UNIVERSITY OF VERMONT EXTENSION

Description and Seeding Rates for Forage Plants Grown in Vermont

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Forages can be defined as fibrous plant materials that are harvested and best utilized by ruminants and some non-ruminants. The portions of the plant that fits the definition of a forage ranges from young, tender leaves and stems (i.e., pasture) to whole plants that include stem, leaf and grain material (i.e., corn silage). Sometimes forages are referred to as "**roughage**" in ration formulation (as opposed to grain concentrate). However, "roughage" implies that forages only provide fiber when we know that forages also provide protein, energy, vitamins and minerals. Almost any plant can be used as forage. However, there are about a dozen or so that are commonly used in Vermont and New England. Below is a quick description of the major forages used plus some that hold promise for increased usage.

Perennial Forages

These are plants that persist for more than two years. Some common forage plants only persist three to five years (exp., alfalfa or red clover) and are commonly used in rotation with an annual crop. Other perennials (exp. most of the grasses and white clover) can last for long periods of time depending on level of management and soil type.

Grasses

There are many species of native and introduced grasses that are potential forages. Most perennial grasses grown in Vermont are temperate species ("cool season") and grow best in the spring and fall. Forage quality can be excellent but requires high levels of management, especially cutting practices and fertilization. When harvested at the same stage of maturity, most cool season grasses have about the same level of forage quality. Below are a brief description of each major specie either commonly found growing in Vermont or has recently been introduced by farmers.

- **Orchardgrass** – A commonly found grass used for both haylage, hay and pasture. It has the potential for high quality (18 - 20% CP, 50 -55%NDF) because of it's tolerance to intensive cutting (as many as 4 cuts per year), but it has a higher risk for low quality if not cut on time (narrow window of opportunity and it heads out early)! Orchardgrass grows best on well-drained soils. It does not tolerant poorly drained sites and is not as winter hardy as other species although adequate under most Vermont conditions. It is shade tolerant. An aggressive species in many forage mixtures, but compatible with alfalfa or red clover in a 3+ cutting, short rotation (3 - 5 year) system. It is relatively easy to establish. It is a high accumulator of potassium; and is not recommended for a dry cow, closeup ration without a forage test for potassium levels. An excellent pasture grass when managed properly. In pasture, it mixes well with ladino and/or red clover. It is not as compatible with birdsfoot trefoil. Varieties vary both in their timing of

seedhead development and morphological shape. Upright, later maturing varieties are generally more suited for hay or haylage. Low growing types are best suited for pasture.

- **Reed canarygrass** – This is a good sod forming grass (spreads by underground stems called "rhizomes") that is very tolerant of wet soils. However, it is not as aggressive in multi-cut forage mixtures on well drained sites and is quite compatible with alfalfa (well drained sites only), red clover or birdsfoot trefoil. Like orchardgrass, it has potential for high quality because of it's tolerance to early cutting (3 to 4 cuts per year), but has potential for low quality if not cut on time (which happens a lot when grown on the wet sites)! There have been past problems with palatability due to high alkaloid content but low alkaloid varieties are available. Establishment is slow. Reed canarygrass is an excellent "sink" for manure but it is a high accumulator of potassium – a poor choice for a dry cow, close-up ration. It can be grazed with special management.

- **Timothy** – Historically, this is one of the most common grasses in New England. It is very winter hardy and grows best on moist soils. Its shallow root system results in poor summer growth in dry years. It is relatively easy to establish. It is a good species for hay because it heads out later than other grass species providing a better window of time when weather may be more conducive for dry hay harvest. However, timothy does not tolerate intensive, early cutting and is more suited to a two-cut grass/clover mix verses a 3 or 4 cut alfalfa/grass mixture; therefore, forage quality is usually moderate to low. It also generally has a lower crude protein content compared to other grasses when cut at similar stages of maturity. It is a good grass for horse or dry cow hay. Timothy is a low accumulator of potassium compared to other cool season grasses; therefore, it can be a good choice for a low potassium close-up ration for dry cows and ewes (testing for potassium is still important since even timothy can be high in K if grown in a high K soil). In mixtures, it can be compatible with a number of grasses or legumes. For hay, it is commonly mixed with red clover or alfalfa. It could also mix well with smooth bromegrass on a moderately well drained soil. For pasture, it could be a component mixed with various grasses and legumes, but should not be the sole grass in a pasture mixture.

- **Smooth bromegrass** - A good sod forming grass that requires a well to moderately drained soil. This grass is very drought hardy due to its deep roots. However, like timothy, it is not tolerant of early or frequent cuttings; therefore, it is not compatible with an intensive cutting program. It performs best in a 2 cut program and could be mixed with a late maturing alfalfa. It is very palatable and makes an excellent hay of moderate quality (15% CP; 60% NDF). A good grass for horses, dry cow programs and ewes.

- **Tall fescue** - This grass has not been as common in Vermont except as introduced in "conservation mixes" that are seeded in ditches and along roads and stream banks. However, it is becoming more popular for haylage production and is often mixed with alfalfa or red clover. Like orchardgrass, it can be intensely managed for high quality and is best to be cut early. It is a coarse leafed grass that has a wide range of adaptability. It is considered a bunchgrass; however, it can produce short rhizomes under close, frequent mowing or grazing. It is suited for hay or pasture. It is less palatable than other forage species; therefore, it can be a problem in multiple specie pasture mixtures because grazing animals will selectively eat other species and leave the tall fescue. However, if grown alone (or mixed with a small amount of red or white clover) it can make very productive pasture. Because its leaves hold their integrity after frosts, it is an excellent grass for "stockpiling" in the fall for deferred grazing in late autumn or early winter. This grass is associated with a *fungal endophyte* (it grows inside the plant) that has been found to provide this

species with much of it's tolerance to drought and pest stress; however, animals grazing tall fescue with high endophyte express physiological problems resulting in poor performance and sometimes reproductive problems. "Low endophyte" or "novel endophyte" varieties are available that eliminate these problems.

- **Meadow fescue** – This is not a common grass in Vermont but has potential. It is closely related to and similar in morphology to tall fescue but is more winter hardy. Recent research from Wisconsin showed to to be very digestible compared to tall fescue under haycrop management. There are limited varieties.

- **Kentucky bluegrass** - Sometimes referred to as "June Grass", this grass and a related specie, Canada bluegrass, are often found in pastures, meadows and thinning out hay fields. Bluegrass is a short, densely growing sod grass that spreads by short rhizomes. It is very tolerant to short grazing. In a vegetative stage managed for pasture, its quality is quite high (>20% CP; 45 - 50%NDF). It quickly drops in production during hot, dry summers. Not very productive for hay or silage; however, you often find it in hay or silage samples from older, thin stands. When buying seed, make sure the variety is suited for pasture and not lawns.

- **Perennial ryegrass** – This is a high quality bunchgrass often used in commercial pasture seed mixtures. It is the most common grass grown in New Zealand and northern Europe. There are two types – tetraploids and diploids. The tetraploids are more upright and productive, best suited as a forage grass. The diploids tend to be lower growing and are commonly used in lawn mixtures. The tetraploids are not as winter hardy as other forage grasses and, therefore, has not historically been recommended for our region. However, newer varieties seem to be more cold tolerant and could be used when mixed with other legumes and grasses. When buying seed, make sure the variety is suited for pasture and not lawns.

- **Italian ryegrass** – This grass is similar looking to perennial ryegrass but it has larger leaves and seedheads. It is the grass often referred to as "annual ryegrass"; however, there are different types and varieties and some will act like a true annual while others can persist for a couple of seasons. However, they are not very winter hardy or reliable as a long term grass. They can be mixed with alfalfa as a haycrop, but preferably harvested as chopped haylage. In pasture, they should only be used in mixtures of three or more other species. The benefit is that they germinate very quickly to provide quick cover. But they can be aggressive with other species, so only a small portion in the mixture is recommended (less than 30%). Do not mix Italian ryegrass with alfalfa if seeded in late summer. The Italian ryegrass will dominate the fall growth and could cause the alfalfa seedlings to be too small for winter recovery.

- **Festulolium** – These grasses are hybrid crosses of either tall fescue or meadow fescue with either Italian or perennial ryegrass. The objective of this cross was to have the winter hardiness and persistence of the fescues with the quality of the ryegrasses. They look a lot like Italian ryegrasses. They may persist longer than Italian ryegrass; however, winter hardiness is variety dependent and still not very reliable for Vermont conditions so should not be grown alone or as the sole grass in a mixture. Like Italian ryegrass, pasture mixtures should only have a small proportion in the seed mix.

Legumes

These plants belong to the "pea" family and have the ability to fix atmospheric nitrogen via a symbiotic association with a root infecting bacteria, *Rhizobia* spp. Legumes generally are of higher forage quality than grasses in terms of crude protein and digestibility. They are sometimes grown alone but often are found in mixture with grasses. Maintaining legumes in mixtures is highly dependent upon harvest management (cutting or grazing frequency and height) and soil fertility (adequate soil pH, phosphorus and potassium levels; low nitrogen status).

- **Alfalfa** - The most popular perennial forage legume used in the U.S. because of its productivity, high quality and 3 to 5 year persistence. There is a better scientific understanding of this specie than any other forage perennial. There are over 200 named cultivars of alfalfa that exist. A good hay or silage crop, but can also be pastured. Deep taproot makes it more dry weather hardy than other forages. Alfalfa requires higher soil pH than most crops and lots of potassium to achieve production levels and reduce risks of winter injury. Over the past 10 years, there have been some very difficult winters for alfalfa (inconsistent snow cover) and the use of straight alfalfa has lost its popularity. We are seeing more grass grown in mixtures with alfalfa. It can be mixed with most of the grasses, but a balance of the alfalfa with the grass is best maintained when grown on a well drained, fertile soil.

- **Red clover** - An important short-lived perennial that is often grown in the Northeast in combination with timothy or other cool season grasses. It is used for hay, silage or pasture. It often produces dusty hay because of slow dry down and its pubescence (short, fine hairs) found on leaves, stems and bracts. One benefit as a silage crop is that it has a lower *degradable protein* content than alfalfa. It usually only persists for 2 to 3 years and fits in well with short rotations. Its best attribute is that it is quick to establish and grows well under shady conditions; therefore, it makes a good pasture "frost seeding" species. It is also often *over seeded* into older stands of thinning alfalfa to "stretch" the stand a couple more years. Compared to alfalfa, it will grow on more acid, less fertile, and wetter soils. Can be cut 3 to 4 times per year for high quality. Mixes well with most grasses.

- **White clover** - An important pasture specie. It spreads by above-ground stems called stolons which help it maintain a "perennial" presence even though the mother plant may only survive for 2 years. Very high quality - high protein and digestibility. Quality does not drop as rapidly with maturity as compared to other forages. There are three major types based on size -*small*, *intermediate* (sometimes called "common" or "Dutch white"), and *large* (also called ***ladino*** derived from an original ecotype that was discovered in the 1800's). The large ladino type is the most productive and, in mixes with tall grasses, can be used for hay or silage as well. Small or intermediate types are more persistent and are usually found in pastures. Pure stands of white clover are rare and not desirable because of a higher risk of bloat. It is often seeded in mixtures with red and/or alsike clover as well as grasses.

- **Birdsfoot trefoil** - A perennial legume that received a lot of attention in the 1950's and 60's in New York and surrounding areas. In the 80's, it started loosing what little popularity it had. It is a tap-rooted legume like alfalfa. Cultivars range from low growing types suited for permanent pasture (called *Empire types*) to upright types suited for hay or silage. It is not as productive as alfalfa and is more difficult to get established. Once established, it will grow on a wider range of soil types and conditions than alfalfa. It does well in pasture. One benefit - there has never been any report of bloat with this species probably due to a higher level of *tannic acid*. On wet soils intolerant to most forage species, it can be mixed with reed canarygrass for pasture or hay. In

pasture, it is slow to get started in the spring and is not compatible with orchardgras. However, it could be mixed with tall fescue, perennial ryegrass or timothy.

- **Alsike clover** - Not a real important legume, but is often found in forage mixtures that are designed for variable drainage soils because of its tolerance to wet conditions. Usually seeded with other clovers especially red or white clover as well as grasses. Flowers are white but will turn pinkish as they mature. Unlike white clover, alsike clover has a more upright branching stem morphology similar to red clover, but not as tall. It should not be grown in pastures or hayfields that will be used by light colored animals that are sensitive to photoreactions.

Annual Forages

There are many annual plants that can be utilized as forage. Many of these are also grown for grain; however, many varieties of grain crops may be better suited for forage or dual purpose so it is important to ask when purchasing these crops.

- **Corn Silage** – This is the most popular annual forage in the northeast and its use is increasing. There are many reasons for this popularity. Corn silage is one of the most productive high-energy forage crops. Because of a high level of nonstructural carbohydrates, it ferments well over a wide range of conditions. It has a reasonable window of time for harvesting a good quality crop. It works well for smaller farms that hire custom operators to plant and harvest.

- **Small Grains** - Spring small grains include ***spring oats***, ***barley*** or ***spring triticale***. They are planted early in spring and harvested by mid summer. They are often used as a companion crop for a forage seeding. Occasionally, they are planted alone for either forage or grain and then followed up by a late summer forage seeding. They can be used for silage or grazing. For optimizing yield and quality, they are usually chopped at the pre-boot (for highest quality) to early head stage when used as silage. Winter small grains include ***rye***, ***winter wheat***, and ***winter triticale***. They are planted in early fall (September) and are often harvested for silage in late spring/early summer. However, they can be used for late autumn and/or early spring grazing as well. Like the spring grains, they are usually chopped at the pre-boot to early head stage when used as silage. They serve as excellent winter cover crops especially on exposed soils left after a summer annual crop like corn.

- **Summer annuals** - ***Forage sorghum***, ***sudangrass*** , ***sorghum-sudan hybrids***, ***pearl millet*** or ***Japanese millet*** are traditional summer annuals that are grown as either emergency crops during a dry year or grown as an interim crop between rotations. They can provide forage by mid summer and be cut more than once. Quality is not as high as small grains or corn silage, but they are more productive during dry years (which, of course, we cannot predict). Piper is the recommended sudangrass and can be used for silage, grazing or greenchop. For silage, sorghum-sudan hybrids are more productive, but they are more coarse stemmed and have a higher prussic acid potential. Japanese millet grows best on wet or moist soils.

- **Brassicas** - members of the ***Brassicaceae*** **(*Cruciferae*)** or mustard family and are often used as an annual crop for fodder. Some brassica species that are sometimes grown for forage include *turnips, kale, rape, and swede*. For optimum production, they require a well prepared seedbed with little weed pressure. Planting time depends on the species and desired grazing time. Rape, turnips and kale are ready to graze within 90 days after planting while swedes require 180 days for maximum production.

Recommended seeding rates and planting times for forages grown in Vermont

The general rule is to have a seeding rate that results in a germination of between 60 and 80 seedlings per square foot. The ranges in seeding rates below account for varied conditions that can result in a range of seedling mortality. The better the seeding conditions within the optimum planting time, the lower the rate is needed within each range.

	Recommended Rate		
	Alone (lb/acre)	**In Mixture** (lb/acre)	**Optimum Planting Times[1]**
Legumes	Range	Range	
Alfalfa	12 - 15	8 - 10	April/early May or early August
Alsike clover	nr	2 - 5	April/early May or August
Birdsfoot trefoil	8 - 10	2 - 6	April/early May
Red clover	10 - 12	2 - 6	April/early May or August
White clover	nr	1 - 2	April/early May or August
Grasses			
Bluegrass, Kentucky	12 - 14	4 - 6	April/early May or August
Bromegrass, smooth	15 - 18	6 - 8	April/early May
Orchardgrass	10 - 12	3 - 5	April/early May or August
Reed Canarygrass	6 - 8	5 - 6	April/early May
Ryegrass, annual	20 - 25	10 - 15	April/early May or August
Ryegrass, perennial	10 - 20	5 - 6	April/early May or August
Tall fescue	12 - 14	6 - 12	April/early May or August
Timothy	8 - 10	2 - 8	April/early May or August
Annual Forages			
Spring grains	3 bu.	1.5 bu[2]	Early to mid April
Winter rye or triticale	3 bu.	n/a	Early to mid September
Sudangrass	30		June
Sorghum-sudangrass	25 - 30		June
Millet	15		June
Turnip and swede[4]	1.5 - 2		May or mid-July[3]
Rape or kale[4]	3 - 4		May or mid-July

[1]Planting beyond the "optimum" time increases risk of a poor stand

[2]If used as a companion crop for a perennial forage seeding or grown in mixture with an annual legume

[3]Turnips and rape planted in spring for mid-summer grazing and July for fall grazing

[4]Swede and kale are long season crops and need to be seeded in the spring

- Prepared and updated by Sid Bosworth, 2/12