Fall Rye

PRODUCTION

Alberta Government

Agdex 117/20-1

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Introduction to Fall Rye Production

Advantages of growing fall (winter) rye:

- Grows well on light, sandy, erosion-prone land although it does respond to better land and good fertility. It has good drought tolerance. It is frequently used after potato production to stabilize soils going into the winter.
- Straw decomposes more slowly than other cereal straw, further contributing to holding soil prone to erosion. Its extensive rooting system also contributes a large amount of organic matter.
- Fall rye is much less subject to winter kill than winter wheat, although winter damage can still occur, even in southern Alberta.
- Allows a spread in labor and machinery use since it reduces the spring workload and permits earlier grain harvest.
- Makes use of late summer, fall and early spring moisture that might be in short supply for spring-sown crops.
- One planting can be used for spring to fall grazing and early spring pasture, then left for grain harvest that summer. However, heavy grazing in summer and fall can result in winterkill and grain yield reduction with such a system. If the aim is grain yield, graze the rye lightly to prevent winterkill.
- As fall rye matures early, it may avoid late summer drought and fall frost.
- Weed control costs are reduced and often eliminated because of fall rye's excellent ability to compete with weeds as well as an allelopathic (inhibition of plant growth) effect on weed germination from rye residues.
- Fall rye out-yields spring-sown rye by about 35 per cent. Commercial yields of 50 to 60 bushels per acre have been reported under good management.
- Used as a green cover crop for weed control in organic crop production.
- Useful in breaking the disease cycle in the rotation.
- Spring-seeded fall rye is used extensively for summer and fall annual pasture.

Disadvantages of growing fall (winter) rye:

- Even though fall rye is hardier than winter wheat, its winter survival cannot be guaranteed.
- Fall rye grain has a limited market for feed or whiskey production and market price is usually low.
- It has a weedy nature. Volunteer fall rye will usually appear for two to three years after a crop has been grown.
- When heading out in June, fall rye can be susceptible to late spring frost, causing damage to the head and reduced yield. Rye yield can be severely reduced by drought stress at heading time, which occurs quite often in southern Alberta.
- Seed germination drops rapidly when fall rye is stored longer than a year.
- Very susceptible to **ergot**, which is very toxic to man and animal. Rye's susceptibility to ergot provides a high inoculum level for cereal crops that follow it, which can be expensive to separate out of the grain.

Adaptation

Fall rye is the most productive of the cereal grain crops under conditions of low temperature, low fertility and drought. However, rye does well when fertilized and on practically all soil types. Because of its fall establishment and cold tolerance, it can be used effectively to control wind erosion on light, sandy soils during fall, winter and early spring.

Fall rye is grown for seed mainly in southern Alberta and east central Alberta, but it can be grown more widely than winter wheat because of its greater winter hardiness. Fall rye production in Alberta averaged 37,000 acres between 2010 - 2014. Yield in this same period averaged 44 bu/ac. This total does not include the acreage of fall rye used for grazing, greenfeed and silage, which would triple the acreage seeded and are the major uses of this crop.

Fall rye can tolerate acid soils better than wheat, barley or canola (Table 1). However, it is not tolerant of saline, wet or poorly drained soils.

Table 1. Acidity Tolerance of Various Crops

	pH
Alfalfa, sugar beets	6.5
Barley, red clover	6.0
Canola, wheat, corn	5.5
Potatoes, rye	5.0
Cranberries, oats	4.5

Fall rye is used extensively for pasture and forage. In some cases, fall rye is left to produce a grain crop after providing pasture, thereby giving the farmer two crops from one planting. However, too heavy a grazing of fall rye in the fall or spring will severely reduce seed yield. See the section on *Using Fall Rye for Pasture, Hay and Silage* later in this publication or look at the Alberta Agriculture factsheet *Winter Cereals for Pasture, Agdex 133/20-1*.

Quality

Quality in grain and oilseed crops is related to the physical and biochemical status of the grain with respect to certain characteristics. These characteristics may be affected to a greater or lesser degree by the variety grown and the environment in which it is grown.

In Canada, the only quality factors applied to rye grain are those in the grading system, specifically test weight, degree of soundness, ergot levels and foreign materials. Quality as it relates to the end use of the rye grain, i.e. breadmaking, livestock feeding and distilling, is virtually undefined. Frequently, falling numbers in Canadian rye (a measure of bread making quality) are too poor for the baking industry. The distilling industry uses the standards of the grading system, and they require #2 C.W. or better.

Pasture, forage and feeding grain to livestock are discussed in subsequent sections of this publication.

Seeding Fall Rye

Seedbed preparation

Like other cereal crops, fall rye will respond to a properly prepared seedbed. A good seedbed should be weed, disease and insect free. It should provide good seed/soil contact and be moist and warm.

Since most fall rye is grown on light textured soils that are subject to wind erosion, pre-seeding tillage should be kept to a minimum. To aid in erosion control and to maximize snow trapping, use implements that will preserve the previous crop residue. Substituting herbicides for cultivation and seeding without pre-seeding tillage (minimum to zero till) are other practical considerations.

Highest yields of fall rye occur when it is planted on summerfallow; however, winter kill is more likely to occur. In areas subject to winter kill, seed fall rye into the standing stubble of a spring-seeded crop. The stubble helps trap insulating snow, protecting young plants from severe winter weather.

Under dry or firm soil conditions, seed with seeding implements that minimize soil disturbance, such as air drills with disc or narrow openers, to prevent soil drying. Growing rye repeatedly on the same land increases the chance of ergot infection and other diseases. A varied crop rotation with less susceptible crops (flax, canola, barley, oats, wheat etc.) is recommended.

Perennial weeds, especially downy brome and quack grass, must be controlled prior to seeding fall rye. Winter annuals are best controlled with a fall herbicide application. Spring annual weeds, including wild oats, are rarely a problem because of rye's strongly competitive nature.

Seed selection

Fall rye seed should be cleaned thoroughly to remove weed seeds, foreign material (including ergot) and cracked kernels. Ergot bodies must be removed to prevent re-infestation of fields. Using pedigreed seed ensures high quality.

There are no ergot resistant rye varieties. The only practical control is to sow clean, year-old seed on land that hasn't grown rye for at least a year. Mowing roadside and headland grass prior to seed set will reduce or eliminate this major source of ergot re-infestation.

Aside from open-pollinated varieties, new, hybrid fall rye varieties are also now available. The hybrid fall rye varieties provide a significant yield boost over conventional fall rye, with an increase in yield between 15 to 25 per cent, due to the hybrid vigour. Hybrid seed does not breed true, and new seed will have to be purchased every year. The hybrid varieties tend to be semi-dwarf and less susceptible to lodging. Also, the hybrid fall ryes have higher falling numbers, making them more suitable for milling into flour.

Variety selection may be aided by consulting the annual publication *Varieties of Cereal and Oilseed Crops for Alberta,* Agdex 100/32 the Alberta Agriculture web site variety section or by consulting the Alberta Seed Guide, published every February (also found on www.seed.ab.ca).

Fall rye grain may be used as seed the same fall in which it is harvested, provided ergot is not a problem, as after-ripening requirements are satisfied through the swathing, drying and harvesting period. Research has shown that fall rye had an 87 per cent emergence when swathed at 40 to 45 per cent moisture, allowed to dry for 8 days and then planted. The curing time between swathing and planting rye usually exceeds this eight-day interval.

All fall rye varieties should be treated with a systemic seed treatment to protect the seed and seedling from rots and smuts. Rye tends to be more susceptible to stem smut, seed and seedling rots than other cereals.

A dual systemic seed treatment (contains an insecticide as well as a systemic fungicide) should be used when planting rye on freshly broken land or when wireworms are known to be a problem. Effective seed treatments for wireworm are very limited. The only products that have any effect on them contain the active ingredient thiamethoxam. Research across western Canada has shown a yield increase from seed treatment on average, and under some conditions, seed treatment has doubled the yield.

Time of seeding

The optimum seeding dates for fall rye in southern and central Alberta are September 1 to 15. These dates regress to August 15 to September 1 if moving northward or to higher elevations. For fall pasture, the optimum seeding time is mid-August.

Seeding fall rye too early usually results in reduced grain yield and lower 1000 kernel weight. Later seeding usually results in a yield reduction, delayed heading, later maturity, reduced plant height and lower bushel weight. Seeding too late can result in poorer winter survival.

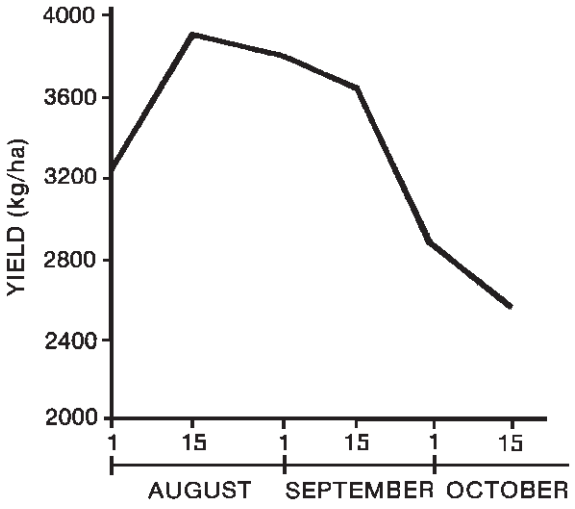

Figure 1*. Influence of seeding date on yield of rye produced on summer fallow (mean of five trials). Source: Crop Development Center, University of Saskatchewan, Saskatoon.*

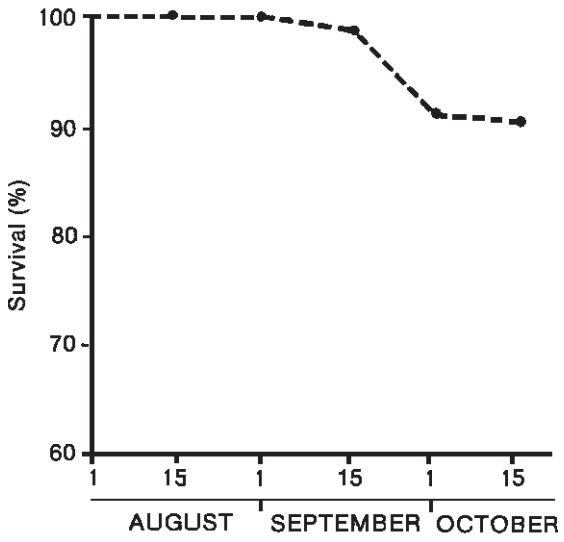

***Figure 2**. Influence of seeding date on per cent winter survival of rye grown in north-central Saskatchewan. Source: Crop Development Center, University of Saskatchewan, Saskatoon.*

Generally, it is necessary for the crop to grow 4 to 6 weeks before the onset of vernalization and cold hardening conditions (daytime temperatures below +10°C and decreasing day length). The top growth should be 3 to 4 inches high.

Do not delay planting because of grasshoppers. Grasshoppers feed mainly on the field margins. Delaying seeding may result in a better crop in these areas, but it may jeopardize the whole crop in an extremely cold winter when maximum cold hardening is needed. What is gained through reduced grasshopper damage is usually lost in reduced yields caused by less cold tolerance.

Rye will germinate at lower moisture levels than most cereals. Occasionally, surface moisture conditions may be unsuitable for germination around the recommended seeding date. Under such conditions, the problem is one of deciding whether or not to delay seeding. No definite answer can be offered to this problem, but most areas of the prairies do receive sufficient moisture during the month of September to germinate rye. It can't germinate unless it's in the ground ready to utilize the September rain.

In studies at Saskatoon, May and June seedings were almost invariably completely winter killed; July seedings were severely damaged. Seedings made in late August or early September came through the best and when the mid-afternoon soil temperature at seeding depth had cooled to about 18°C.

However, fall rye is commonly seeded in the spring for use as annual pasture in the summer and fall. For grazing purposes, spring-seeded fall rye will winterkill and provide little grain or grazing the follow spring.

Depth of seeding

Seed fall rye shallow, preferably 1 to 1.5 inches into a firm, moist seedbed. Research has shown that fall rye sown at a 1 inch depth had twice the emergence of that sown at 2 inches and that shallow-seeded fall rye had greater winter hardiness.

When shallow seeding, the previous crop's residue will have a greater tendency to interfere with good seed-to-soil contact. Even spreading of the previous crop residue is essential for quick emergence. Make sure seed-to-soil contact occurs. Packer wheels greatly enhance the establishment and winter hardening of the crop.

When seeding into untilled stubble fields, adequate drill penetration and furrow fill are often problems because of the dry, packed fall soil conditions. Hoe drills and minimum tillage drills provide the most positive penetration in this type of seedbed and give the best assurance of good seed-to-soil contact through furrow closure with packed soil. Soil moisture in stubble fields rarely improves with depth, so there is little to be gained by seeding deeper than the minimum required to give good coverage of the seed with packed soil.

When seeding on summerfallow, take extra care to obtain a firm seedbed to facilitate shallow seed placement into moist soil and to prevent soil erosion by wind.

Seeding rate

Fall rye intended as a grain crop should be sown at 55 to 60 lb/acre (1 bu/acre). Fall rye planted for late fall or early spring pasture may be sown at a heavier rate of 55 to 110 lb/acre (1.5 - 2 bu/acre).

The higher seeding rates are used for varieties with a larger kernel size, like Hazlet, and lower rates for smaller seeded varieties like Prima. The seeding rate varies not only with the seed size (grams per 1000 kernels) but with the germination percentage of the seed and general seedbed conditions. A target of 20 to 24 live healthy plants per square foot is adequate for maximum grain yield.

The following example shows how to calculate seeding rate in pounds per acre of fall rye with a 93 per cent germination rate, 33 grams per 1,000 kernel weight and a seedbed emergence mortality rate of 3 per cent. Target plant population is 20 plants per square foot.

Adjusting for germination (93%) and 3%

$$\text{mortality} = 20 \text{ plants} \times \frac{1}{\text{sq ft}} \times \frac{1}{(.93 - .03)} = 22 \text{ kernels}$$

need to be sown per square foot to get 20 live plants

Then:

$$22 \text{ kernels} \times \frac{33\text{g}}{1 \text{ sq ft}} \times \frac{1 \text{ lb*}}{1{,}000 \text{ kernels}} \times \frac{43{,}560 \text{ sq ft}}{454\text{g}} = \frac{70}{\text{ac}} \text{ lb/ac}$$

70 lb/ac is the seeding rate needed. The Alberta Agriculture web site calculator will do this for you; go to the website at *www.agriculture.alberta.ca* and search for *"seeding rate calculator."*

** l pound equals 454 grams.*

Fertilizing Fall Rye

Fertilizer should be applied according to soil test results. Fall rye responds well to adequate phosphorus and to higher levels of nitrogen when compared with hard red spring wheat.

In the absence of soil test results, consult the *Alberta Fertilizer Guide, Agdex 541-1*, for general information applicable to your area.

Place phosphorous with or near the seed at seeding time or band prior to seeding. Typical application rates with the seed range from 20 to 35 lb/ac of P_2O_5 to a maximum safe rate of 50 lb/ac. Nitrogen to a maximum of 25 lb N per acre of urea (46-0-0) can be placed with the seed, with good soil moisture. Higher rates than the above can lead to both salt burning of the seedlings and a thin plant stand, reducing potential yield.

The amount of nitrogen safely placed within the seed will vary depending on soil texture, amount of seedbed utilization and moisture conditions. See Alberta Agriculture's *frequently asked questions (FAQ) on seed-placed fertilizer* for more information. Just search on the term "Seed-placed Fertilizer: Frequently Asked Questions."

Higher amounts of nitrogen can be safely applied with the seed if it is a polymerized form of urea where the nitrogen is released over the period of several weeks.

If soil moisture is marginal for germination, high rates of fertilizer should not be placed with the seed. Both nitrogen and phosphorous can be banded prior to seeding, but take care to avoid loss of seedbed moisture and protective crop residue.

Nitrogen can also be broadcast in early spring when winter survival, spring conditions and crop outlook can be used to adjust the rate of nitrogen application. If applying spring nitrogen, you are limited to urea or ammonium sulfate. Nitrogen losses with broadcast urea can be high due to denitrification and/or volatilization if there is no moisture to take the fertilizer into the soil. If applying nitrogen by broadcasting, minimize losses to the atmosphere by applying just before a rainfall or use a urease inhibitor to slow down the denitrification process.

Possible disadvantages of spring application:

- weather conditions prevent timely application
- nitrogen may be trapped on the soil surface owing to lack of moisture
- requires valuable spring working time
- risk of nitrogen losses due to surface application increases as soil and air temperatures increase

Winter Plant Survival of Fall Rye

There is no magical number of live plants that determines whether one should leave a partially winter killed stand for grain production or not, as many production factors have to be considered.

For example, if the field is situated in a normally dry area of Alberta, one would tend to keep a stand with fewer live plants than if the field were in an area that traditionally had adequate spring moisture. In a dry area, by the time the remaining rye is removed from the field and the new crop is seeded, the seedbed would likely become so dry that very poor germination would result. Unless timely rains occur, the yield would be as poor, or worse, than if the light stand of fall rye were left.

Fall rye has a very good tillering ability, which helps compensate for wide variations in plant population densities. As a rough rule of thumb, in southern Alberta five to six live plants per square foot and seven to eight in central and northern Alberta are adequate to justify leaving the stand. The ideal plant population for both north and south is about 20 to 24 live plants per square foot. With the new, hybrid rye varieties, plant populations above the 16 to 18 plants per square foot provided no yield improvement.

To determine the number of live plants in the spring, wait one or two weeks after growth has begun, and then dig up a few plants and examine them for new root growth from the crown. The new roots are pure white and thicker than the roots formed the previous fall. If new spring root growth is present, even though the leaves are dead, the plant will recover. In some cases, new leaf growth from the crown will be seen but no new root growth. A plant in this condition will likely die as soon as it uses up the food reserve stored in the crown.

If an earlier spring determination of survival is desired, remove a few plants from the field on a warm day. Be careful to protect the plants removed if the air temperature is lower than the soil temperature at the time of removal. If the air temperature is below the plants' minimum survival temperature at that

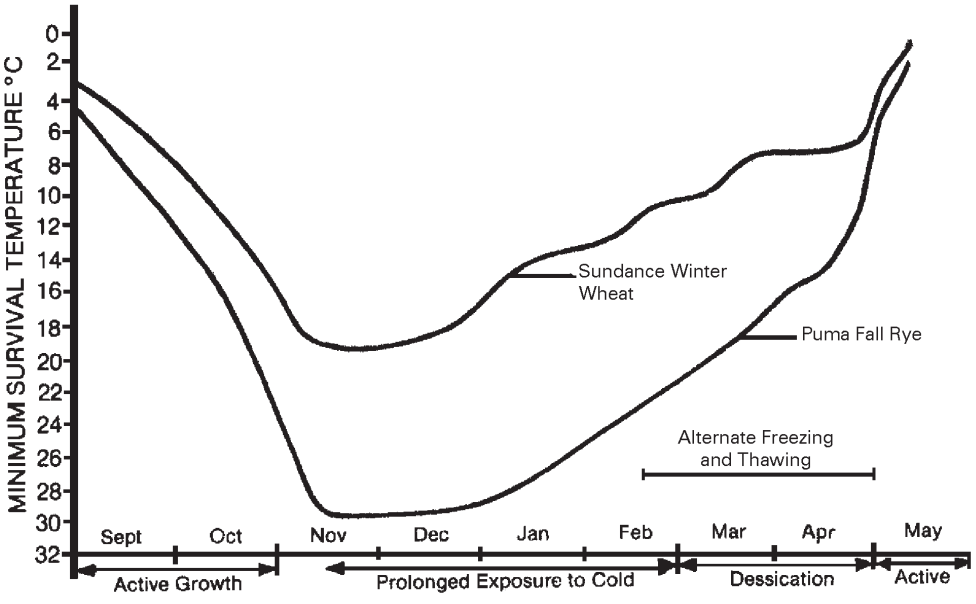

***Figure 3**. Changes in cold hardiness of winter wheat and rye for the period September to May. The primary factors responsible for these changes are shown at the bottom of the graph. Source: Crop Development Center, University of Saskatchewan, Saskatoon.*

particular stage of winter hardiness, the plants will die. This outcome would lead to a false conclusion as to the extent of crop injury.

Bring the excavated plants into a warm area of the house, place the crowns in a moist paper towel (or place in sand, soil, cloth, etc.), cover, and allow to grow. Make sure the paper towel does not dry out at any time.

Live plants can be identified in a few days by the presence of new white roots growing from the crown area.

If patchy winter survival occurs, the farmer must assess what amount of survival is acceptable, realizing that the areas winter killed will likely become troublesome weed patches. When only a few small scattered bare patches exist, some farmers suggest sowing fall rye or winter wheat in these patches as a weed control measure. The winter rye or wheat will stay in a low vegetative state allowing unhindered harvest operations. If many large patches occur, it may be more economical to seed these to spring rye, recognizing the inconvenient harvest situation created by having crops mature at different times.

If damage is extensive and a decision to reseed is made, the surviving fall rye plants should be removed as soon as possible to minimize loss of moisture, tie-up of soil nutrients and to facilitate early seeding of the spring crop. In addition, cultivation will minimize the chances of phytotoxic poisoning (plant-to-plant poisoning) of the new crop, which can occur with fall rye residues. Phytotoxic poisoning is also reduced by seeding immediately after destroying the winter crop and preparing the new seedbed.

Pest Control in Fall Rye

Weed control

Control of weeds in fall rye should be considered in the fall. Winter annuals can be controlled effectively with a 300 to 400 ml per acre application of 2,4-D amine 500 or an equivalent amount of the active ingredient of the esters. Leaving the winter annual weeds to the following spring allows them to become more tolerant and much more difficult to control.

Summer annual weeds, including wild oats, are not generally a problem in fall rye as it is a strong competitor. However, if stands are thinned through winter kill, herbicides can be applied as with spring cereals, but the time of application will be earlier in the spring and at the three-leaf to jointing stage. By early June, fall rye is generally in the shot-blade stage and is then susceptible to damage if treated with 2,4-D or related herbicides.

Fall rye should not be grazed in the fall or spring if maximum weed control and grain yield are desired.

For more detailed information on control of specific weeds, consult the latest edition of *Crop Protection, Agdex 606-1* (the Blue Book).

Insect control

Grasshoppers

Do not delay seeding because of grasshoppers. They are active when conditions favor plant growth, but become less active as cold hardening conditions set in. Grasshoppers usually feed on the margins of the field. Delaying seeding may prevent grasshopper damage on these margins, but the whole crop is now jeopardized by winter kill as a consequence of maximum cold hardening not being achieved. What is gained by reducing grasshopper damage is usually lost in reduced yield caused by lower cold tolerance.

Sevin, Cygon, ECO Bait, Lagon and Malathion are registered chemical insecticides for grasshopper control.

Aphids

Aphids very rarely require control in fall rye because they are fairly advanced in their life cycle when the rye emerges. Malathion is registered for aphid control in rye.

Sawfly

Wheat stem sawfly can infest fall rye, but never damages it significantly because the rye is almost mature by the time the insect population reaches harmful levels.

Wireworms

Since wireworms move deep in the soil in late August, they do little damage to the emerging crop. In the spring, fall rye growth is sufficiently advanced by the time wireworms become active so that the plants generally experience far less damage than occurs in later emerging spring wheat. Therefore, treating fall rye seed with an insecticide is of doubtful value. It is better to reduce the wireworm population by cropping an infested field with treated spring wheat or barley. However, when sowing land either known to be infested with wireworms or freshly broken, it is good insurance to treat the seed.

Cutworms

When seeding into fallow in years of high cutworm risk, consider delaying seeding until mid-September. The main cutworm egg laying period is from about early August until mid-September. Maintaining a crust over the land during this period will greatly reduce egg laying.

Cutworms may be controlled by spraying with Pounce insecticide on the rare occasion when spring cutworm damage is significant.

Diseases

Ergot

Ergot is a common and important disease of rye. Rye is particularly susceptible to ergot because it is mainly cross-pollinated, whereas wheat, barley and oats are mainly self-pollinated. Ergot is caused by a fungus (*Claviceps purpurea*) and can be identified by large, dark purple or black bodies called sclerotia (ergots), which develop in place of the rye kernels.

The loss in yield from ergot infection results from the replacement of normal kernels by ergot bodies and the fungal blighting of normal flowers, which fail to form seeds. Economic losses are caused by lower yield and grade received for the grain and the poisonous effect of the grain if fed to livestock.

Ergotism, the disease caused by the presence of alkaloids in the ergot bodies found in feed, can cause abortion. It is marked in the early stages by feed refusal, non-descript infections that resemble shipping fever or BVD. High levels of contamination cause irritation and pain in the extrementies (tail, ears, feet), the loss of hair from the ears and tail, and later, a dry gangrene sets in.

Alkaloids present in ergot have been detected in flour and cereals intended for human as well as animal feed. The old method of using a kernel count (any grain containing more than 0.1 per cent ergot or 1 ergot in 1,000 kernels) is not accurate to determine if the grain is dangerous to feed.

The Prairie Diagnostic Laboratory in Saskatoon is able to test for seven different alkaloids that can be present in ergot. Total ergot alkaloids above 200 parts per billion (ppb) can cause a reduction in animal performance (blood flow reduced in the milk vein of dairy cows, which reduces milk production). When total ergot alkaloid levels are known, it is a matter of reducing the amount of infected grain in the ration to keep alkaloid levels below the 200 ppb level.

The varieties of Prima and AC Remington have good resistance to ergot; other varieties are less resistant. Seed treatment does not prevent ergot.

To reduce ergot infestations, take the following measures:

- Use ergot-free seed if possible.
- Rotate with crops resistant to ergot, such as flax, canola and legumes.
- As the source of ergot infection is often the grass in headlands or ditches, mowing this grass before flowering or seed set will greatly reduce or eliminate the chances of ergot infection.
- Ergots germinate at or near the soil surface to produce infectious spores that attack cereal flowers. To prevent them from germinating, work the field to a depth greater than two inches to bury the ergot bodies.
- Seed at a uniform depth as shallow as possible for adequate moisture to obtain a uniform early emergence.
- Separate the seed collected from the first few combine rounds to prevent contamination of the entire lot as most of the ergot infested grain will likely be concentrated in this region.

- Often, infestations of ergot occur with cool, moist conditions during flowering.

Snow molds

Snow mold is caused by one of several fungi that attack the rye plant in the early spring starting about the time the snow begins to melt. The disease appears as a grey or pinkish web-like mold covering the leaves. Some of these fungi also produce small black bodies about the size of pinheads.

Infected areas normally appear as different sized patches scattered throughout the field. Often, only individual plants are attacked. This patchiness occurs because the disease organisms grow under very specific temperatures and moisture conditions; these occur for a long enough period only in individual parts of the field. If single plants are infected, yield losses should be light. If there are many dead patches, losses can be heavy. Yield losses are usually heaviest if there is deep snow that melts slowly, which occurs frequently in the parkland and in northern Alberta.

Snow mold fungi increase with frequent winter cereal cropping or perennial forage cropping. Never sow fall rye on a field that has just been taken out of a forage crop, because the risk of severe snow mold damage is great. Poor winter survival has often been blamed on the lack of cold temperature tolerance, when, in fact, the damage resulted from snow mold fungi. At present, no chemical control is recognized for snow mold in fall rye.

Ice encasement and drowning are two other common causes of patchy stands, sometimes falsely blamed on a lack of cold temperature tolerance. As result, fall rye should only be seeded on well drained fields that do not puddle or pond.

Stem smut

Certain varieties of fall rye are susceptible to stem smut; they are AC Remington, Dakota and Hazlet. AC Rifle, Musketeer and Prima are all rated as good for stem smut resistance. Stem smut can be controlled by treating the seed with a systemic seed dressing. At the present time, the only registered systemic seed dressing is carbathiin (Vitaflo 280).

Plants affected by stem smut can be detected as soon as the crop begins to head, but the disease does not become conspicuous until after the crop starts to ripen. As the name of the disease suggests, masses of black smut spores appear on the uppermost part of the stems. The disease extends into the heads, which also become blackened with smut spores and yield no grain. Heads of infected plants often fail to emerge from the boot and are usually bent or otherwise distorted. Infected stems are much shorter than healthy ones.

Seed decay and seeding blight

Rye is particularly susceptible to seed decay and seedling blight caused by various soil fungi.

Various seed treatments will provide protection from these pathogens and markedly increase seedling emergence and plant stands.

Rye is also susceptible to diseases common to other cereals such as common root rot, scald, fusarium blight, powdery mildew and leaf rust, but yield is usually much less affected. Rye severely infected with leaf rust may have higher nitrate levels, making feeding dangerous.

Harvesting and Storage of Fall Rye

Fall rye shatters very easily when ripe. For this reason, it should be swathed when the kernel moisture content is 40 to 45 per cent. Waiting for the crop to dry down for straight combining results in substantial shattering and a volunteer crop problem in following years.

Research results from the Agriculture and Agri-Food Canada station at Swift Current show that fall rye swathed with up to 47 per cent kernel moisture and allowed to field dry (7 - 9 days) suffered no quality loss and graded number one. However, artificial drying of rye grain resulted in downgrading when

it was harvested at a moisture content greater than 20 per cent and was further downgraded when harvest moisture levels exceeded 35 per cent. The main downgrading factors were green and immature kernels and low test weight. Therefore, fall rye can be swathed and allowed to field dry without quality loss, but should not be combined and artificially dried until the kernel moisture is below 20 per cent.

Resistance to sprouting is a problem in older rye varieties, and this issue can result in quality loss problems if wet weather occurs during harvest. Some of the newer varieties, such as AC Remington and AC Rifle, have better sprouting resistance.

Rye threshes very easily. Under dry threshing conditions care must be taken to adjust the concave setting and/or cylinder speed to minimize cracking. Care in picking up the swath is also necessary to avoid undue shattering.

Fall rye is ready to harvest before other cereals, including winter wheat and early seeded early maturing barley.

Rye at 14 per cent or lower kernel moisture is considered dry and safe for storage. At 13 per cent moisture, loss of condition due to molds or mites is unlikely. Normal storage bins used for cereal crops may be used to store fall rye.

Using Fall Rye for Pasture, Hay and Silage

Fall rye is a very versatile crop when it is used for forage. It can be used for pasture, hay or silage, but the majority of fall rye is seeded for summer, fall and spring grazing. It can be seeded throughout the spring or summer and utilized the year of seeding for pasture as well as the following year for pasture, silage or grain production, depending on grazing management.

Forage production of fall rye may not be as high as for some other cereals, but its ability to withstand grazing and the winter hardiness of the crop allow it to be used as a forage for more than one year in most areas of the province.

The current varieties of fall rye listed are all winter hardy and include Hazlet, Bono, Brasetto, Guttino and Prima. Hazlet and Prima are both open pollinated varieties and are best suited for grazing, while the others are hybrid varieties with higher yields best suited for grain production, primarily for milling or distilling.

Fall rye will produce best when grown on fertile, well drained soils of medium texture. However, when grown under less ideal conditions, such as soils with high acidity, low fertility or heavy and light textured soils, fall rye will generally outyield other commonly grown cereals.

When grown for pasture, fall rye should be seeded at 55 to 110 lb/acre (drier areas should use a lower seeding rate). The plant's ability to tiller profusely under good growing conditions makes this crop an effective pasture. It can be grazed once the roots are established and a good ground cover has developed through tillering. At this time, the plants should be 6 inches high. Fall rye can grow substantially under cool temperatures and is suitable for fall and early spring grazing.

The nutrient level of fall rye for pasture is excellent. Protein levels will vary with the amount of soil nitrogen and growing conditions, but a dry matter protein content of 18 to 23 per cent can be expected. Fibre levels are generally 25 to 30 per cent. At Brooks, (irrigated) spring seeded fall rye had a higher protein content throughout the summer than oats, barley or utility wheat. Fall rye sampled the end of October still had a protein content of 22.4 per cent. The fact that fall rye can maintain quality late in the season makes it a good late season pasture.

Fall seeding for pasture

Generally, fall rye is seeded August 1 to 15 for good fall grazing. This window for seeding allows the crop to become established, so it can provide quality pasture well into the fall. Few forage crops can match

the quality and production of fall rye in the fall. Avoid grazing so heavily that the ground is left bare; overgrazing will affect the next year's production and winter survival and may lead to erosion.

Fall seeded fall rye provides earlier spring grazing than other annual and most perennial pastures. Fall rye works well in pasture rotations for early grazing, until perennial pastures have enough top growth to graze. Fall rye is the most dependable winter cereal for winter survival. The key to spring grazing is to graze early and graze hard to prevent the fall rye from producing stems and seed.

Fall rye, if heavily grazed in the fall or spring, will yield less silage or grain the following year (Figure 4). The effect of fall or spring grazing on seed or silage yields depends on winter conditions, soil type, temperature, moisture levels and fertility.

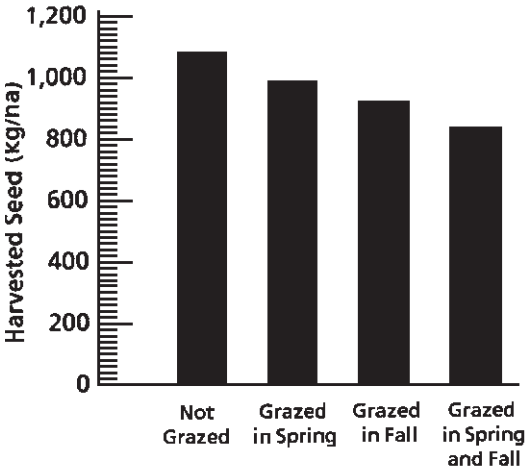

Figure 4*. An average effect of grazing on subsequent grain yields. Source: Agriculture Canada Research Station, Swift Current*

A decision must be made at seeding as to the desired use of the crop. To be safe, if the fall rye is to be used for silage or grain the following year, keep fall and spring grazings to a minimum. The later in the spring the crop is grazed, the more it will yield for pasture but the less for silage or grain (Table 1). Grazing a crop of fall rye as the tillers are approaching the boot stage will greatly affect grain yield. The plant at this time is beginning reproductive growth rather than vegetative growth.

Table 2. Spring grazing of Fall Rye, Brooks

Date of Clipping	Mean Clipping Yield kg/ha	Summer Hay (silage) Yield kg/ha	Grain Yield kg/ha
1st week May	1890	8930	3520
2nd week May	3160	7520	2720
3rd week May	5360	5410	1400
4th week May	6090	5370	1540
1st week June	6050	3310	1115
2nd week June	5560	4910	1830
Control	0	9010	3470

Source: Proceedings of Alternative Crops Conference, Lethbridge, Alberta. To convert kg/ha to lb/ac, multiply by 0.89.

Spring seeding for pasture

Fall rye seeded in the spring has the advantage of providing summer and fall pasture in the year of seeding as well as in the following year. Spring seeded fall rye works well as a rotational pasture. If grazed heavily with a long rest period between rotations, it will yield more than if it were grazed with a short rest rotation or continually grazed. It can be grazed every three to four weeks depending on fertility and rainfall.

Research at Swift Current has shown that daily gains in cattle are higher when the fall rye has been grazed less. What fall rye lacks in quantity of production is made up for in quality. Overgrazing at any time will severely reduce the regrowth ability and future production.

Early production of spring cereals is higher than spring seeded fall rye (Figure 5), but production of these crops declines rapidly in mid-summer. Adding 25 lb of oats or barley to the fall rye will increase the pasture yield early in the season and allow 7 to 10 days earlier grazing.

In trials at Brooks, average yields of fall rye in a simulated pasture rotation under irrigation yielded 3.2 tons/acre (dry matter) of forage. In Lacombe, a simulated pasture trial yielded 1.8 tons/acres (dry matter) of fall rye for forage. These yields may not be duplicated in the field since there will be yield losses caused by trampling. Soil fertility, soil type and rainfall will all have an effect on the yield.

Interseeding

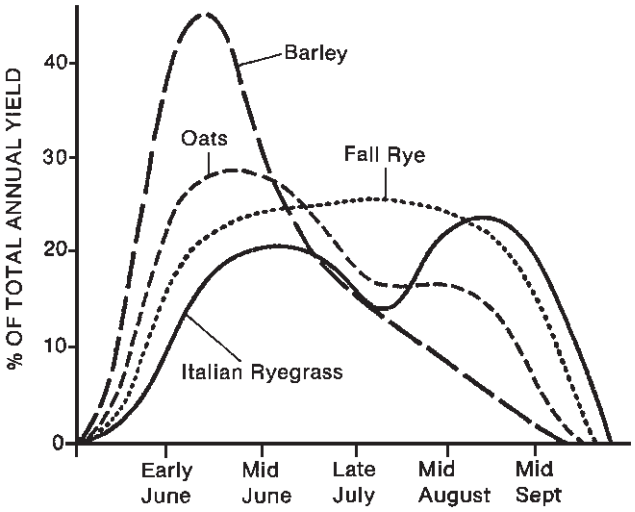

***Figure 5**. Typical seasonal distribution of pasture yield*.*

** Caution-lines do not represent actual yields but indicate typical growth pattern of the crops.*

Fall rye can be spring seeded with oats and or barley for silage or grain. Yields of these crops may be reduced by the competitive nature of fall rye. Crops for silage may be less affected since they are harvested early, and vegetative growth is less affected by competition than in grain formation. The reduction in yield is variable and depends on soil moisture, fertility and soil types.

The underseeded fall rye can be used for pasture after the spring crops have been harvested. The amount and quality of rye regrowth is good when used in this manner. If the silage or grain crop is more important than the fall rye for pasture, the fall rye seeding rates should be decreased by one quarter to one half the regular seeding rate. However, lowering the fall rye seeding rate will reduce the pasture yield.

The spring companion crop chosen will also affect the yield of fall rye for pasture. Oats are generally less competitive than barley and should be considered if the fall rye is important for pasture during the year of seeding. Oats may also have more regrowth than barley when the crop is grazed after harvest, although the competitive nature of the fall rye will greatly affect the regrowth of the other cereal.

The fall rye can be overwintered and used for pasture silage or grain the following year.

Fall rye and fall triticale exhibit greater resistance to diseases, such as barley yellow dwarf, than winter wheat when grown in this manner.

Double cropping

Fall rye has been seeded into freshly harvested grain stubble or cereal silage stubble and successfully utilized for fall pasture. If the fall rye is seeded directly into the stubble without cultivation, the stubble will hold the snow and provide better cover during the winter and may improve winter survival.

When following this double cropping procedure, select an early maturing spring sown variety to facilitate early seeding of the fall rye. Double cropping is generally only acceptable for pastures since there will be volunteer grain in the fall rye the following spring.

The success of double cropping depends on soil moisture and weed populations. It may also be advantageous to double crop soils susceptible to erosion.

Hay and silage

Fall rye for silage or green feed production is ready early in the season if it is not grazed in the spring. This approach allows the producer to spread out the silage season.

The harvest stage for fall rye as green feed or silage depends on feeding requirements. If intake and animal performance are critical, fall rye should be harvested at the flag leaf to flowering stage. Research[1] has shown that fall rye harvested during this stage will have feeding qualities similar to that of barley in

the soft dough stage. If harvest is delayed, fiber levels increase while palatability and intake decrease.

Feeding trials conducted at the University of Saskatchewan indicated that the intake of fall rye harvested at the soft dough stage was only 66 per cent of fall rye taken at the flower stage. This finding is substantiated by work done by Harshbarger et al in Illinois in 1956.

Of course, the earlier the crop is taken, the lower the yield. It may be more critical to take the crop early when making green feed as intake may be more restricted in dry feed than silage. Operators often notice this situation with oat green feed, which is usually more palatable than fall rye.

If the crop is allowed to become too mature, ergot bodies may be formed in the seed head. These ergot bodies may cause abortions in livestock if they are present in high enough concentrations. If ergot is a problem, the feed should be mixed or diluted with other feeds to reduce the concentration. Maximum allowable levels of ergot in grain for feed purposes is best provided by a test for alkaloid levels.

The quality of fall rye for silage is comparable to other cereals, whereas if it is cut for hay past the heading stage, it tends to be of lower quality, coarse and less palatable. When rye is cut late for silage or hay, protein content decreases and fibre content increases.

Yields of fall rye for silage or hay are generally lower than yields of oats or barley, but may be higher in areas or years where there is less rainfall and crops are stressed.

Fall rye is a winter cereal and has the advantage of utilizing good spring moisture; it resumes growth in the spring as the soil temperature permits. This feature makes fall rye an attractive crop for silage or hay on sandy soils or in drier areas of the province.

Grazing and feeding problems

Nitrate poisoning may be a problem when grazing or feeding fall rye silage or hay if the crop has been stressed by frost, drought, hail or plant diseases, which can cause a nitrate accumulation in the plant. This accumulation may become high enough to be toxic in livestock. The risk of nitrate poisoning will increase if the crop has been fertilized with high rates of nitrogen or planted on heavily manured fields. It should not be fertilized at rates higher than normal grain crops, unless the livestock are intensively managed.

Producers should be cautious if grazing or feeding fall rye that has been under severe stress. Livestock should be removed from the pasture or the silage or hay restricted until the feed has been analyzed. Nitrate levels in the feed over 0.35 per cent to 0.45 per cent are considered potentially toxic. This high nitrate feed may be mixed with safe feed to reduce the risk.

If nitrate levels are abnormally high in a pasture, take care to see that the fall rye is not the sole feedstuff. Animals can be fed grain or other high quality feeds prior to pasture exposure each day. Cattle grazing pastures with high nitrates can become somewhat acclimatized, over time, to moderate levels of nitrate in fall rye.

Grass tetany is another problem that may arise when grazing fall rye or other lush growing pastures, especially when heavily fertilized with nitrogen and potassium. This condition is caused by low levels of magnesium in the animal's blood. Even though the herbage may contain adequate levels of magnesium, absorption may be low if there is an imbalance of other minerals. Grass tetany may be a risk if the ratio of potassium (K) to calcium (Ca) and magnesium (Mg) in the herbage is greater than 2.2. Fertilizing pastures with magnesium or feeding magnesium may reduce the risk.

This condition can be recognized by nervousness and twitching by the animals; in the later stages, the animal may stagger, go down on its side and go into convulsions. If this problem arises, work closely with your veterinarian.

Having bales of hay or green feed out in the pasture when very lush conditions are present will reduce the risk of problems as well.

Overall, however, the adaptability, versatility and quality of fall rye make it an attractive crop to grow

[1] *Stefanyshyn-Cote, Barbara Ann, "The Effect of Maturity and Ensiling on the Nutritional Quality of Fall Rye {Secale Cereale L.} Forage" University of Saskatchewan, Saskatoon, 1993.*

for livestock forage. It allows the producer flexibility while maintaining a high quality forage program.

Feeding rye grain to livestock

Rye can be a highly nutritious, economical feed grain for livestock, but it has not always been popular with livestock producers or feed companies. Although some of their reasons for this discrimination are valid, most are unfounded. Admittedly, rye is less palatable to most livestock than other grains and is more susceptible to ergot. However, these conditions can be allowed for when setting up the feeding program or ration.

While it is important to be aware of the danger of ergot contamination, the concern should not be used as an excuse to condemn rye as feed. Most rye does not have enough ergot to be harmful, and when it does, it can be cleaned and/or diluted to safe levels.

Rye is similar to barley in its average nutritive content. It has about 12 per cent protein, 2.5 per cent fibre, 76 per cent total digestible nutrients (TDN) for cattle and 3,330 kcal/kg digestible energy for pigs. It has slightly less energy content than wheat or corn, but more than oats. Its protein content is lower than that of wheat. As with other cereals, rye's nutritive content varies with growing conditions.

Rye appears equal to or slightly superior to barley in livestock rations, but using it to replace wheat has resulted in lower performance.

In research trials, dairy rations containing 40 or 60 per cent rye were fully equal to barley rations with respect to daily consumption and milk production.

In trials with finishing steers, rations containing 60 per cent rye were equal to rations containing the same amounts of barley.

In Manitoba tests with beef steers, rye was successfully used to replace all the cereal, and beef steers gained 2.86 lb/day.

In trials with growing-finishing pigs, replacing up to 30 per cent of the barley with low-ergot rye did not significantly reduce performance. Pelleting rations containing rye helped to reduce the depression in average daily gains that occurred when higher levels of rye were fed. Rye is not recommended for piglets.

Studies at Kentville, Ontario, showed that rye can replace up to 10 per cent of the wheat in broiler-finisher diets with similar results. Higher levels reduced performance as wheat is higher in energy than rye. Diets for pullets, layers and breeder flocks can contain 10 to 20 per cent rye, but rye is not recommended for young chicks as it may cause watery droppings and pasty vents.

Although the evidence shows that rye is at least equal to barley in energy value when fed as part of the diet, animals often eat less when rye is the only grain, so performance suffers. This result is generally attributed to a lack of palatability. Animals do not like the taste of rye as much as other grains. This is not a serious problem in most cattle or sheep rations because rye is used as a concentrate along with other grains. Also, as beef cattle are often not fed for maximum grain intake, any effect on daily intake is not noticeable.

The palatability of rye is a greater problem with pigs and poultry. Rye should be analysed by a reputable feed laboratory and the ration formulated according to the results.