Atlantic Forage Guide

The **Atlantic Forage Guide** was prepared by members of the Atlantic Forage and Corn Team to replace the forage portion of the **Atlantic Field Crops Guide**. Members include field crop extension and research representatives from Prince Edward Island, New Brunswick, AgraPoint, the Nova Scotia Agricultural College, the Crops and Livestock Research Centre of Agriculture and Agri-food Canada, and private sector employees who are involved in the promotion of forages in the region.

Atlantic Forage and Corn Team (AFACT)
Atlantic Canada

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INTRODUCTION

Forage production is an important component of livestock enterprises as high-quality feed must be available year-round. As no single forage species or mixture can supply the total requirements for livestock, a comprehensive plan is required for each particular livestock operation. Management plans must consider the type of livestock and the size of the operation, as well as factors of land type and availability, labour, storage methods, available capital, equipment, time of year the forage is required, and producer preferences. On most farms forage programs incorporate several perennial species for hay or silage, pasture, and zero-graze; annual species are also used occasionally. Forage crops must be managed as intensively as other high-yielding crops with consideration given to climate, soil, and end use of the forage. Management practices include variety selection, fertilization, pest control, time and frequency of cut, and appropriate fall rest period.

FORAGE ESTABLISHMENT

Perennial forage plants must develop sufficient size and root reserves to survive winter temperatures and regrow the following spring; only the most winterhardy grasses, such as timothy and bromegrass, can be planted in late August or early September. Legume/grass perennial mixtures are best established from late April to mid-May and should provide 2 to 3 t/ha of dry matter in the seeding year and have sufficient development to overwinter well.

Seedbed preparation

Small-seeded legumes and grasses require a fine, firm seedbed for uniform planting depth and good germination. Overworking the soil or using large tillage equipment may result in a loose seedbed that will need to be firmed sufficiently with a cultipacker-type seeder or roller before seeding. The seedbed can also be firmed by a land leveller or roller harrow. Working the soils too early when the soil is wet can lead to crusting, water logging, and poor emergence of legumes and grasses.

Inoculation of legumes

Legume seed must be inoculated with an appropriate *Rhizobium* inoculant before planting. Inoculants contain bacteria which form nodules on the roots of legumes to fix nitrogen from the

air. Pre-inoculated seed is available but it is important to check the expiry date. Commercially-available inoculants contain live bacteria and should be stored in a cool dark place. Check the expiry date on the packet before applying and follow the instructions carefully. Pre-inoculated seed that has been stored over winter should be re-inoculated to ensure that viable bacteria are on each seed at planting.

Coated seed

Coated seed is used in forage stands to improve seedling emergence and establishment. It may also be beneficial in reintroducing legumes into pastures or hay fields, particularly in situations where tillage is limited. Various combinations of inoculating bacteria, lime, nutrients, and bonding agents are used in the coatings. Although the effectiveness of inoculation can be improved by using coated seed, this is usually not necessary. Coated seed from previous years should be re-inoculated to ensure the presence of live bacteria in the year of seeding.

Because coated seeds are larger than uncoated ones, a kilogram of coated seed contains fewer seeds than a kilogram of uncoated seed; seeder settings may need to be adjusted accordingly.

Seeding method

Small forage seeds should be distributed uniformly and covered with 1 cm of soil. If the soil is extremely dry, a slightly deeper placement into moist soil is recommended. Either a drill or cultipacker seeder (e.g., Brillion) may be used. Cultipacker seeders place the seed uniformly in the upper 1 cm of soil and firm the seedbed immediately after planting. With many grain drills, seed tubes can be attached to the drill so that the seeds are placed directly behind the disc openers for shallow forage seed placement. It is recommended that the field be rolled following drilled seeding.

Direct seeding

New forage crops can be established without a companion or cover crop. Forage seeded without a companion crop will normally yield one cut in the first year; yield doubles in the first production year. Under good conditions, alfalfa planted in late April or early May can be harvested in July and once more before the recommended last harvest date. Adequate fertility,

especially phosphorous, is important for direct-seeded stands. If a grain drill is equipped with fertilizer boxes, forage establishment may be improved with banded phosphorous.

Underseeding/cover crops/companion crops

Underseeding forage with a cereal companion crop is a traditional practice for many farmers in the Atlantic region. When successful, underseeding can reduce erosion and limit weed growth. Harvesting cereal crops early for silage can improve forage seedling growth and establishment. With good weed control, the cereal companion crop can also be harvested for grain if the combining occurs early enough for the forage crop to develop properly before winter.

There is always the potential for cereal crops to out-compete forages for sunlight, nutrients, and water. As a result, grass and legume seedlings may die or not be vigorous enough to develop into strong stands. Competition from companion crops and the late removal of straw are two common reasons for poor forage stand establishment. Red clover, orchardgrass, and ryegrasses are better suited for underseeding than alfalfa and timothy.

WEED CONTROL

Weed control limits weed growth and invasion to allow efficient and profitable forage production. An efficient weed control program should reduce the weed population to a level that is not economically damaging; total weed eradication (non-noxious) is expensive and not necessary for forage production. The first step of a good weed control program is to identify the type and quantity of weeds present in the forage crop before harvest. Weeds should be classified as annuals or perennials and both grasses and broadleaf weeds should be included. The severity of infestation should be noted as being rare, scattered, occasional, common and/or abundant. This assessment should be done annually to evaluate the current weed control program and to make adjustments for the following year.

Types of control generally fall into four main categories: mechanical or physical, cultural or management, biological, and chemical. The main factors to consider when selecting a weed control program are the type of stand to be treated (seeded or established), weed type, and weed density.

Mechanical weed control

Mechanical weed control is most effective in newly-seeded forage stands. Fields are clipped in late June or early July to remove weed flowers and to allow the forage to grow. This practice controls many annual weeds but is not effective against perennial weeds, such as quackgrass or dandelion. Many perennial weeds can be controlled on a short-term basis by plowing, discing, and reseeding. For weeds with rhizomes, such as quackgrass, a chemical weed control method is more effective.

Cultural weed control

Cultural weed control concentrates on management practices that improve crop growth; a vigorous forage crop will be better able to out-compete weeds. Choose a well-adapted forage variety, lime and fertilize according to soil-test recommendations, plant as early as possible, and practise good grazing and cutting management.

Biological weed control

Biological weed control introduces specific diseases or insects to target a particular type of weed. Insects have been particularly effective; for example, the cinnabar moth was successfully introduced to control tansy ragwort. For more information on the cinnabar moth and other biological control programs, contact the Nova Scotia Agricultural College.

Chemical weed control

Chemical weed control methods involve the use of herbicides to inhibit weed growth. Herbicides are specific to weed type and should be applied only according to label specifications. The timing, method, and amount of the application depend on the stage of crop growth and weed development. Herbicides should be used in combination with other weed control methods and in conjunction with sound crop management practices. For more information, consult OMAFRA Publication 75, *Guide to Weed Control*.

FERTILIZING FORAGES

Forage crops require large applications of nutrients for high yields. When combined with good

crop management, the application of fertilizer and lime according to soil-test recommendations will maximize the economic yield of forage crops. To maintain productivity, a soil test should be taken every two to three years. If legumes make up 60% or more of the forage stand, a boron test should also be taken. Testing for low levels of soil micronutrients may also be appropriate. Liming the soil can reduce fertilizer costs and increase yields; forage yields almost double when appropriate fertilizer is applied to a soil with a pH of 6.2 as compared with an acidic soil with a pH of less than 5.4.

Fertilizing in the seeding year

Always apply lime and fertilizer according to soil-test recommendations. Limestone should be applied in the fall before seeding and worked into the soil to raise the pH to required levels. Forage species differ in their sensitivity to soil pH (Table 1). If your soil needs magnesium, use dolomitic limestone. The need for magnesium is dependent on soil calcium and potassium levels. Consult with your nutrient management planner.

Table 1. Sensitivity of forage species to soil acidity

Sensitive keep soil pH near 6.5	Low tolerance keep soil pH 6.0–6.5	Moderate tolerance keep soil pH above 5.8
Alfalfa	Kentucky bluegrass	Alsike clover
Smooth bromegrass	White clover	Birdsfoot trefoil
Sweet clover	Orchardgrass	Meadow fescue
	Red clover	Redtop
	Ryegrasses	Reed canarygrass
	Timothy	Tall fescue

General guidelines for fertilizing forages in the seeding year are provided in Table 2. Phosphorous is very important for good root development and seedling establishment. Starter nitrogen is required by all forage seedlings including legumes until they become nodulated and can fix their own nitrogen. Forage crops use more potassium than any other element. Potassium helps plants to resist disease, insects, and drought while improving cold hardiness and sugar transport.

Table 2. Recommended fertilization for forages in the seeding year (broadcast-seeded forage, sown alone or with companion cereals)

Time	Nutrients (kg/ha)			Example analysis	Application (kg/ha)
	N	P2O5	K2O		
Before seeding[z]	15–25	60–120	60–120	5-20-20	300–500
After clipping or 1st harvest					
Legume-dominant swards	0		90	0-0-60	150
Grass-dominant swards	35–55	15–20	35–55	18-6-18	200–300

[z]For band seeding, broadcast half of the fertilizer before seeding and apply the other half in a band. Use the higher application in fields that have been infrequently fertilized and/or limed.

Boron should be applied to legumes in the seeding year according to soil-test analysis. Excess boron can retard or even kill forage seedlings. For alfalfa crops, a soil test for boron should be taken every two to three years. Soil boron levels under 1 ppm indicate an application is needed. Forage crops may also be deficient in other micronutrients, including zinc (see *Crop Micronutrients in Atlantic Canada*, Publ. 537-86).

Manure is a good source of organic matter and nutrients and its use can substantially reduce the amount of commercial fertilizer required. For maximum benefits, manure should be applied before seeding in the spring and worked into the soil. See Table 3 for information on manure nutrient values.

Table 3. Average dry matter and nutrient concentration of manures on Nova Scotia farms

Manure type	Consistency	Dry matter (kg/t)	Total N (kg/t)	Ammonium N (kg/t)	P2O5 (kg/t)	K2O (kg/t)
Dairy	Liquid	88	3.1	1.5	1.6	3.4
	Semi-solid	157	4.4	1.8	2.5	4.7
	Solid	218	5.0	1.5	3.0	5.8
Beef	Semi-solid	126	2.7	0.8	1.2	3.8
	Solid	214	4.4	1.0	2.2	5.3
Swine	Liquid	53	2.5	1.7	1.9	1.1
	Semi-solid	152	5.3	2.4	5.0	2.2
	Solid	240	7.6	3.0	4.7	5.4
Poultry	Liquid	171	7.7	4.1	5.4	3.1
	Semi-solid	318	15.2	6.6	13.5	7.0
	Solid	706	33.9	8.4	25.1	15.9

Modified from Brenton and Mellish (1996).

Fertilizing established stands

Without adequate fertilization, forage stands will thin out and revert back to less productive native swards. A balanced fertility program is necessary to ensure the longevity of the tame species (see Table 4).

Table 4. Fertilization of established forage stands

Timing for typical stands	Nutrients (kg/ha) N	P2O5	K2O	Example analysis	Rate (kg/ha)
Harvest for silage or hay					
Over 60% legumes					
-Spring, growth starts	20	0–60	60	10-10-30	200
-After 2nd or 3rd cut	0	0	90–120	0-0-60	150–200
30–60% legumes					
-Spring, growth starts	50	0–60	0–100	21-6-18	250
-After cut 1	50	0	0	34-0-0	150
Over 70% grass					
-Spring, growth starts	75	0–60	0–100	21-6-18	350
-After cut 1	50–70	0	0	34-0-0	150–200
Pasture					
Over 60% legumes					
-Mid-June, late July, early Sept.	20	0–60	0–60	10-20-20	200
30–60% legumes					
-early spring, mid-June, late July, early Sept.	30	10	25	21-6-18	150
Over 70% grasses					
-Late April, early May	35–50	0–60	0–60	21-6-18	250
-mid-June, mid-August	35–40	0	0	34-0-0	100–125

To maintain hay and silage stands, follow these five recommendations:

- Fertilize annually with potassium according to soil-test recommendations.

- In the seeding year, make sure to apply sufficient amounts of phosphorus. A small amount is required annually for production years.

- Nitrogen is required for pure grass stands or mixtures that have less than 60% legumes. Apply fertilizer containing nitrogen in early spring and again after each cut. Several kinds of nitrogen fertilizer are available. A urea-based nitrogen fertilizer can be used for spring/first cut applications. Less volatile types of nitrogen fertilizer, such as those containing ammonium nitrate or calcium ammonium nitrate, are recommended when there is a high potential for loss by evaporation (late June to late August). Fertilizer should be applied at least four to five weeks before harvest to ensure that protein is properly converted by plants.

- When manure is applied, reduce chemical fertilization accordingly (Table 3).

- When older grass swards lose productivity, it may be more economical to reseed with a legume or legume/grass mixture than to continue with high applications of nitrogen.

Fertilizing pastures

Forages used for pasture have similar nutrient requirements as those grown for hay or silage. However, in well-managed pastures many nutrients can be supplied by grazing animals in the form of manure and urine. Commercial fertilizer can be used to stimulate early growth. A regular soil-testing schedule can monitor the nutrient levels of individual fields so that fertility applications are customized and cost-effective. Along with Table 4, the following points will help in developing your own individual fertility program.

- The timing of fertilizer applications, particularly nitrogen, can greatly influence pasture growth. An early spring application of nitrate fertilizer stimulates growth while soil temperatures are low and the soil bacteria that release and convert nitrogen to the nitrate form are not yet active. Intensively-managed pastures produce high yields, particularly early in the season; it is usually necessary to harvest some of the forage as hay or silage.

- For many grass pastures, a split application of nitrogen is more efficient and will result in better grass growth. Applications should be balanced to help protect the health of grazing animals.

- When grasses are heavily fertilized, especially with potassium in early spring, use dolomitic limestone to minimize the incidence of hypomagnesaemia (grass tetany) in grazing stock.

- If large amounts of potassium are required, splitting the application may help to prevent grass tetany by producing forage with a good balance of potassium and magnesium.

- In some cases, supplemental applications of phosphorus may be needed, especially to encourage white clover growth.

COMMON INSECT PESTS

European skipper

The European skipper is common throughout the Atlantic Provinces and heavy infestations can substantially reduce timothy yields. Adult butterflies are orange-brown in colour with a 3-cm wing spread. They tend to congregate in damp places and can be found in hayfields by

midsummer. The larvae are light green and the caterpillars can grow up to 2 cm in length. They feed off of timothy leaves, leaving the leaf margins irregularly notched. When larvae are abundant they can defoliate timothy and other grasses, including orchardgrass, perennial ryegrass, and meadow fescue. European skippers will also feed on leguminous plants when other food is scarce.

Fields should be checked for caterpillars in late May or early June, when leaves are first rolled into tubes. The field should be treated with insecticides if damage was extensive in the previous year or if there are 65 or more caterpillars per square meter. Early cutting can reduce the damage in some years and cutting hay before mid-June should help prevent pest build-up. In Prince Edward Island, a virus has been introduced to help control the European skipper.

Alfalfa blotch leafminer

Alfalfa blotch leafminer can be found in most alfalfa-growing areas. The adult leafminer is a small black fly which emerges in late May. It is best identified by the numerous pinhole punctures it makes in alfalfa leaflets when it feeds and lays eggs. The affected leaflets frequently shatter and the heavy pinhole damage causes necrosis in parts of the leaflets as well as nutritional loss. After the eggs hatch, the developing maggots or miners feed inside the leaflets, eating away the central part and creating mines or tunnels that terminate in blotches. The maggots then drop to the soil and pupate. The insect's life cycle is about a month; in the Atlantic region there are three generations per growing season.

Damage may be reduced in the first crop by early cutting but later cutting dates do not correspond to subsequent infestations. Introduced and native parasites of the leafminer have been successful at controlling this pest. Chemical control is not recommended.

Armyworm

Localized armyworm outbreaks can occur periodically in the Atlantic Provinces. Maintain a close watch in late June and July, especially in grass fields. Examine crops just before sunset when caterpillars are most visible. Control methods include cutting the crop immediately or applying pesticides. Read product labels carefully because chemical control methods can limit forage use.

COMMON DISEASES

All forage legumes and grasses grown in the Atlantic region are susceptible to disease. Disease prevalence depends on many factors, including the presence of sources of infection and favourable temperature and moisture conditions.

Legume diseases

Many diseases affect more than one forage legume crop. In the Atlantic region, root and crown rots, common leaf spot, black stem, downy mildew, powdery mildew, northern anthracnose, sooty blotch, clover phyllody, and nematode diseases have been identified in a variety of legumes.

Verticillium wilt of alfalfa has been identified throughout Atlantic Canada. Verticillium wilt is a serious disease because it can reduce alfalfa plant populations to the extent that forage quality and quantity is severely affected. Verticillium wilt is spread by sowing contaminated seed or by carrying infected plant parts from one field to another on harvesting equipment. Long-term control can be achieved by using alfalfa cultivars that show resistance to the effects of the verticillium organism. Highly-resistant cultivars recommended for use in the Atlantic Provinces are provided in the annual, *Forage Guide to Variety & Mixture Selection*.

Grass diseases

Common diseases that affect Atlantic forage crops include leaf rust brown stripe, eyespot, and brown spot. Each disease is caused by a different organism. Symptoms include decaying roots, spots on the stems and leaves, and leaves replacing flower petals.

Prevention is the best method of disease control; chemical control methods are seldom necessary. Good farm practices, such as using resistant or tolerant cultivars, crop rotation, and using early cutting management, will reduce the incidence of disease. In terms of farm management, delayed cutting is the factor most responsible in the build-up of disease.

CROP MANAGEMENT

Harvest management

Harvesting should be timed to maximize forage yield and quality while ensuring long-term stand survival.

Table 5. Average optimum dates for first cuts of forage grasses and legumes in production

Climatic zone	Very early Orchardgrass, bromegrass, Kentucky bluegrass, reed canary, and fescues	Early Most alfalfa, early timothy	Medium Later alfalfa, medium timothy, double-cut red clover	Late Late timothy, single-cut red clover, and birdsfoot trefoil
1	May 27–June 4	June 2–9	June 11–18	June 16–23
2	June 9–16	June 14–21	June 19–26	June 23–30
3	June 17–24	June 22–29	June 27–July 4	July 1–8
4	June 25–July 2	June 30–July 7	July 5–12	July 9–16
5	July 3	July 8	July 13	July 17

For optimal quality, harvest forage crops when the legume portion is at the bud-to-10%-bloom stage (Table 5). Cutting at this stage will allow for up to three harvests per season before September 1 in some Maritime locations. Although the three-cut system does provide higher quality feed, harvest costs are higher and stand longevity may be affected.

When the entire forage crop on a farm is planted to one crop or mixture, the crop must be cut within a week to ensure top-quality feed. Planting a range of species or cultivars can extend the harvesting period. Select legumes according to their maturity (see the annual Forage Guide to Variety & Mixture Selection) and match grass species and cultivars to the legume. When selecting legume and grass species, keep in mind the length of time it will take to harvest all the forages and consider the unique soil and climate conditions of each field.

It is important to minimize forage legume leaf loss during harvest because approximately 70% of the plant's total protein is found in the leaves. Three management methods that can reduce leaf loss are: cutting with mower-conditioners, tedding soon after cutting, and harvesting as silage. For hay crops high in legume content, leaf shattering can be reduced by raking at about 40% moisture content, baling at slightly higher moisture levels (i.e., 20–25% moisture), and using effective preservatives or barn dryers. To improve drying, windrow inverters can be used to move

and invert windrows of nearly-dry forage with little leaf loss.

Fall management

In the fall, legumes and grasses accumulate and store food, as starch, in their roots during a period known as the 'critical fall rest period'. High levels of reserves are needed for winter survival and spring growth. Cutting during the critical fall rest period can lower root reserves, weaken plants, and increase the chances of winterkill. To ensure stand longevity and vigorous spring growth, do not cut or graze perennial crops, including alfalfa, after the critical date recommended for your area. (Generally not after September 1st in the Atlantic Provinces.)

Pasture management

Proper grazing management is critical to optimize forage yields, maximize the longevity of improved species, and maintain sward quality. Short periods of heavy grazing (one to five days) should be followed by a recovery period. The length of time required for pasture regrowth will vary from year to year but as a rough estimate the recovery period needed in midsummer (approximately 35 days) will be twice as long as that required in May or June (approximately 12–15 days).

White clover and birdsfoot trefoil are particularly valuable feed components and pastures should be managed to ensure their long-term survival. Annual crops, such as kale, rape, stubble turnip, and ryegrass, can provide high-quality feed for grazing animals from mid to late season. When grazing these annual crops, livestock must have access to perennial pastures or hay to ensure adequate fibre intake, optimal health, and milk quality.

Although recently-seeded pastures with improved forage species respond best to applied fertility, the yield of older permanent pastures can also be improved with additions of lime, fertilizer, or manure.

Further information on pasture management and annual forage crops is available from local crop specialists.

Forages for soil improvement

To maintain soil fertility, crops should be rotated regularly on all farmland. Forages are an important crop to include in rotations because they improve soil structure, reduce soil erosion, break insect and disease cycles, and add organic matter to the soil. Legumes have the additional benefit of being able to fix soil nitrogen.

Alfalfa grown with a grass is a good rotation crop that can provide long-term productive forage with good soil drainage and a soil pH of 6.0 or greater. Red clover, usually mixed with timothy and meadow fescue, is another good break or rotation crop, especially on soils unsuitable for alfalfa production.

Italian and Westerwolds (annual) ryegrasses can control soil erosion, add organic matter, and improve soil structure. Annual ryegrasses are poor hosts for the root lesion nematode and are not hosts for clover and northern root knot nematodes; growing ryegrasses in rotation may alleviate these pest problems. Annual ryegrasses can also be direct seeded in the spring to provide pasture and/or silage. Italian type annual ryegrasses are best suited for pastures and ryegrass can be underseeded to cereal crops to provide a late-season pasture or cover crop. When silage is to be harvested, a Westerwolds ryegrass should be sown. For erosion control, annual ryegrasses can be sown up until early August, although dry soils may hinder seedling establishment.

Table 6. Root mass of grasses and legumes in the top 15 cm of soil in the seeding year, Charlottetown, PEI

Species	Cultivar	Dry root mass (t/ha)
Italian ryegrass	Lemtal	64
Italian ryegrass	Maris Ledger	64
Westerwolds ryegrass	Promenade	64
Westerwolds ryegrass	Aubade	34
Red clover		1.5–2.5
Alfalfa		1.5–2.5
Barley		1.0–1.5

PERENNIAL FORAGE SPECIES

Choosing a mixture

A good forage program begins with selecting the legume and grass species that are best suited to

local growing conditions. For the most recent variety and mixture recommendations, consult publication, *Forage Guide to Variety & Mixture Selection*. Simple mixtures, i.e., one legume species with one or two grass species, are often more productive than complex mixtures. In a complex mixture, the competitive strength of the species is often not related to forage yield, and competition from a low-yielding species can depress total stand yield. Mixtures with a high percentage of legumes are recommended only under optimum field conditions.

The legume species should be chosen first; legumes contain more protein than grasses and have the ability to improve the soil by fixing nitrogen. Including legumes in a rotation improves soil structure, increases organic matter, and provides nitrogen for subsequent crops. When selecting a legume species, consider its intended use and winterhardiness. The desired longevity of the stand should also be taken into consideration as well as soil drainage. Soil fertility and pH can be altered to accommodate the requirements for an individual species. From the list of recommended mixtures, select those grass cultivars that will best complement the legume species.

Red clover (*Trifolium pratense*)

Red clover is a biennial or short-lived perennial that yields well in the first production year. It is more tolerant than alfalfa to low soil pH and variable drainage conditions. Because red clover is difficult to make into hay (see Harvest Management), it is more easily managed as silage. Timothy is the best grass to mix with red clover for stored feed. Red clover is not recommended in pasture mixtures because it is short-lived and does not tolerate close and frequent grazing. Red clover should not be included in alfalfa/grass mixtures because the strong competition with alfalfa during the seeding year will result in thin alfalfa stands.

Double-cut and single-cut types of red clover are available. Double-cut red clover reaches the cutting stage about 10 days earlier than single-cut types and has a stronger, more vigorous regrowth. For growers looking to harvest one crop a season, single-cut red clover with a very late timothy (e.g., Farol) makes a suitable mixture for a delayed harvest in July; yield is high and quality is good. Red clover also makes an excellent plough-down or green manure crop. In a good year, direct seeding of red clover can produce a four tonne/hectare hay crop in late July and a further two tonnes each of top growth and roots by late fall.

Alfalfa (*Medicago sativa*)

Alfalfa is a high-yielding forage legume that produces nutritious feed. This legume should be grown in protected fields with good drainage. Soils should be high in nutrients with a pH of 6.3 or greater. For best results, use seeds that have been treated with an inoculant that is specific to alfalfa.

Alfalfa should be grown in a grass mixture. Including a grass in an alfalfa stand can reduce heaving, icing, and lodging while slowing weed encroachment. A companion grass can also ensure some forage production even in years of severe winterkill. Under good field conditions, alfalfa will persist for two to five years. In most areas, alfalfa performs better with two harvests a year than with three.

White clover (*Trifolium repens*)

White clover is primarily a pasture species. It is the most important pasture legume in Atlantic Canada, supplying significant amounts of palatable nutritious grazing. Due to its low growth habit and persistence under grazing, white clover is often included in pasture mixtures with orchardgrass, fescues, perennial ryegrass, timothy, or reed canarygrass.

White clover is classified into three types based on leaf size. Small-leaved types are often found in old pastures and are referred to as ‘wild’ or naturalized clovers. Forage production is limited due to the smaller plant size but these types persist well even under continuous grazing.

Cultivars such as Sonja and Milkanova have medium-sized leaves. Intermediate types of white clover are often included in improved pasture mixtures because they show superior forage production and nitrogen fixation, especially compared with ‘wild’ types. The third type of white clover, known as Ladino clovers, has large leaves. Although more productive, Ladino clovers tend to be less persistent than the wild and intermediate types. They are recommended for use in haylage mixtures, particularly on soils with variable drainage. This legume is difficult to wilt properly for hay.

Sound management is key for maintaining white clover production in pastures. Maintain fertile soil conditions, graze pasture swards to a height of 6–8 cm, and ensure adequate recovery after

grazing.

Birdsfoot trefoil (*Lotus corniculatus*)

Trefoil-based mixtures can be used for pasture, stored feed, or green chop. Trefoil is well adapted to pasturing as it does not cause bloat and is a good legume for fields that are difficult to plow and reseed. Under proper management, this species has a long lifespan. Trefoil should not be grazed in the spring until the sward reaches a height of 25 to 30 cm. For best results, use rotational grazing and prevent the animals from grazing the stand too low. Trefoil requires the same fall rest period as alfalfa; yields will be reduced if trefoil is harvested or grazed during the critical fall harvest period. As a stored feed, trefoil matures later than other legumes and maintains good feed value.

Generally, trefoil is slow to establish and maintain. Trefoil is best direct seeded and does not tolerate shading at the seedling stage. Seeds should be inoculated with the correct *Rhizobium* bacteria to ensure vigorous growth. If trefoil is underseeded to cereals, the cereal should be seeded at no more than 50 kg/ha and removed early as green chop. Birdsfoot trefoil does not compete vigorously against grasses and weeds, nor does it persist well under intensive grazing. When successfully established, however, trefoil often outperforms other legumes in fields with low fertility and poor drainage.

Alsike clover (*Trifolium hybridum*)

Alsike clover is a medium-sized clover with smaller leaves and flowers than Ladino. Alsike can grow on wet, acidic soils but it does not tolerate drought and hot weather. Yields can be high on fertile soils under favourable climatic conditions. Alsike clover is a short-lived legume and is therefore not recommended for perennial mixtures.

Sweet clover (*Melilotus alba*)

Sweet clover is a tall, biennial legume that is often used for soil improvement because of its deep taproot. It is adapted to a wide range of soil and climatic conditions but it does not tolerate acidic soils. Sweet clover contains coumarin which may cause sweet clover bleeding disease in livestock. Cultivars low in coumarin are available but they may not be hardy enough for use in Atlantic Canada. The seed coat of sweet clover is hard and scarified seed should be sown. Ensure

the proper strain of *Rhizobium* bacteria is used for inoculating seed.

Timothy (*Phleum pratense*)

Timothy is the most winterhardy forage species in Atlantic Canada and is widely grown throughout this region. Under good management, timothy can persist for long periods of time. Although timothy can tolerate acidic, wet soils, yield and quality are best on moderately well-drained soils with a pH of 6 or higher. Timothy is relatively easy to establish and maintain and it is compatible with other forage legumes. When cut at the boot to early heading stage, it produces good-quality forage.

Applying N-P-K fertilizer is essential for maintaining timothy. Fertilizing in spring and after harvest is best for timothy growth; regrowth tends to be slow, particularly under dry and hot summer conditions because timothy has shallow roots. To ensure a good second crop, harvest the first crop at early heading and apply fertilizer that is high in nitrogen. Crude protein content depends largely on the maturity of timothy and the amount of applied nitrogen fertilizer. Cultivars are available in a range of maturities; this enables growers to space out harvest periods while maintaining the optimum quality of the crop.

Smooth bromegrass (*Bromus inermis*)

Smooth bromegrass is an excellent companion grass for alfalfa in a hay or haylage system. Bromegrass has early maturity and good yield, especially on droughty soils. It forms a strong sod and fills in as alfalfa thins out. Under a two-cut harvest system bromegrass has good regrowth but persistence may be poor with a three-cut system.

Bromegrass has a deep root system that requires well-drained soils; it spreads by short rhizomes. High additions of nitrogen are needed when bromegrass is grown as a pure stand or when alfalfa has thinned out in a mixture.

Meadow bromegrass (*Bromus riparius*)

Meadow bromegrass is a reduced creeping type of bromegrass with many basal leaves. Meadow bromegrass regrows rapidly after defoliation and is suitable for pasture. It has more uniform seasonal growth than smooth bromegrass, particularly in July and August. In Atlantic Canada,

meadow bromegrass has performed well in field experiments but there is little on-farm information available.

Orchardgrass (*Dactylis glomerata*)

Orchardgrass is an early maturing, aggressive grass which can be used for stored feed, green chop, or as pasture. Because of a late May to early June heading date and rapid regrowth, it should be seeded alone or with aggressive legumes such as alfalfa or Ladino clover. Orchardgrass must be cut just as the head emerges from the boot as quality decreases rapidly after heading.

Orchardgrass requires well-drained soils for top yields. Good surface drainage is also important as ice and surface flooding can kill orchardgrass. In some cases, heavy applications of nitrogen fertilizer in the spring may help orchardgrass to recover from winter injury.

Meadow fescue (*Festuca pratensis*)

Meadow fescue is a perennial bunchgrass that grows to a height of 35 to 75 cm. It is adapted to the same climate and soil as timothy but yields best on deep, fertile soils. It will tolerate wet soils with proper care and fertilization. Meadow fescue's basal growth habit makes it a good grazing grass, generally in mixtures. Meadow fescue is not often recommended for stored feed due to its high stem-to-leaf ratio at heading.

Perennial ryegrass (*Lolium perenne*)

Perennial ryegrass is a high-quality, nutritious forage that makes an excellent pasture for grazing animals. It is a fast-growing species that requires a mild climate, fertile soil, and ample moisture. Perennial ryegrass has a relatively shallow root system and productivity is therefore adversely affected by hot, dry weather. In Atlantic Canada, currently-recommended cultivars are susceptible to winter injury; perennial ryegrass should be grown in a mixture where it lacks winterhardiness.

Reed canarygrass (*Phalaris arundinacea*)

Reed canarygrass is a tall plant with broad leaves. This species can tolerate excess soil moisture (even flooding) and low pH, but yields are highest on fertile, well-drained soils. To ensure high yields of good quality forage, reed canarygrass should be cut at the boot stage. Reed canarygrass

loses quality rapidly after heading; mature grass is not well utilized and will result in low animal intake and poor performance.

Low animal intake and poor palatability of reed canarygrass have been associated with mildly toxic alkaloids contained in the plant. Several new varieties with lower alkaloid contents and improved animal acceptability are available. Reed canarygrass does not retain its germination in storage as well as most other grasses; leftover seed should be tested for germination before planting.

Tall fescue (*Festuca arundinacea*)

Tall fescue is a deep-rooted, long-living perennial. It is tolerant of poor drainage, adapted to most soils, and resistant to trampling. Although tall fescue is basically a bunch grass, frequent mowing or grazing will produce an even sod.

Tall fescue can be used for pasture or as stored feed. The coarse leaves and rough leaf margins of tall fescue lowers palatability. For the best palatability and quality, fescue should be cut early and grazed at a young, immature stage. Tall fescue makes a good fall pasture as growth and quality are adequate late in the season. New cultivars of fescue and fescue-cross hybrids may help to improve livestock acceptance of this productive grass.

Kentucky bluegrass (*Poa pratensis*)

Kentucky bluegrass is an adapted grass that grows wild in pastures throughout Atlantic Canada. Bluegrass has a dense, shallow root system and produces lush palatable herbage. Bluegrass grows aggressively in the spring while summer growth depends on adequate moisture and timely fertilizer applications. Pasture production can be enhanced by good management practices including controlled grazing and adequate fertilization.

The dense root system and creeping growth habit of bluegrass makes it suitable for use as a bottom grass in horse pastures and in preventing soil erosion on ditch banks. Recent research has identified several high-yielding bluegrass cultivars that are well-suited for pasture use.

Creeping red fescue (*Festuca rubra*)

Creeping red fescue is a low-growing grass that spreads vigorously. This species can be established on most soils with adequate fertility and makes a good addition to pasture mixes as a bottom grass because it tolerates heavy animal traffic. Creeping red fescue is also useful for ditch banks, terraces, and steep slopes; the roots hold the soil while the thatch of top growth slows water movement and protects the soil surface.

ANNUAL FORAGE CROPS

Perennial legumes and grasses constitute most of the forages presently grown in the Atlantic region but supplementary annual forages are also important and can provide feed in the event of severe winterkill. Annual forages provide nutritious feed late in the season; this is particularly valuable during the critical fall harvest period. When selecting an annual forage crop, consider the cost of working the land, when the forage is ready for grazing or harvest, the expected yield, and the end use of the forage crop. Annual forage crops can be used in rotations with perennial legumes, cash crops, and pastures.

Persian clover (*Trifolium resupinatum*)

Under Atlantic Canadian conditions, Persian clover is an annual legume. It may be grown in mixtures with annual ryegrass for pasture. Proper inoculation is required as this is a new clover for this region.

Berseem clover (*Trifolium alexandrinum*)

Berseem or Egyptian clover is an annual cool-season legume that produces a nutritious crop. This species has an upright growth habit and, prior to blooming, it regrows rapidly after cutting or grazing. Berseem produces a large biomass for plow-down in rotations. Seeds should be treated with an inoculant that is specific to berseem clover.

Italian and Westerwolds ryegrass (*Lolium multiflorum*)

Following early spring seeding, Italian and Westerwolds ryegrasses can provide high-quality forage from mid-July to late fall. Ryegrass should be seeded at 25–35 kg/ha and fertilized at seeding, in July, and in August for maximum yields. Nitrogen is particularly important for high

yields. Italian ryegrass is best suited for pasture use while Westerwolds ryegrass may also be used for stored feed. Sowing oats or barley at 50–70 kg/ha with annual ryegrass will increase the first harvest which can be used for silage at the boot stage of cereal. For additional information on Italian and Westerwolds ryegrasses, see Agriculture Canada publication 1859, *Annual Ryegrasses in Atlantic Canada*.

Cereals

Both winter and spring cereals can be used for supplemental grazing or harvested as a silage crop. Sow cereals at the rates recommended for grain production when not underseeded. When underseeded, lower seed rates to 80–100 kg/ha. In cereal/field pea mixtures, peas can constitute up to 50% of the mixture to improve feed quality.

Spring cereals can be seeded from early spring until late July and will provide grazing approximately six weeks later. Winter cereals seeded in late summer will also provide some fall grazing. Seeding winter cereals earlier than recommended for grain production can increase fall grazing but there is a risk of increased disease pressure. Annual forages (i.e., ryegrass, kale, and rape) and permanent pastures are generally more cost effective than cereals as a grazing crop.

Small grains (cereals) make good silage; fermentable carbohydrate levels are high, buffering capacity is low, and moisture content can be reduced by wilting. Cereals and cereal/field-pea mixtures should be harvested at boot stage for lactating dairy cows and at early dough stage for beef cattle.

Forage crops are frequently undersown with a cereal cover crop. Harvesting the cereal as a silage crop will reduce the forage stand damage that results from competition and lodging. Early removal of the cereal crop as silage will also provide a longer fall growing period for the new forage crop.

Green fodder crops

Green fodder crops include forage brassicas, such as kale, rape, and stubble turnips, and fodder beets. These crops provide superior late-season supplementary grazing with high yields of quality

feed. These crops also represent a viable way of extending the grazing season into the late fall. Forage brassicas require strip or small paddock grazing for efficient utilization. When grazing these annual crops, livestock access to perennial pastures or hay is required to ensure adequate fibre, health, and milk quality.

Kale (*Brassica oleracea*)

Kale requires a long growing season of 90–100 days for full crop development. This species is particularly frost-hardy and can be grazed up to December.

Forage rape (*Brassica napus*)

Rape grows faster than kale and produces a leafy crop late in the season. Feeding rape to milking cows may taint their milk.

Stubble turnips (*Brassica rapa*)

Stubble turnips are fast-growing, with large leaves and a root bulb. About 75% of the root bulb is above ground and is readily grazed by livestock. Stubble turnip hybrids are leafier but they have no root bulbs or very small ones. Hybrid species are also suitable for green manuring.

Fodder beets (*Beta vulgaris*)

Fodder beets are a high-yielding crop with a high energy content. Most of the production from this crop are from the roots. Fodder beets can be grazed and the bulbs harvested for storage. Approximately 4 to 6 kg of fodder beet can replace 1 kg of rolled barley.

For more information on any of the crops discussed above, consult your local crops specialist.