture can cause poor growth in fields that have produced a crop and been plowed. Fall plowing dries the soil, results in loose seedbeds, and provides less winter protection than stubble fields.

Corn Ground - Corn or other row crop stubble is a good place to seed rye. Some row crop herbicides with soil persistence will injure rye, and fields with herbicide carryover should be avoided.

Disease Control

In the severe stem rust epidemics on wheat and durum in the early 1950s, only occasional and very slight rust was observed on rye and no yield reduction was reported. Rye varieties currently recommended for this region have shown little development of stem or leaf rust. Races of leaf rust which attack rye are different from those which attack wheat.

Ergot can be a serious disease in rye, because it not only causes yield reductions but also can cause ergot poisoning of man and animals. Rye may be more subject to ergot than other cereals because it is cross-pollinated and often has many sterile florets. Ergot is characterized by large, dark purple to black sclerotia bodies of the causal fungus, which are found in the rye heads just prior to harvest. The fungus infects the florets and replaces the grain with the dark sclerotia. Many sclerotia fall to the ground before harvest and overwinter on the soil surface. These bodies then produce spores the following spring which can infect subsequent grain crops.

Ergot can cause a direct loss. Five percent yield reductions are common in rye. In the commercial grain trade, rye or wheat is classified "ergoty" when it contains more than 0.3 percent ergot sclerotia by weight. Thorough cleaning of the seed will remove many of the larger and more viable ergot bodies. Traces of ergot left in rye often prove toxic to livestock, possibly leading to reduced feed intake, reduced gains, gangrene, poor conception and abortions.

Ergot can be controlled in several ways. Included are: 1. Rotate to a non-cereal crop or summer fallow for at least one year; 2. plant only sclerotia-free seed; 3. bury sclerotia deep to reduce infection and 4. control wild grasses around the field to reduce the sources of infection. No commercial varieties of rye or other susceptible crops, such as barley and wheat, are resistant.

Seed treatment is a recommended practice for rye, just as it is for other small grains. Seed treatment with a

recommended fungicide can protect seedlings from blights and other root rot organisms and from striped smut. Treatment will not prevent ergot in rye.

Potential Rye Insect Problems

There have been very few reports of specific insect problems affecting the production of winter rye in North Dakota. Insects such as aphids, army worms, grasshoppers and wireworms could increase to economic levels in any area of the state when environmental conditions favor high survivability and development. These same insects can also damage other cereal grains.

Several insects that commonly utilize wheat as a primary host plant are also known to attack rye on occasion. These insects include the wheat stem sawfly, wheat stem maggot and Hessian fly. Rye is reported to be relatively resistant to wheat stem sawfly but may become infested during years of heavy sawfly populations. Only light infestations of Hessian fly have been observed on rye in North Dakota. Infestations of wheat stem maggot rarely exceed 1 or 2 percent in any small grain.

Fertilizing Rye

tt Limited studies conducted with rye in North Dakota suggest that rye responds similarly to wheat to fertilizer. Soil tests for both phosphate and nitrogen are the best guide on which to base fertilizer rates (Table 3). Phosphate fertilizer and up to 15 pounds of urea nitrogen can be applied with the seed using conventional drills. Additional liquid or dry nitrogen can be applied broadcast, or knifed in prior to seeding as anhydrous ammonia.

Rye For Livestock Feed

Pasture - Rye is a less palatable pasture crop than wheat, oats and most grasses but is grazed readily when other green foliage is not available. Winter rye makes rapid, early spring growth and often is available for grazing before other pasture, especially native grasses. For fall grazing, winter rye should be sown in August.

When rye is being grown for grain production, grazing should be limited as grain yield will be reduced. Fall grazing tends to delay crop maturity, increase winterkill and reduce grain yield.

Spring grazing is probably the best choice for winter rye fields to be harvested for grain in North Dakota. Rye should not be spring grazed until it is about 4 to 5 inches tall and livestock should be removed before the crop begins to joint. This technique permits 2 to 3 weeks of light spring grazing. Trampling by livestock in wet fields can injure rye stands. Spring grazing will likely reduce grain yields somewhat, but the value of the pasture may more than offset the grain yield reduction.

Spring rye can be grazed after reaching the jointing stage. High stocking rates are recommended in order to utilize this late spring pasture rapidly.

Hay and Silage - Poor rye stands are sometimes used for hay or silage, especially if they contain a mixture of wild oats. Mature rye hay is only of marginal quality. The awns are rough and stems are coarse. When using rye for hay, cut it in the late boot to very early heading stage. Rye is seldom used for silage. Best quality is obtained by ensiling just before the milk stage.

Table 3. Fertilizer recommendations for wheat, winter wheat and rye.

| Yield Goal | Soil N Plus Fertilizer N Suggested | Broadcast Recommendations | | | | | | | |
|-------------------|------------------------------------|---|-------|-------|---------|------------------------------------|---------|---------|----------|
| | | P Soil Test Level (lb/acre) | | | | K Soil Test Level (lb/acre) | | | |
| Wheat Durum & Rye | | VL | L | M | H | VL | L | M | H |
| bu/acre | lb/acre-2' depth | 0-9 | 10-19 | 20-29 | Over 30 | 0-99 | 100-199 | 200-299 | Over 300 |
| | | -----P ₂ O ₅ lb/acre----- | | | | -----K ₂ O lb/acre----- | | | |
| 30 | 75 | 25 | 20 | 10 | 0 | 65 | 40 | 15 | 0 |
| 40 | 100 | 35 | 25 | 10 | 0 | 90 | 55 | 15 | 0 |
| 50 | 125 | 45 | 30 | 15 | 0 | 110 | 65 | 20 | 0 |
| 60 | 150 | 55 | 35 | 20 | 0 | 135 | 80 | 25 | 0 |
| 70 | 175 | 60 | 40 | 20 | 0 | 155 | 90 | 30 | 0 |
| 80 | 200 | 70 | 50 | 25 | 0 | 180 | 105 | 35 | 0 |
| 90 | 225 | 80 | 60 | 30 | 0 | 200 | 115 | 40 | 0 |

Nitrogen = 2.5YG* - NST*
 Phosphorus = (1.033 - 0.029PST*)YG
 Potassium = (2.670 - 0.009KST*)YG

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*YG = Yield goal
 *NST = Nitrogen soil test (Nitrate-nitrogen)
 *PST = Phosphorus soil test (Olsen)
 *KST = Potassium soil test (Neutral Normal Ammonium Acetate)

Feeding Rye Grain - Rye grain is suitable feed for all classes of livestock. Rye has a strong flavor and is best utilized in grain mixtures. For best livestock performance and ration palatability, no more than 30 percent of the grain ration should consist of rye. Rye grain is similar to wheat in nutrient composition, but has a somewhat lower feeding value. Ergot levels as low as 0.04 percent have reduced gains and produced toxicity symptoms when fed to cattle. Ergot should be removed by mechanical screening if possible, when rye is fed to livestock.

Harvesting and Storage

Rye is usually swathed and combined but can be straight cut. Because it has a tendency to shatter, it should be swathed as soon as possible. Rye can be swathed as soon as the grain is in the hard dough stage and can no longer be crushed between thumb and finger. To reduce shatter loss when direct combining, begin harvest at about 22 percent moisture and follow by drying. Safe rye moisture levels are 13.0 percent for short-term and 12.0 percent for long-term storage.

Marketing Rye

Rye is used by both humans and livestock. Because of its unique flavor, humans use rye flour for bread, alcohol production and in specialty foods like breakfast cereals. U.S. No. 1 rye should have a minimum test weight of 56

pounds per bushel and should contain no more than 10 percent thin kernels. Rye which contains more than 0.3 percent ergot sclerotia shall be designated as special grade "ergoty." The presence of ergot is the most common deficiency of rye.

Summary

- Winter rye is the most effective grain crop for competing with weeds.
- It seldom rusts severely and allows distribution of labor and machine use on the farm.
- Seed Sept. 1-15 at 60-75 pounds per acre.
- Seed in August for fall grazing.
- Clean seed to remove weed seed, ergot, other crops and small seed.
- Seed only recommended varieties with good or very good winterhardiness.
- Fertilize according to soil test guidelines.
- When weeds are present, use appropriate labeled herbicides.
- Swath at hard dough stage to avoid shattering.
- Clean and treat bins with insecticides prior to storage.
- Store at safe moisture and temperature levels.
- Avoid close rotations with winter wheat.

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