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PERENNIAL FORAGES FOR HAY AND SILAGE

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Introduction

Selection of appropriate perennial species to grow for hay or silage requires an understanding of the soil and site characteristics, forage species adaptation characteristics, animal requirements, and of course market demands for those selling hay. This fact sheet provides guidelines for selecting the "right" perennial forages for hay and silage production in Ohio.

Soil and Site Assessment

The choice of species is limited to those adapted to the local soil and climatic conditions. Soil surveys help identify the soil map unit and soil characteristics that affect forage crop production. Soil survey information can be found at Natural Resources Conservation Service (NRCS) offices or online at https://websoilsurvey.nrcs.usda.gov/app/.

Keep in mind that soil pH can be increased with lime, soil fertility can be improved with fertilizer and manure, and soil drainage can be improved with artificial drainage.

Soil drainage is one of the most important and usually the most difficult and expensive characteristic to modify.

Plant-related characteristics that influence suitability of forage species to a particular use are listed in Tables 1 and 2. Selecting species that can tolerate the prevailing soil and site conditions will reduce production risk.

Species and Variety Selection

The intended use of forages, animal performance goals, and forage yield and quality targets should be considered when selecting forage species for hay or silage production. Tables 1 and 2 outline the important characteristics for selecting the legumes or grasses for use as stored feed on your farm. Soil characteristics are listed first in Table 1, because these determine if a species is adapted to the soil conditions on the farm. Table 2 describes the primary strengths and limitations of each species.

The tables in this factsheet focus on species we feel are the most suitable for stored feed production and especially for hay use in our region.

Table 1. Agronomic adaptation and characteristics of perennial forages highly suitable for stored feed in Ohio.

Forage Species	Minimum Drainage[1]	Tolerance pH < 6.0[2]	Minimum Fertility	Drought Tolerance[3]	Seedling Vigor	Relative Maturity[4]	Growth Habit
Alfalfa	WD	Low	High - Med	High	High	Early - Medium	Bunch
Red Clover	SPD	Medium	Medium	Medium	High	Medium - Late	Bunch
Orchardgrass	MWD	Medium	Medium	High - Med	High	Early - Medium	Bunch
Perennial Ryegrass or Festulolium	MWD	Medium	Med - High	Low	Very High	Early - Medium	Bunch
Smooth Bromegrass	MWD	Medium	High	Medium	Medium	Medium - Late	Open Sod
Tall Fescue	SPD	High	Medium	High	High	Medium - Late	Variable[5]
Timothy	SPD	Medium	Medium	Low	Low	Late	Bunch

Other species adapted to Ohio that can be grown for stored feed include white and alsike clovers, birdsfoot trefoil, Kentucky bluegrass, reed canarygrass, and several native warm-season grasses. All those species have characteristics or specific requirements that make them less suitable or more difficult for hay and silage compared with the species shown in the tables. Those other species may be useful in specific situations, or they could be included as components in hay mixtures to achieve specific objectives. For more information on those additional species, refer to the Ohio Agronomy Guide chapter on Forage Production.

Table 2. Characteristics of selected perennial cool-season forages legumes adapted to Ohio.

Species	Strengths	Limitations
Alfalfa	High yield; good seedling vigor; good summer growth; excellent drought tolerance; good persistence; excellent forage quality and palatability.	Requires good drainage and high soil pH and high fertility; prone to alfalfa weevil and potato leafhopper damage.
Red Clover	High yield; excellent seedling vigor; tolerates wet and acid soils better than alfalfa; fair summer regrowth; resistant to insects; excellent for renovation and overseeding; fair palatability.	Short-lived – usually persists 2 years, or 3 years with newer varieties; not heat or drought tolerant; difficult to dry for hay.
Orchardgrass	High yield, rapid regrowth; good summer growth; fair drought tolerance; fair flooding tolerance in summer; responsive to N.	Early to mature, forage quality and palatability decline rapidly with heading; poor flood¬ing tolerance in winter; aggres¬sive toward legumes; bunchy growth.
Perennial Ryegrass or Festulolium	Medium yield; vigorous establisher; high forage quality and palatability; fair to poor summer regrowth; fair tolerance to wet soils; compatible with legumes.	Less persistent and lower yielding than orchardgrass; lacks heat and drought tolerance (best in moist, fertile soils); difficult to dry for hay; difficult to cut with sickle bar mower.
Smooth Bromegrass	Winterhardy; sod-form¬ing; leafy summer regrowth; good d¬rought survival; best on fertile, well-drained silt-loam or clay-loam soils; later maturity than orchardgrass	Fluffy seed difficult to drill unless mixed with a carrier; susceptible to damage when cut during stem elongation stage; not tolerant of frequent cutting; poor summer regrowth; leaf diseases; lower yield than orchardgrass.
Tall Fescue	High yield; persistent, widely adapted; leafy regrowth; good seedling vigor; fair flooding tolerance in summer; tolerates heavy traffic; endophyte-free varieties improve animal performance	Poor palatability and quality in summer; high-endophyte varieties reduce animal performance and cause animal health problems
Timothy	Medium spring yield, late maturity; winterhardy; easy to establish; leafy regrowth; good com¬panion for legumes; highly marketable hay	Lacks drought and heat tolerance; low summer yield and forage quality; not toler¬ant of frequent cutting; cutting during stem elongation can damage the stand.

Production Objectives

Forage production objectives should reflect the dry matter and nutritional requirements of the livestock to be fed, and how those needs are met throughout the year. If the forage is grown for the cash hay market, select species with high market demand.

Management Constraints

Harvest and storage management and seasonal labor availability may influence species selection. For example, smooth bromegrass and timothy are better adapted to a 3-cut schedule than to 4 harvests per season. In contrast, orchardgrass and perennial ryegrass are well-adapted to 4-cut or even 5-cut schedules.

Disease and Insect Pressure

Resistance to diseases should be considered when selecting species and varieties. Will you monitor insect pests, and take corrective action on a timely basis? If not, select species and varieties that are affected less by major pests in your area. For example, select alfalfa varieties with high resistance to potato leafhopper if you are not prepared or able to monitor and control that pest with insecticides in a timely fashion.

Advantages of Pure Forage Stands

Pure grass or pure legume stands generally have fewer establishment, management, and utilization restrictions:

- Pure stands are easier to man¬age, as only one species needs to be kept productive.
- More herbicide options are available for weed control in pure stands.
- High forage quality is usually easier to achieve with pure legume stands than with pure grass or mixed grass-legume stands.

Advantages of Forage Mixtures

There are many reasons to consider mixtures. Legumes and grasses complement each other, making the best of weather and soil conditions. Mixtures often provide more uniform seasonal production and may be higher yielding and more persistent over time than pure stands.

The following desirable traits of grasses and legumes are combined in mixtures:

- Legumes eliminate or at least reduce the need for nitrogen fertilizer on pure grass stands.
- Legumes usually improve forage quality of mixtures and slow the decline in quality with advancing maturity to provide a wider “window” for harvesting good quality forage.
- Legumes in mixtures also reduce the potential for nitrate poisoning and grass tetany compared with pure grass stands.
- Grasses reduce erosion on steep slopes be¬cause they have a fibrous root system.
- Grasses are competitive with weeds.
- Most grasses improve hay drying.
- Grasses lengthen the for¬age stand life because they are more tolerant of mismanagement and poor soil conditions than legumes.

Selecting Forages for Mixtures

Keep mixtures simple, seldom are more than two species justified in a seeding intended for hay or silage production. Simpler mixtures are easier to manage and maintain than complex mixtures. Consider the following when developing mixture combinations:

Adaptation: All species in the mixture should be adapted to the prevailing soil conditions (drainage, soil moisture holding capacity, soil pH, fertility, etc.).

Rate of establishment: Combine species with similar seedling vigor. If one species has greater seedling vigor (e.g. perennial ryegrass) it may prevent establishment of a slower establishing species (e.g. smooth bromegrass). In such mixtures, use a very low seeding rate for the species with greater seedling vigor. The most persistent plant species are often the least competitive in the seedling stage.

Time of maturity: Species and varieties in a mixture should mature at about the same time. If one species is to mature later, it should be the grass component. This allows the legume to be cut at the right stage without sacrificing quality. Grasses are generally more tolerant of cutting at an early stage than legumes. Specific varieties of grasses within a species can vary widely in maturity.

Persistence: Combine species in mixtures with similar persistence. An exception to this rule is the use of “companion crops”, or fast-establishing short-lived perennial or annual species used to achieve quick ground cover (e.g. ryegrasses and small grain species). Do not exceed recommended seeding rates of these temporary companions, otherwise the more desirable perennials will be crowded out and fail to establish.

Management compatibility: Select species that are well adapted to the intended cutting management. For example, orchardgrass is compatible with alfalfa on a 4-cut schedule because it regrows quickly. But timothy and

smooth bromegrass are more compatible with alfalfa on a 3-cut schedule. Early and frequent cutting reduces the energy reserves of bromegrass and timothy, and crown buds may not develop sufficiently to elongate rapidly after the first cutting.

Aftermath production: Alfalfa produces better during the summer months than red clover. Of the grasses, orchardgrass and tall fescue produce the best summer growth. Smooth bromegrass produces moderate to light aftermath, while timothy, and perennial ryegrass are usually low yielding in the summer months. Moisture and temperature conditions affect aftermath production of cool-season grasses more than alfalfa.

Variety Selection

While variety selection is important, it is not as important as good management in achieving high yields of quality forage. Choosing the "right" variety can be a challenge, especially with the many varieties of some species that are now available.
Variety performance trial data from locations in your region can be very useful in selecting varieties that are well adapted to your farm. Look at variety performance across locations and years when it is available. Stable yield performance across many sites demonstrates that the variety is adapted to a wide range of environmental conditions that can occur on any given farm. Stable yield performance over years is especially important for long rotations.

When selecting varieties, consider disease and insect resistance needed for your farm. Also be careful to select varieties with relative maturity that matches the other components in the mixture and your intended cutting schedule.

Seeding Rates

Suggested seeding rates for pure stands of each species and in simple mixtures containing one to three species are given in Table 3.

Table 3 lists seeding rates in terms of pure live seed (PLS). Be sure to adjust the actual seeding rates used for the % PLS of the seed lot used. PLS content can be calculated from the information on the seed tag:

$$\%PLS = \%\ Purity \times \%\ Total\ Germination$$

Calculate the actual seeding rate as follows:

$$\text{Actual lbs/acre} = \frac{\text{lbs PLS/acre}}{\%\ \text{PLS x } 100}$$

Many newer varieties are sold as coated seed. Adjust seeding rates upward to account the % of the total weight that is the inert coating material (% is on the seed tag).

	Seeding rate (lb PLS/acre)[1]	
Species	Pure stands	Mixtures
Alfalfa	15	4 – 12
Red clover	11	3 – 8
Orchardgrass	10	2 – 7
Perennial ryegrass / Festulolium	24	6 – 12
Smooth Bromegrass	16	4 – 12
Tall Fescue	15	4 – 12
Timothy	8	2 - 6

[1] PLS = pure live seed. Mixture seeding rates should be adjusted based on relative abundance desired. Inoculate legumes with appropriate rhizobia.

Seeding Dates

New seedings should only be made after corrective applications of lime and fertilizer are applied according to a soil test (preferably the fall of the year before seeding).

Plant forages early enough in the spring so seedlings become well established and vigorous before the hot and drier mid-summer months (Table 4). Weed competition also increases dramatically with late spring seeding.

Late summer and early fall seedings must be made early enough (generally early to mid-August) so they are well-established before killing frosts (Table 4). Generally, at least six weeks of growth is required before a killing frost for adequate winter survival. Do not harvest late summer and early fall seedings.

Table 4. Seeding dates for forages in Ohio.

Time	Northern Ohio	Southern Ohio
Spring	April 1 – May 10	March 15 – April 25
Late summer[1]	August 1 – 30	August 1 – 30
Frost seeding	Feb – March 15	Feb – March 1

[1]Plant legumes by August 20 in northern Ohio and by August 30 in southern Ohio. Timothy can be planted up to early October.

First Year Management

Be sure to scout for weeds during the first 60 days after seeding the forage crop. Weeds that emerge with the new forage seedlings have the greatest potential to cause stand establishment problems. See the Ohio, Indiana, and Illinois Weed Control Guide for specific recommendations on weed control.

Wait 60 to 70 days after seeding in the spring for a first harvest to allow the plants to become well established with subsequent harvests at 30- to 35-day intervals. Red clover should not be allowed to bloom in the seeding year because this results in decreased stand vigor the following year. An early clipping of grasses when about 10-inches tall can improve tillering, as well as preventing annual weeds from going to seed. A final harvest the seeding year should made by early September.

Summary

Forage species selection is a critical first step to long-term profitable forage production. Selecting appropriate forage species for specific fields is a practical and important decision-making process. The selected forages should be adapted to the specific soil and management system. They should also be selected based on the feed requirements of the livestock to be fed or the demands of the cash hay market if hay is to be sold.

References

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