Agriculture Canada

Publication 805

reed canarygrass

a production guide

Cover photo: Reed canarygrass, with its distinct inflorescence, is a moisture-loving grass that will produce high yields of good-quality forage.

reed canarygrass

a production guide

S. Bittman
Research Station, Melfort, Sask.

J. Waddington
Research Station, Melfort, Sask.

B. E. Coulman
Dept. of Plant Science, Macdonald College
Ste Anne de Bellevue, P.Q.

S. G. Bonin
Research Station, Beaverlodge, Alta.

PUBLICATION 805/E, available from
Communications Branch, Agriculture Canada,
Ottawa K1A 0C7

Cat. No. A53-805/1988E
ISBN 0-662-16235-8

Également disponible en français sous le titre
Alpiste roseau – un guide de production.

QUESTIONS OFTEN ASKED BY FARMERS ABOUT REED CANARYGRASS

1) Where can I grow reed canarygrass?

You can grow reed canarygrass on areas subject to flooding, or with poor drainage due to a high water table or heavy soil. For seed production, land with a good moisture supply and good drainage is preferable (see Adaptation).

2) How does its yield and quality compare with other grasses?

Reed canarygrass may outyield other grasses under conditions of plentiful or excessive moisture supply and good to excellent soil fertility. Digestibility and protein content are dependent on early cutting and an adequate nitrogen supply, and usually compare well with other grasses (see Yield and quality potential).

3) Should I use it for hay, silage, or pasture?

You may use reed canarygrass for any of these, depending on your needs and facilities. Do not allow the grass to become overmature before harvesting it (see Hay and silage; Pasture).

4) How serious is the palatability problem on pasture?

The problem of palatability, although real, can be minimized with proper management (see Pasture; Alkaloids).

5) Should I grow reed canarygrass for seed?

Grow reed canarygrass for seed if you have the equipment to establish and maintain a stand in rows and are prepared to respond to a demanding harvest schedule (see Seed production).

CONTENTS

INTRODUCTION

Reed canarygrass (*Phalaris arundinacea* L.) is not a reed and is connected with canaries only through its cousin canarygrass (*Phalaris canariensis* L.), which is grown for bird seed. Reed canarygrass resembles reeds by growing tall and strong stemmed, usually in wet boggy areas around lakes and sloughs. However, unlike reeds, it is nutritious to livestock and therefore a very useful forage crop. Although reed canarygrass is common in wet areas throughout much of temperate Europe, Asia, and North America, the idea of cultivating it is relatively recent, coming just 200 years ago to Swedes and 100 years ago to North Americans.

Description

Reed canarygrass is a tall, coarse-looking grass, with strong culms often more than 2 m high bearing large, flat leaves up to 2 cm wide and 30 cm long. The grass, which is a long-lived perennial, spreads by thick underground stems called rhizomes, and eventually forms a tough, dense sod that is able to support a great deal of traffic even when wet. Rhizomes grow throughout the summer, developing from buds in the axils of scale leaves on old rhizomes. New shoots emerge from rhizome tips and axillary buds. Shoots emerging in spring survive just that season, whereas those emerging in fall generally persist into the next season.

Beginning growth early in spring, reed canarygrass heads out shortly after orchardgrass (*Dactylis glomerata* L.), but before either bromegrass (*Bromus inermis* Leyss.) or timothy (*Phleum pratense* L.). The elongated stem bears up to nine leaves and supports a spikelike panicle. The panicle spreads out during flowering to allow cross pollination, then contracts as seeds develop (Figs. 1, 9).

Seeds mature from the top of the panicle downward and drop off as soon as they ripen, making them difficult to harvest. Reed canarygrass seed is small (1.1 million/kg) and shiny, varying from light gray to black. Yellow seeds occur on some plants.

Because reed canarygrass needs to be vernalized to initiate flowers, regrowth after the first cut remains vegetative, leafy, and suitable for grazing.

Adaptation

Reed canarygrass grows naturally along the wet margins of streams and ponds across most of North America (Fig. 2). It is widely recognized for its ability to withstand flooding for prolonged periods (see Box I). The plants survive extended flooding because

FIGURE 1. Inflorescence of reed canarygrass during anthesis. The panicle has spread to facilitate cross pollination.

the roots can tolerate poor aeration in the soil. For the same reason the roots are able to penetrate heavy, compact soils better than roots of other grasses, resulting in superior production and drought tolerance in these conditions. Reed canarygrass also tolerates a wide range of soil pH (4.9–8.3), but does not withstand salinity.

FIGURE 2 Reed canarygrass grows naturally along wet margins of lakes and sloughs because it tolerates prolonged flooding.

Although reed canarygrass is normally winterhardy, poor snow cover or depleted root reserves, which may be caused by excessive harvesting or grazing, can lead to injury. Fast-growing young leaves may be discolored by either late spring or early fall frosts, but damage is usually not extensive or serious. However, late spring frosts occurring at the time of flowering or seed set may severely reduce yield and quality of seeds formed.

Seedlings of reed canarygrass, unlike established plants, grow sluggishly and do not tolerate flooding. In nature, the seeds mature early and drop readily to take advantage of low water levels in summer and thereby avoid the risk of flooding. The seeds either germinate immediately after falling if conditions are suitable, or become dormant until the next dry season. Under cultivation, seedlings must be protected from prolonged flooding and from weed competition.

Box I - Reed canarygrass finds a home in British Columbia . . .

Researchers at the Agriculture Canada Research Station, Kamloops, have found that reed canarygrass is ideally suited for replacing unproductive native vegetation on wet meadows in interior British Columbia (Fig. 3).

These meadows, which are scattered between Clinton to the south and Prince George to the north, are normally covered with sedges and rushes of low agricultural value. Reed canarygrass, when well fertilized, can yield up to 11 t/ha of good-quality hay. It can tolerate the high water table, extended spring flooding, and occasional drought better than other introduced species such as timothy and meadow foxtail (*Alopecurus pratensis* L.). It also forms a sturdy sod that can support traffic even when wet. Reed canarygrass, because of its unique qualities, will help tremendously in developing these areas.

. . . and on peat soils in Newfoundland

There are more than a million ha of peat soils in Newfoundland that can be drained and used for production of forages. Researchers at the Agriculture Canada Research Station, St. John's, have found reed canarygrass better adapted to these soils than timothy, orchardgrass, tall fescue (*Festuca arundinacea* (Schreb.)), or Kentucky bluegrass (*Poa pratensis* L.). Because these soils are low in pH and fertility, they must be heavily limed and fertilized with nitrogen, phosphorus, potassium, and trace elements. Yield and animal performance are somewhat lower than on mineral soils for reasons not entirely understood. Researchers are trying to solve these problems to enable better management of reed canarygrass and better use of the peatland resource.

FIGURE 3 Reed canarygrass makes excellent pasture in British Columbia and other humid areas in Canada.

Cultivars

Six cultivars of reed canarygrass are licensed in Canada. The four newest cultivars contain low levels of alkaloids.

Grove – Agriculture Canada, Ottawa, Ont.
- Licensed 1970
- Leafy, good regrowth, late maturing

Castor – Agriculture Canada, Beaverlodge, Alta.
- Licensed 1972
- High seed yield, good seed retention, early maturing

Vantage – Iowa State University, Ames, Iowa
- Licensed 1981
- Low in tryptamine alkaloids, good seed retention, early maturing

Rival – University of Manitoba, Winnipeg, Man.
- Licensed 1985
- Lower in total alkaloids than Vantage, good winter hardiness, high seed yield, early maturing

Palaton – Land O'lakes Inc., Webster City, Iowa
- Licensed 1986
- Lower in alkaloids than Rival and Vantage, with little or no tryptamine and carboline and low in gramine
- early maturing, yielding more than Rival but less than Grove or Vantage

FIGURE 4 Reed canarygrass yields plenty of good-quality hay. This field at Melfort, Sask., produced well over 3 t of first-cut hay per hectare.

Venture – Land O'lakes Inc., Webster City, Iowa
- Licensed 1987
- Lower in alkaloids than Vantage, with little or no tryptamine and carboline and low in gramine
- early maturing, yielding the same as Grove but less than Vantage, with good seed retention

Yield and quality potential

With proper management, good swards of reed canarygrass yield large amounts of good-quality hay (Fig. 4). In moist regions of Canada and on wet or heavy soils reed canarygrass often yields as much as or more than other species. Table 1 compares the productivity of this species with that of other grasses. The variability in the yield shows that we cannot accurately predict the most productive grass in all situations (Table 1).

The quality of grasses is determined generally by their leaf-to-stem ratio — leaves have most of the protein and minerals, whereas stems have most of the fibre. Partly due to its leafiness, reed canarygrass usually contains more protein and minerals (Ca, K, Zn, Mn, and Cu) than do either bromegrass or timothy. Its digestibility may be higher or lower than other grasses while its palatability is lower.

The quality of reed canarygrass depends on growing conditions and management factors such as fertility and time of cutting. Under favorable conditions reed canarygrass is about 55–60% digestible and contains about 12–15% protein. With insufficient fertility and late harvesting, quality can decline to 40% digestibility and 6% protein content.

MANAGEMENT

Establishment

On upland soils, establish reed canarygrass as you would any other forage grass that has small seed and sluggish seedlings.

Prepare a firm, smooth seedbed to reduce moisture loss from the surface, facilitate moisture movement to the seed, and enable uniform seeding depth.

Seed no deeper than 2 cm. Seeding too deep is a common cause of crop failure. A cultipacker seeder provides excellent depth control for seed placement. Press drills with depth control attachments are also satisfactory. In high rainfall areas, broadcasting, then harrowing lightly to cover the seed is also an effective seeding method.

For forage production, seed reed canarygrass at 6–9 kg/ha. Seed at the higher rate when the seedbed is rough and uneven, when seed is of lower germination, or when broadcasting, so that enough seed will find a suitable environment for germination. When seeding in rows on a good seedbed, the lower rate can be used. For seed production, seed in rows spaced 90 cm apart at 2 kg/ha.

Take full advantage of spring moisture by seeding before mid-June. Seeding later reduces forage yield and may eliminate seed production the next year, because juvenile plants will not vernalize over winter. Seedings delayed until after mid-August will require most of the next growing season to establish, except in moist and mild areas of Canada. Seeding in late fall to take advantage of early spring moisture may be successful provided that erosion is not a problem and germination does not start until spring.

Reed canarygrass is often grown on low-lying, wet fields. Unfortunately, establishing the grass in wet areas is more difficult because seedlings, unlike mature plants, do not tolerate prolonged flooding. In these fields, seed in midsummer just after the soil surface has dried. In some cases it may be necessary to wait for a dry year. It is important to avoid traffic on wet reed canarygrass sod until it is well established, perhaps 2–3 years after seeding.

Seeding may not be possible in sloughs that remain wet in summer or along streambanks prone to erosion. Establishment in

TABLE 1. Forage yield of reed canarygrass compared to other grasses
(See Appendix for sources)

Location	Reed canarygrass yield (t dry matter/ha)	Bromegrass	Timothy	Orchard-grass
Nappan, N.S.	8.5	+	+	+
O'leary, P.E.I.	12.9	-	-	
Urbainville, P.E.I.	12.2	+	+	
Lower St. Lawrence region, P.Q.	7.1	-	-	+
Saskatoon, Sask. (Irrigation)	7.6	-		
Swift Current, Sask. (Irrigation)				
Location 1	6.5	-		
Location 2	7.4	+		
Prince George, B.C.	4.1	-	-	+

+ Reed canarygrass yielded more.
- Reed canarygrass yielded less.

these areas can be accomplished by planting stem and rhizome sections, although this method is difficult. Take the stems and rhizomes from mature plants when the carbohydrates necessary for growth are greatest. Chop and spread the mature green stems and then disk them to a depth of 5-7 cm in wet soils to promote rooting at the nodes. Obtain rhizomes by plowing an established sod after harvest but before new growth reduces carbohydrate levels. Load the plowed sod on a manure spreader and spread at 30-40 t/ha. Double disk the area, then pack to smooth the surface.

Weed control

Because reed canarygrass seedlings develop slowly, new stands are susceptible to competition from weeds. Poor establishment results in thin, unproductive stands for at least 1-2 years.

However, a thin sward receiving ample fertilizer and timely cutting will gradually fill in and exclude most annual and many perennial weeds.

Establishment of annual weeds in the seedling stand can be reduced by cross-seeding a companion crop such as oats. However, the companion crop, although providing additional forage, will reduce reed canarygrass yields, particularly when moisture is lacking. Minimize competition from the companion crop by seeding at half the recommended rate and harvesting before the heading stage. Wheat offers less competition than oats but is often not adapted in areas seeded to reed canarygrass.

Many annual weeds can be controlled during the seedling year with little injury to reed canarygrass by mowing or judicious light grazing. Most broad-leaved weeds can be controlled by applying MCPA or 2,4-D at rates up to 0.6 kg/ha between the three-leaf and shot-blade stages of growth of the grass seedling. Most wild oat herbicides have severely damaged reed canarygrass seedlings, and cannot be recommended.

If weeds can be controlled during the seedling year, subsequent management to maintain a vigorous, productive stand of reed canarygrass will prevent most weeds from establishing or spreading (Fig. 5). Persistent broad-leaved perennial weeds such as Canada thistle can be controlled by an application of MCPA or 2,4-D at rates up to 2.2 kg/ha before the grass reaches the shot-blade stage of growth, or after harvest.

Where reed canarygrass is grown in rows for seed production, cultivation is the most effective way of controlling weeds. Patches of noxious weeds such as quack grass (*Agropyron repens* (L.) Beauv.) can be controlled with glyphosate, although this will also kill any reed canarygrass in the area sprayed.

Because successful weed control often depends on knowledge of local conditions, consult your provincial extension personnel for up-to-date recommendations.

Mixtures with legumes

It is difficult to maintain legumes in a stand with reed canarygrass for several reasons. First, reed canarygrass is usually grown on low, wet land on which few legumes can persist. Also, because reed canarygrass is competitive for water, nutrients, and light, it tends to choke out legumes. Furthermore, in pastures, livestock will selectively overgraze legumes because they are much more palatable.

Careful management will encourage legumes to persist. Ensure that soil pH is above 6.0 and provide phosphorus, potassium, sulfur, and micronutrients in quantities adequate for the legume. Inoculate the legume to promote nitrogen fixation and apply little

FIGURE 5 Although weeds may establish on bare patches, the tall vigorous growth of reed canarygrass provides strong competition and prevents them from spreading.

nitrogen fertilizer. Reduce shading of the legume by cutting early. Graze pastures in rotation to maintain both the legume and grass (see Pasture). Finally, when the legume has died out cultivate the stand but reseed only the legume. The reed canarygrass will reestablish from pieces of the old sod.

It is important to choose the legume best adapted to the soil conditions. On poorly drained soils seed either birdsfoot trefoil (*Lotus corniculatus* L.) or alsike clover (*Trifolium hybridum* L.) depending on which is better adapted in your area. On well-drained soils, grow alfalfa (*Medicago* spp.) wherever possible.

Rejuvenation

Vigorous stands of reed canarygrass are seldom affected by diseases, pests, or weeds. However, productivity of a stand often declines once a continuous sod has formed because the high density of plants and roots increases requirements for nutrients beyond the capacity of the soil to supply them. Productivity may also be reduced by winter injury or by mortality of legumes in a mixed stand.

It is usually possible to rejuvenate a stand, without reseeding, by shallow plowing or disking, then sowing with a legume and annual cereal. To reduce competition, harvest the cereal early for forage. Sufficient reed canarygrass usually survives this treatment to reestablish the stand.

Stands can also be rejuvenated by ample applications of fertilizer.

Fertilization

The yield and quality of reed canarygrass depend on the amount of available nutrients, *especially nitrogen*, in the soil (Fig. 6). In a test at Prince George, B.C. (see Table 2), nitrogen applied at 225 kg/ha to an established stand increased yields of dry matter by 300%, digestible dry matter by 270%, and crude protein by 350%. At a low rate (less than 50 kg/ha), nitrogen increases yield efficiently, but has little effect on quality. In contrast, a high rate of nitrogen (more than 150 kg/ha) promotes a higher concentration of crude protein but is less efficient in boosting yield. Although digestibility is unaffected by nitrogen, palatability of pastures is improved with moderate amounts (50–100 kg/ha) of nitrogen. However, high nitrogen levels may lower palatability by increasing nitrate and alkaloid concentrations in the plants (see Alkaloids). Nitrogen can be applied to established stands, without a soil test, at rates generally recommended for the area because there is usually little available nitrogen in soils under sod.

TABLE 2. Applying nitrogen fertilizer to increase yield of reed canarygrass*

	Nitrogen rate, kg/ha			
	0 (Yield kg/ha)	55 (Increase over zero rate, %)	110	225
Dry matter	2035	175	225	300
Digestible dry matter	930	170	205	270
Protein	260	165	210	350

*Based on Bonin, S. G., and D. C. Tomlin. 1968. Can. J. Plant Sci. 48:511-517.

Nitrogen applied at moderate rates in spring benefits the first crop in particular, because most of the fertilizer is absorbed. Heavy rates or split applications supply nitrogen to the aftermath growth. However, later in the season, as days get shorter and soil drier, growth response to fertilizer declines.

Before seeding reed canarygrass, test the pH and nutrient levels of the soils because these vary, depending on previous crop and soil type. Although reed canarygrass tolerates a wide range of pH (4.9-8.3), soils testing below 5.5 should be limed to increase availability of phosphorus, potassium, and several micronutrients. Incorporate fertilizer and lime before seeding to promote seedling development.

A vigorous stand of reed canarygrass takes up about 30 kg of phosphorus (P_2O_5), 150 kg of potassium (K_2O), and 10 kg of sulfur/ha each year. To compensate for this loss, these elements should be added according to soil test recommendations. Hay fields require more fertilizer than pastures because more nutrients are taken off (in 5 t of hay compared to 600 kg of beef, for example). Inspect your crop regularly for signs of nutrient deficiency. A yellow-green color usually indicates nitrogen deficiency (Fig. 6). Purple tinges on the leaves may indicate phosphorus deficiency. Browning of leaves beside the midrib may indicate potassium deficiency (Fig. 7).

The amount of fertilizer to be given to a crop is an important cost decision and should be based on these considerations:

- Cost of fertilizer
- Expected gain in yield and quality
- Value of feed and requirements for protein supplements for livestock
- Value of livestock products.

To safeguard the cash outlay on fertilizer it is important to graze or harvest and store the feed properly.

FIGURE 6 Reed canarygrass needs nitrogen to maintain productivity.

UTILIZATION

Hay and silage

Scheduling harvests. Scheduling harvests for hay or silage is an important management decision which affects yield and quality of the reed canarygrass crop as well as the persistence of the sward.

a) One harvest annually

Studies at several locations in Canada and the United States have shown that dry matter yield continues to increase through heading, flowering, and seed development stages (Fig. 8). However, yield of digestible dry matter and protein peaks at the heading stage, and declines slightly by the flowering stage and sharply by the mature seed stage. Although dry matter continues to accumulate, to obtain most nutrients from a field, there is no benefit in waiting beyond heading stage even when only one crop is taken.

b) Two harvests annually

Reed canarygrass matures early and recovers quickly: two cuts are generally possible. By properly scheduling the two harvests, workers at Prince George, B.C., increased productivity of dry matter

FIGURE 7 Potassium deficiency causes browning of leaves, especially alongside the midrib (see leaf at bottom).

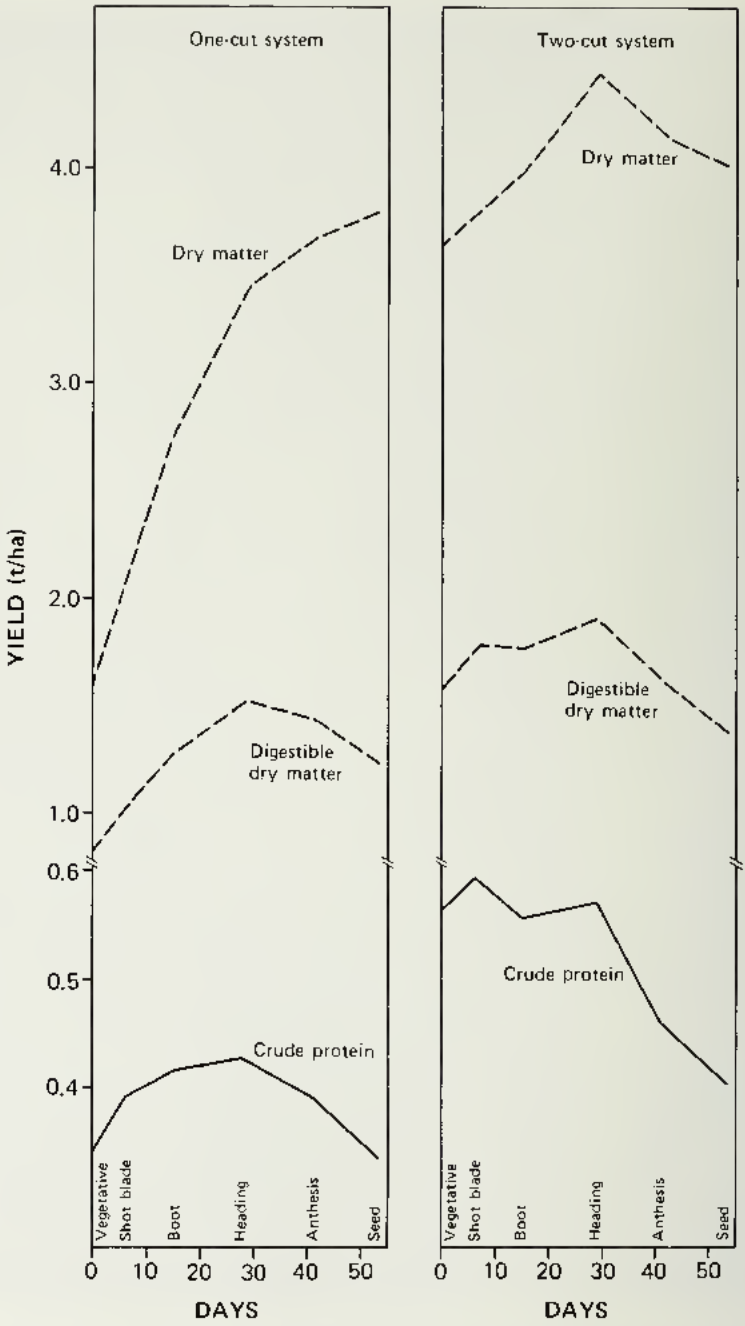

FIGURE 8 Stage of growth at harvest affects the yield of dry matter, digestible dry matter, and protein. (Permission to use this adaptation of the graph courtesy of Canadian Journal of Plant Science.)

by 29%, digestible dry matter by 25%, and protein by 34% over a single cut using the same amount of fertilizer (Fig. 8). Because the second cut is lush and leafy, it contributes a large amount of protein.

To get the most dry matter, digestible dry matter, and protein from a two-cut system, take the first cut at the heading stage (Fig. 8). If a large area is to be cut, start harvesting at the boot stage. Postponing the first cut not only causes the first crop to deteriorate (Table 3), but also delays regrowth. A late first cut results in a slight loss of total crop, but a severe loss of digestible dry matter and protein (Fig. 8). When fertilizer has been applied, a delay in cutting causes more serious loss of digestible dry matter and protein, and jeopardizes the investment in the fertilizer.

In the fall, let reed canarygrass grow for at least a few weeks before freeze-up, especially when heavily fertilized, to allow for rebuilding of root reserves. Plants with ample root reserves survive the winter better and grow more vigorously in spring.

Storage. Reed canarygrass is often grown in areas that have wet soils and frequent rainfall at the time when the grass should be harvested. Under these circumstances, direct-cut silage is the best way to conserve the crop. The heavy sod formed by a mature sward of reed canarygrass, even when wet, provides support for

TABLE 3. How quality of reed canarygrass is affected by stage of growth at first cut

Stage at first cut	One cut		Two cuts
	Digestibility %*	Crude** protein %	Crude** protein %
Vegetative	68	21	16
Shot blade		18	16
Boot	65	15	14
Heading	57	12	13
Anthesis	53	11	11
Seed	42	9	10

*Based on Pritchard, G. I., L. P. Folkins, and W. J. Pigden. 1963. Can. J. Plant Sci. 43:79-87.

**Based on Bonin, S. G., and D. C. Tomlin. 1968. Can. J. Plant Sci. 48:511-517.

harvesting machinery. Under less adverse conditions, reed canarygrass makes excellent hay, haylage (40–50% moisture), and wilted silage (50–60% moisture). Conserving reed canarygrass reduces its alkaloid concentration (see Alkaloids).

Aftermath growth of reed canarygrass remains vegetative and is of high quality, though often high in alkaloids. This regrowth can be grazed effectively, but should be cut and conserved if excessive alkaloids cause problems to grazing livestock.

Pasture

Properly managed and grazed reed canarygrass makes good pasture through much of the season and is often used on fields that are too wet to harvest. However, growth in spring is so vigorous that it is difficult to graze closely enough (less than 50 cm) to keep it from heading out. After heading, the grass becomes coarse, less digestible, less palatable, and stems will be totally refused by livestock. If this happens, remove the livestock to an alternate pasture and harvest surplus forage.

In contrast to rank spring growth, aftermath growth remains vegetative and highly amenable to grazing because the plants must be chilled (or vernalized) to initiate flowering. Regrowth may, however, be high in alkaloids (see Alkaloids). It is a good practice to take a cutting in spring and use the aftermath, after a rest period, for mid to late summer pasture. To maintain productivity, stands should always be rested several weeks in midsummer and should not be grazed or cut shorter than 6 cm. Avoid late fall grazing because reed canarygrass overwinters best if it enters the winter with some top growth.

Even at an early vegetative stage, when composed largely of leaves, reed canarygrass is less palatable than other cool-season grasses. If grazing animals have a choice of several grass species in a pasture, they will show preference for grasses such as timothy and bromegrass. It is important, therefore, to separate reed canarygrass from other grasses to avoid differential grazing. With a pure stand, palatability is not a problem and animals will eat only slightly less reed canarygrass than bromegrass or timothy. Although individual animals may not gain quite as well, more animals can usually be put on a reed canarygrass pasture and total animal gains on a hectare can be higher.

Alkaloids

The low palatability of reed canarygrass has been linked to high concentrations of potentially toxic compounds called alkaloids. Many symptoms have at times been reported for animals, par-

ticularly sheep, grazing reed canarygrass. These symptoms are digestive (diarrhea, high water consumption, and low feed intake) or general (rapid breathing under heat stress, watery eyes, ill-thrift appearance, and coarse dull coat).

Reaction to reed canarygrass is never serious and can be remedied simply by moving the livestock to another pasture. To reduce the risk of reaction, these precautions are helpful:

- Graze with cattle rather than sheep. Though cattle may be affected, they are less sensitive than sheep.
- Acclimatize animals before pasturing on lush growth. A few weeks on reed canarygrass hay before going on pasture helps the animals get used to this grass.
- Avoid high-alkaloid situations. Factors associated with high concentrations of alkaloids are heavy rates of nitrogen fertilizer; lush, leafy vegetation, particularly regrowth; and drought-stressed plants.
- Grow the new low-alkaloid varieties that are now available.
- Conserve the grass. Alkaloid levels are lower in hay and silage.

The new, low-alkaloid cultivars now available (see Box II) should help make reed canarygrass more palatable to livestock and more acceptable to farmers.

Box II–The mystery of poor palatability

Although reed canarygrass was known to be nutritious, farmers and agrologists found that grazing livestock would often reject it and gain poorly. After years of research, scientists at the University of Minnesota succeeded in showing that poor palatability and poor animal performance were directly related to the presence of nine chemical substances identified as alkaloids. These alkaloids are mild poisons produced by the plants to protect them from browsing.

A breakthrough came in 1971 when scientists at the University of Manitoba showed that most alkaloids could be eliminated by selective breeding. Since then, several low-alkaloid lines have been developed by researchers at the University of Manitoba and by public and private breeders in Iowa. Plant breeders are continuing to perfect new strains that combine high productivity with low concentrations of alkaloids.

Seed production

Seed of reed canarygrass can bring an excellent price; however, production is subject to several hazards and should not be attempted casually. Market for the seed is small and uncertain, while the seed rapidly loses viability in storage. Furthermore, because the seed shatters so rapidly after ripening it is difficult to harvest and yields are unreliable.

Although rarely more than half the crop will be harvested due to shattering, production under good management can reach 400–500 kg/ha. Management techniques depend on the type of equipment available but always require excellent judgment.

It is important to establish reed canarygrass for seed production on an area free from weeds. Grassy weeds, especially blue grasses, should be controlled because their seed is difficult to separate out. Chemical control or an extra year of fallow may be necessary to clean a field. Low wet areas, although suitable for forage production, should not be used for seed because they are difficult to clean out, are often infested with volunteer grasses, and encourage rank growth which makes harvesting more difficult.

Sow reed canarygrass in rows 90 cm apart at 2 kg/ha. Row cropping conserves soil moisture, enables efficient roguing, suppresses weeds effectively, and with adequate fertility prolongs the life of the stand. To till between rows, use a small row-crop tractor with adjustable wheels and a three-point hitch. The cultivator, mounted on the hitch, should consist of a tool bar with cultivator teeth spaced for working two or three rows at a time.

Begin cultivating in early spring to loosen the soil. To control weeds and volunteer grasses, cultivate again before the grass is too tall to drive through without damaging it. Cultivate also in midfall to uproot volunteer reed canarygrass and, finally, chisel in late fall to leave a rough soil surface to prevent crusting and caking and to encourage moisture entry into the soil.

If row cropping equipment is not available, plant rows 30–40 cm apart. These stands will produce more the first year, but will decline rapidly unless fertility is kept very high, moisture is ample, and the stand is scarified annually.

Reed canarygrass seeds ripen quickly from the top of the panicle downward. The top seeds drop before lower seeds have ripened (Fig. 9). The shatter-resistant cultivar Castor, released by Agriculture Canada (see Box III), yields more seed but even for this cultivar, timing of harvest is critical.

Seed may be harvested by swathing first or by direct combining. When using only a combine harvester, set the header as high as possible to avoid harvesting shorter volunteer grasses and processing excessive amounts of vegetation. To maximize the amount of

FIGURE 9 Reed canarygrass panicle bearing seed. Upper seeds dropped before lower seeds ripened.

ripe seed, start combining when the tips of the panicles have started to shatter. A delay of only 2-3 days due to poor weather can mean a near total loss of crop.

Swathing reduces the risk of shattering. Start swathing at the first sign of shattering in the field. To assure that the stubble supports the swath, cut diagonally across the field and set the cutting bar relatively low. Cutting too low picks up more weeds and increases the bulk of the swath, which then dries more slowly. Slow drying, though subjecting the grass to greater risk of poor weather, gives seed more chance to mature. Thus, judgment is required in deciding both date and height of swathing.

After harvesting, particularly direct combining, a substantial amount of forage remains standing. Harvest this for roughage or bedding immediately after combining, then top dress with 50 kg/ha of nitrogen to stimulate regrowth before winter. Do not remove the regrowth in the fall as this will depress yields the next year by depleting root reserve and inhibiting tiller initiation.

Immediately after combining, seed should be dried, preferably with forced warm air (less than 38°C) or by spreading thinly in a well-ventilated area and turning frequently. Swathed seed will generally be dryer than direct-combined seed. Improper or delayed drying reduces germination and grade. For top grade, 55% of seed must be viable.

Box III - Help, finally, for seed growers

Use of reed canarygrass has been restricted by shortage of seed. Farmers have been reluctant to grow the seed because it is difficult to harvest. First, seed ripens at the top of each panicle before lower seed has even filled. Second, ripe seed shatters very readily. At best it is difficult to pick up more than half the crop, but with a few days of untimely bad weather most of the remaining seed will be lost!

Scientists at the Agriculture Canada Research Station, Beaverlodge, Alta., have been searching for many years for strains of reed canarygrass that can hold their seed a little tighter. In 1972, efforts were rewarded when they released a new cultivar called Castor, which retains its seeds better than other cultivars. Tests across Canada have shown that seed harvests of Castor were 2-3 times greater than Frontier, the cultivar farmers most often use. Continued improvements in seed retention will help make seed more available and reed canarygrass more accepted by farmers.

Other uses

Reed canarygrass can be used to control erosion in gulleys and along streambanks because it tolerates flooding and stabilizes the soil with its rhizomes. For rapid establishment in these areas, plant sod or stem sections. Do not use reed canarygrass in irrigation canals because the lush growth will impede the flow of water.

Reed canarygrass growing in areas that are not dry until late summer can be harvested for good-quality bedding.

Reed canarygrass has not performed well for reclamation of wet mine sites that have high salinity. However, it has been used effectively for meadows irrigated with municipal sewage effluent because it can tolerate great amounts of moisture and fertility.

For information on growing reed canarygrass in sloughs, see Agric. Can. Publ. 1440 *Slough drainage and cropping*.

CONCLUSION

Reed canarygrass has proved extremely useful as a forage crop on poorly drained areas throughout Canada. It is even gaining acceptance as an alternate grass for well-drained sites in some regions. Acceptance by farmers will grow when low-alkaloid cultivars reach the market and as more seed becomes available due to better seed-retaining cultivars. As more is learned about managing and utilizing it, reed canarygrass will become a much more important cultivated forage species.

ACKNOWLEDGMENTS

This publication could not have been written without the help and cooperation of researchers across Canada. Special thanks are extended to Agriculture Canada scientists F. W. Calder (Nappan) for suggestions, A. L. van Ryswick (Kamloops) for photographs in Figs. 6 and 7, and L. M. Edwards (Potash Corporation of Sask.) for assistance.

APPENDIX

(Sources for Table 1)

LOCATION	REFERENCE
Nappan, N. S.	Langille, J. E. 1977. Canadex 127.
O'leary and Urbainville, P.E.I.	Coulson, N. N. Personal communication. Research Station, Charlottetown, P.E.I.
Lower St. Lawrence, P.Q.	St. Pierre, J. C. Personal communication. Research Station, Ste. Foy, P.Q.
Saskatoon, Sask.	Knowles, R. P., and L. G. Sonmor, Research Station, Saskatoon, Sask.
Swift Current, Sask. (Locations 1 and 2)	Lawrence, T., and R. Ashford. 1969. Can. J. Plant Sci. 49:321-332.
Prince George, B.C.	Tingle, J. N., and C. R. Elliott. 1975. Can. J. Plant Sci. 55:271-278.

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm^2)	x 0.15	square inch
square metre (m^2)	x 1.2	square yard
square kilometre (km^2)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm^3)	x 0.06	cubic inch
cubic metre (m^3)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2.5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre