

MATCHING PLANTS TO SOIL AND SITE CHARACTERISTICS AND GRAZING SYSTEM GOALS AND OBJECTIVES

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Species selection based upon soil and site characteristics.

Many factors need to be taken into account when selecting suitable grass and legume species. Seed of a wide range of grasses and legumes is available in the Mid-Atlantic Region, and each species has its own particular characteristics, making it more or less suitable for a particular site and purpose. Many forage plantings fail or perform poorly simply because the species chosen for planting is not adaptive to the site or the area.

The first and foremost factor to be taken into account when selecting species is the necessity of matching grasses and legumes to the characteristics of the soil on which they are to be grown, characteristics such as soil type, drainage, moisture holding capacity, fertility and pH. But producers, farm supply personnel, advisors and consultants often select or recommend species based upon personal or industry preferences and biases without taking into account soil and site characteristics. To illustrate a rather common occurrence, I was asked several years ago to visit a newly constructed horse farm on the Eastern Shore of Maryland. It was a beautiful waterfront property fully constructed with new barns, board fences, road and laneways — pretty much everything a horse owner would want — except green pastures. A "shotgun" pasture mix of about a half dozen grasses and three or four legumes had been seeded, but a year and a half later very little of what had been seeded remained. Pastures were mostly either bare soil or crabgrass and weeds.

It was readily evident that most of the soil on the farm was very poorly drained and unsuited for the species most desired for horse pasture — orchardgrass, bluegrass and white clover. Other species in the mixture such as perennial ryegrass and timothy are not adapted to that area (hot, dry summers). The species that were adapted to the soil - tall fescue, reed canarygrass, alsike clover -were not acceptable to the owners.

The foremost consideration before purchasing the land should have been the soil and site characteristics and suitability of the land for the grass and legume species the owner desired for pasture. That thought never crossed the mind of the owner until the land had been cleared and construction of buildings, fences and facilities completed - a costly mistake. Unfortunately, this example is not an unusual occurrence, particularly with small and part-time farmers.

That is the reason so much emphasis is placed on conducting a thorough inventory of all available resources that will be utilized in the pasture and grazing program.

Among the questions to be addressed in the process of selecting adapted grass and legume species is: **What are the soil limitations of the fields in the grazing system?** Is drainage a limiting factor any place on the farm? Poorly drained soils place stresses on plant root systems. Species differ in their ability to persist on poorly drained soils. Are fertility and pH limiting factors? It is important to know not only what the fertility and pH limitations are, but also to know where they are (which fields). Old, permanent pastures typically have low pH and fertility, severe limitations especially for legume production. But keep in mind that soil pH and fertility are correctable limitations in forage systems. However, seldom can all fields be

corrected to recommended pH and fertility levels at one time and it may take 2 to 3 years for surface applications of lime and fertilizer to effectively change levels in the root zone.

Tables 4.1 and 4.2 show the adaptations and characteristics of the most common grass and legume forages grown in the Mid-Atlantic Region. Note that soil characteristics (drainage, fertility and pH) are listed first, in the columns on the left, since they are the first criteria to be considered in matching forage species to soil and site characteristics. They determine whether a species is adapted to the soils on the farm. The drainage and fertility characteristics listed reflect the minimum level for adequate species adaptation. Next the appropriate species are listed, given the particular drainage, fertility, and pH characteristics of the soil. The remaining characteristics (reading to the right) are plant-related and determine which species should be selected for the intended use.

Other significant soil limitations include rooting depth and topography. Shallow soils are droughty and they will stress plants during hot, dry weather. Steep slopes limit access and operation of equipment for liming, fertilizing, clipping, etc., a criterion to consider with species requiring high pH and fertility.

Where or how can this information be obtained? It can be obtained from the local Natural Resource Conservation Service (NRCS) or Soil Conservation District (SCD) office. County soil survey books contain maps and descriptions of all the soils in the county. The descriptions include any limitations of a particular soil for agricultural production. A soils map, available free of charge from the NRCS or SCD in most areas, is a valuable tool in selecting forage species for a particular site. This information is essential, especially for land a producer who has not previously farmed and land being considered for purchase.

Soil fertility and pH status of soil is determined through soil testing. Soil testing is one of the first steps to be completed in developing a pasture improvement program.

Use Tables 4.1 and 4.2 to select species that will tolerate the soil and fertility conditions present. For example, alfalfa and orchardgrass are adapted to well-drained soils with high fertility. On somewhat poorly drained soils with medium fertility, red clover is a better legume companion with orchardgrass. On soils with poor drainage, reed canarygrass with birdsfoot trefoil or ladino clover are better adapted.

Species selection to meet grazing system goals

Once the list of species adapted to the soil conditions within the grazing system has been determined, further decisions on forage selections must be made with the 'end user' or grazing animal in mind. One consideration should be the nutritional needs of the species and classes of livestock which are to be grazed on each pasture field. Will the pasture support the type of animals that will be grazing? Will it be used during early lactation and breeding (a time of maximum need for both quality and quantity as well as freedom from antiquality constituents such as the endophyte that occurs in tall fescue)? Will it be for growth of replacement heifers or ewes or for backgrounding feeder calves? Growing animals and lactating animals require high quality forage (protein and energy) to meet production requirements.

What role will each pasture field play? Will it be part of the "backbone" of the grazing system or will it be a supplemental forage to fill a gap or low point in forage production? What will be the primary season of use? For example, tall fescue selected for fall and winter grazing will not provide grazing in August, September and October. Likewise, a productive summer grass like switchgrass will have a relatively short (but productive) growing season compared to tall fescue or orchardgrass.

What will be the frequency of grazing and the length of rest periods? Kentucky bluegrass and ladino white clover are more likely to persist under close grazing on a somewhat poorly drained soil with high fertility than are orchardgrass and red clover. What is the extent of traffic? Is the primary intended purpose

of the pasture to be for an exercise lot for horses or loafing lot for dairy cows? In these cases, an endophyte-infected tall fescue is the species of choice.

Thus it is helpful to have some understanding of the forage quality of various species of forage grasses and legumes and to choose those which will best meet the nutritional requirements of the species and classes of livestock being grazed. Consider having several grass and legume mixtures to provide forage in as many months of the year as possible to reduce stored feed costs. Prepackaged "shotgun" mixtures of numerous grasses and legumes usually have no advantage over simpler mixtures that are carefully designed to match specific grasses and legumes to the soil and site characteristics and grazing system goals.

Soil-drainage classes

0. Very poorly drained - Water is removed from the soil so slowly that the water table remains at or on the surface the greater part of the time. Soils of this drainage usually occupy level or depressed sites and are frequently ponded.

1. Poorly drained - Water is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year. Poorly drained conditions are due to a high water table, to a slowly permeable layer within the profile, to seepage, or to some combination of these conditions. The large quantities of water that remain in and on poorly drained soils prohibit the growing of field crops under natural conditions in most years. Artificial drainage is generally necessary for crop production.

2. Somewhat poorly drained - Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. These soils commonly have a slowly permeable layer within the profile, high water table, additions through seepage, or a combination of these conditions. The growth of crops is restricted to a marked degree, unless artificial drainage is provided.

3. Moderately well drained - Water is removed from the soil somewhat slowly, so that the profile is wet for a small but significant part of the time. Moderately well drained soils commonly have a slowly permeable layer within or immediately beneath the solum (the genetic soil developed by soil-forming processes, normally includes the A and B horizons, or the upper part of the soil profile above the parent material), a relatively high water table, additions of water through seepage, or some combination of these conditions.

4. Well-drained - Water is removed from the soil readily but not rapidly. A well-drained soil has "good" drainage. These soils are commonly intermediate in texture, although soils of other textural classes may also be well drained. Well-drained soils commonly retain optimum amounts of moisture for plant growth after rains or addition of irrigation water.

5. Somewhat excessively drained - Water is removed from the soil rapidly. Many of these soils have little horizon differentiation and are sandy and very porous. Only a narrow range of crops can be grown on these soils, and yields are usually low without irrigation.

6. Excessively drained - Water is removed from the soil very rapidly. These soils may be steep, very porous, or both. Shallow soils on slopes may be excessively drained. Enough precipitation is commonly lost from these soils to make them unsuitable for ordinary crop production.

(Source: Soil Survey Manual. U.S. Dept. Agriculture Handbook No. 18,1962.)

