GRASSLAND CONDITION

Profitable grassland management for livestock pasture depends upon the manager's ability to match forage growth and livestock nutritional needs. Every livestock producer must first be a "graze farmer" since ruminant livestock depend directly on the quality and quantity of forage available. Shortages of forage quality or quantity at critical periods of the animal's productive cycle means loss of production. Livestock production can never reach an economically optimum level on improperly managed pasture. This unit will discuss principles that can be used to match forage growth with animal nutritional needs to develop pasture programs.

Using Forages To Fill Grazing Season

Understanding forage growth is a key to any successful pasture program. No single forage provides adequate year-round grazing, but complimentary combinations of several forages including both cool-season and warm-season forages can provide good quality season-long grazing and some winter grazing as well (Figure 1). Forage selection for a pasture program is sometimes difficult due to the wide variety of forages available. The following section discusses the appraisal of existing conditions in a pasture.

Appraisal of Existing Conditions

1. What is the pasture type?
   A. Fescue (>90% fescue)
   B. Mixed cool-season grasses (<10% legumes)
   C. Cool-season grass dominant pasture (10 to 25% legume or other grasses)
   D. Cool-season Grass / legume pasture (26 to 60% legume)
   E. Legume dominant pasture (>75% legume)
   F. Warm-season grass pastures (<25% other species)

Fescue (>90% fescue) Tall fescue is the major cool season grass planted in Missouri. Fescue pastures have tall fescue as the dominant forage species (>90%) with only scattered plants of other forages present. Active growth periods of tall fescue occur in spring and fall. Fescue pastures need nitrogen fertilization to produce good forage yields. Soil test fertilizer recommendations for cool-season grass pasture should be followed to achieve desired yield levels.

Besides providing forage in spring and fall, tall fescue is often managed for winter pasture. Fall growth of the tall fescue is allowed to accumulate and grazing is deferred until winter. This practice is called stockpiling and works well in fall because the accumulated growth tends to remain high in nutritive quality and does not become mature as it does in spring. Tall fescue foliage tolerates freezing weather better than most other cool season grasses so it is preferred for fall stockpiled pasture.

Many tall fescue pastures are infected with the fescue endophyte which causes fescue toxicosis in grazing animals. Fescue toxicosis is caused by a toxin produced by an endophytic fungus that grows inside the fescue plant. Animals grazing fescue pastures that are infected with the endophytic fungus can show symptoms of lameness, heat stress, lower weight gains,
Figure 1. Complimentary growth patterns of cool and warm-season grasses
low milk production, and low conception rates all of which reduce farm profitability. The fescue endophyte problem on a farm can often be offset by planting new pastures of endophyte free fescue varieties or by incorporating legumes into existing infected pastures. Fescue pastures usually have low value for wildlife due to the density of the foliage at ground level.

**Mixed cool-season grasses (<10% legumes)** Mixed cool-season grass pastures consist of a mix of cool season grass forages that may or may not include tall fescue. This category can also include pure stands of other cool-season grasses besides tall fescue. Perennial cool season grasses adapted to Missouri include Kentucky bluegrass, orchardgrass, perennial ryegrass, redtop, reed canarygrass, smooth bromegrass, tall fescue, and timothy. These grasses are commonly grown in pure stands, in mixtures with other cool season grasses, or in combination with legumes. Mixed cool-season pastures should receive nitrogen fertilization and the low percentage of legume (10%) is considered nutritionally non-significant. Soil test fertilizer recommendations for cool-season grass pasture should be followed to achieve desired yield levels. Cool season grasses are not often seeded in mixtures with warm season grasses in the same field because this combination requires very careful management to maintain the mixture.

Cool season grasses grow best during spring and fall, but are usually dormant or unproductive during hot summer months (Figure 2). From one-half to two-thirds of the annual growth of cool season grasses occurs in the spring and up to one-third of the annual growth occurs during the fall. Forage quality is very high when new growth begins in spring and declines with increasing growth as the plants become mature and produce seed. Fall regrowth of cool season grasses also has very good forage quality, however forage quality does not decline during the fall growth phase as in spring because plants remain vegetative during this time of year. Cold weather, snow, or ice can cause forage quality to decline during winter.

**Cool-season grass dominant pasture (10 to 25% legume or other grasses)** Cool-season grass dominant pastures generally need no nitrogen fertilizer in spring, but may respond well to nitrogen fertilizer in fall. These pastures can include fescue and/or a mix of cool season grasses along with a moderate percentage of legumes (10 to 25%). Legume percentages in this range will improve the nutritional value of a pasture and will help offset the effects of the fescue endophyte on cattle, but are not high enough to eliminate the need for nitrogen fertilization under high animal stocking rates. Soil test fertilizer recommendations for cool-season grass should be followed to achieve desired yield levels. However, if the goal of the landowner is to increase the percentage of legume in the pasture, then soil test fertilizer recommendations for clover-grass pasture should be followed to encourage legume growth. The legume component also helps extend the active spring growth period of the pasture into early summer. Other grasses including warm season grasses or weedy grass may be present at levels less than 25% of the pasture mix.

**Cool-season Grass / legume pasture (26 to 60% legume)** Legumes are commonly grown in combination with cool season grasses to improve nutritional quality of the pasture. Legumes are highly palatable and nutritious to livestock. Legumes generally have higher
nutritive quality at any given growth stage than grasses. Legumes also help improve forage quality of a pasture when the companion grasses in a mixture become more mature than desired. Forage quality of grass/legume mixtures is excellent and livestock grazing this mixture should have few symptoms from fescue endophyte. Grass/legume pastures show little or no response to nitrogen fertilization because the nitrogen supplied by the legume through nitrogen fixation is high enough to support the growth of both the grass and legume. Legumes need higher soil fertility levels than grasses. Soil test fertilizer recommendations for clover-grass pasture should be followed to maintain production in this mixture. Grass/legume pastures also have more value to wildlife than fescue, mixed cool-season, or cool-season dominant pastures.

**Legume dominant pasture (> 75% legume)** Fields with this high percentage of legume (> 75%) are more typical of hay fields than of grazed pastures, but legume dominant fields used for pasture will have the same benefits as listed for grass- legume pastures. Legumes can be used for pasture in spring, summer or fall, but require careful management to maintain adequate stands. Legumes also help offset the effects of fescue toxicosis when mixed in fields of endophyte infected tall fescue. Soil test fertilizer recommendations for clover-grass pasture should be followed to maintain production in this mixture.

Legumes adapted to Missouri include alfalfa, annual lespedeza (Kobe or Korean), birdsfoot trefoil, red clover, and white or ladino clover. Red and white clover grow in spring, early summer, and fall. Alfalfa and birdsfoot trefoil grow from spring through summer and fall. Annual lespedeza grows in summer and dies at frost. All of these are perennial plants except for and annual lespedeza and red clover.

**Determining legume percentage**

Determining the actual percentage of legume present in a pasture by visual estimates can be difficult for the untrained eye. A good rule to use for visually determining the percent of yield from the legume component in a pasture is to estimate the percentage of canopy cover as legume when the pasture canopy is six to eight inches tall and then divide by two to get the approximate season-long dry matter contribution from the legume. For example, if the canopy of white clover in a pasture is estimated to be approximately 30% then the percent legume as dry matter in that pasture would be about 15%. Obviously, a high percentage of canopy cover from the legume is necessary to provide all the advantages attributed to grass-legume mixtures.

**Warm-season grass pastures (<25% other species)** Warm season grasses grow best during the summer months but grow very little in spring or fall (Fig. 1). Warm season grasses provide good quality, actively growing forage during the hot summer when cool-season grasses and many legumes are dormant or unproductive. Warm season grasses should be used when forage availability is low in summer or when very high summer forage production is needed. A combination of warm season and cool season grass pastures will provide a constant forage supply over the growing season. Keep in mind that warm and cool season grasses should be planted in separate pastures for easier management.

Native warm season grasses adapted to Missouri include big bluestem, indiangrass, little bluestem, and switchgrass. These grasses are usually grown in pure stands or in mixtures
with other warm season grasses. They are usually not grown in combination with most introduced legumes or cool season grasses because the native warm season grasses are not as aggressive as many legumes or cool season grasses especially in fertilized pastures. The native grasses should not be grazed shorter than eight inches to maintain vigor and regrowth of the plants. Introduced or non-native warm season grasses include bermudagrass (south Missouri only) and caucasian bluestem. Caucasian bluestem and bermudagrass are normally only grown in pure stands because they are more aggressive forage plants, they are lower growing than the native grasses, and they must be grazed at much shorter heights than the native grasses in order to maintain forage quality. All of the plants listed above are perennials.

The native warm-season grasses respond to moderate fertilizer applications and are much more desirable for wildlife cover than introduced warm-season grasses or most cool-season grasses. Introduced warm-season grasses such as bermudagrass and caucasian bluestem respond to high rates of nitrogen fertilizer, but have little value as wildlife cover. Fertilizer recommendations for warm-season grass pasture should be followed for all warm-season grass pastures except for bermudagrass which has a specific recommendation listed for hay or pasture. Annual grasses, forbs, legumes, and cool-season grasses often become established in a warm-season grass pasture through seed dispersal or improper grazing or feeding management. These invading species should be maintained at less than 25% of the sward so the benefits of the warm-season grass can be realized.

Warm season grasses should be grazed when they are in the vegetative stage of growth. Fiber levels increase rapidly as the plants mature, reducing forage quality and making warm season grasses undesirable for stockpiling for later grazing. These grasses usually have a very rapid growth rate and very high production potential. Close attention is required to prevent them from becoming too mature for good forage quality.

2. What is the average growth stage of the dominant forage species?

A. Vegetative
B. Boot or bud
C. Heading or bloom
D. Mature
E. Dormant

The growth stage of the forage is very important in pasture management. As the forage matures the nutritional value and acceptability to grazing animals decline rapidly. Forages should be grazed before they reach maturity since nutritive quality is highest when the forage is vegetative and growing. This stage also corresponds with low plant fiber and high digestibility. Fiber levels increase as the plants mature decreasing digestibility of the forage. Plants go through specific developmental stages as they mature. For grasses these stages are vegetative, boot, heading, bloom, mature seed. Most cool season grasses produce seed only in the spring. Regrowth of cool-season grasses in summer and fall after the seed stems have been removed by grazing or hay harvest is vegetative and leafy with no seedheads. Warm season grasses can produce seed more than once per year. Legumes go through similar stages of
development as the grasses. These stages for legumes are vegetative, bud, bloom, mature seed. Unlike most grasses, legumes except for annual lespedeza, can flower and produce seed several times during the growing season.

3. What best describes the grazing pressure of the pasture?
   A. Overgrazed
   B. Spot grazed
   C. Evenly grazed
   D. Undergrazed

Grazing pressure or the intensity and frequency of grazing can strongly influence the regrowth vigor of a pasture. Pastures that are grazed too short or those that are grazed too frequently lose plant vigor. Any stress on the plants also limits livestock production because the grazing animals are dependent on the forage. An assessment of the grazing pressure on a pasture can tell about the relative vigor of a pasture.

   Overgrazed: Overgrazing occurs when the pasture is grazed too frequently before the plants produce adequate regrowth. Overgrazing and closely grazing are not necessarily synonymous. Pastures plants that are closely grazed can recover and grow normally as long as an adequate period is allowed before that pasture is grazed again. Overgrazing does not allow enough time for plants to store nutrient reserves for regrowth before they are grazed again. This results in a depletion of the plant's nutrient reserves causing slower regrowth and lower plant vigor. Overgrazing also leads to the weakening of the plant's root systems so overgrazed plants also respond more slowly to good management practices than properly grazed forages. Overgrazing can shift the composition of a pasture from taller growing forages that do not tolerate frequent grazing to lower growing species that tolerate heavier grazing.

   Characteristics of overgrazed fields may include thin stands, very short forage plants, low forage vigor, and invading weeds or brush. Forage plants in overgrazed fields appear uniformly short and weak.

   Spot-grazed: Spot-grazing is actually a form of over-grazing in which spots or patches of a pasture are grazed too frequently. Spot-grazing occurs during periods of active forage growth when livestock graze spots in a pasture while allowing other areas of the field to become mature and unpalatable. The regrowth of the grazed forage in the spots is often more palatable than the forage left ungrazed so the grazing animals frequently re-graze new growth of these spots. Spot-grazed fields have uneven forage heights and the forage in the grazed spots may become weak and thin if cattle remain in the field too long. Spot-grazing often occurs when livestock density or number in a pasture is too low for the current forage conditions. Frequent pasture rotation will improve the condition of spot grazed pastures.

   Evenly grazed: Evenly grazed pastures, as the description implies, have a generally uniform grazing height, thick stands, good forage vigor, and respond well to good management. These pastures often have a good mix of grasses and/or legumes present. Some spot-grazed areas may be present, but make up less than 20% of the field.

   Under-grazed: Under-grazed pastures often have large quantities of accumulated growth that has become coarse or mature. These pastures have low nutritive value for
livestock, but can be good areas for wildlife, depending upon the forages species present. Heavy shade from taller growing forage species can reduce the density of lower growing plants in a pasture.

4. Is weed or brush control needed other than by grazing or soil fertility management?
A. Yes
B. No

Weed and brush control is sometimes necessary to control certain invading species. Many weedy plants can be controlled by good grazing management and proper use of fertilizer. Forage plants growing in pastures that have good soil fertility and are not overgrazed are more competitive and prevent many weeds from becoming established. Other means of control, including mechanical or chemical control, becomes necessary when woody plants and other undesirable species make up 30% or more of the canopy in a pasture. Thorny species, including blackberry, thistles, multiflora rose, and greenbrier, are not controlled by grazing and should be mechanically or chemically controlled at levels less than 30% canopy.

5. What soil pH range is recommended for this sward?
A. 4.5-5.0
B. 5.1-5.5
C. 5.6-6.0
D. 6.1-6.5
E. 6.6-7.0
F. 7.1-7.5

Most legumes need a higher soil pH than most grasses. Recommended soil pH levels for forages in Missouri range from 5.6 to 6.5, but certain crops require a higher soil pH within this range than others. The University of Missouri also recommends different pH ranges in different parts of the state for the same crop or forage. Specific pH ranges for forages grown in Missouri can be found in the table below which is from University Extension Guidesheet no. 9112, "Interpreting Missouri Soil Test Reports".

Soil pH is a measure of the acidity or alkalinity of the soil. The subscripted "s" in the pH term simply denotes the type of laboratory test used to measure the acidity of the soil sample- in this case a salt testing solution. Values for pH (no subscript), however, is determined in the lab by a water-based test instead of a salt solution. The University of Missouri soil testing laboratory uses the salt testing solution and reports soil acidity levels as pH. A value given for pH is about 0.5 units more acidic than the same value given simply as pH. For example, a pH value of 5.5 would be similar to a pH value of 6.0.

Most Missouri soils are acidic, however heavy applications of limestone can increase the soil pH to basic or alkaline levels. A pH of 7.0 is neutral - meaning it is neither acidic or basic. Low soil pH can have a dramatic impact on forage growth and persistence. The acidity of a soil increases by a factor of 10 for each integer below a pH of 7.0. For example, a pH of 6.0 is 10 times more acidic than 7.0, a pH of 5.0 is 100 times more acidic than 7.0, and a pH
of 4.0 is 1000 times more acidic than 7.0.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Soil region</th>
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<tbody>
<tr>
<td>Alfalfa and alfalfa-grass</td>
<td>6.6-7.0</td>
</tr>
<tr>
<td>establishment</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>Bird's foot trefoil and bird's foot</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>trefoil-grass establishment</td>
<td>5.6-6.0</td>
</tr>
<tr>
<td>Clover and clover-grass</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td>establishment</td>
<td>5.6-6.0</td>
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<tr>
<td>Cool-season grass</td>
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<tr>
<td>establishment and production</td>
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<tr>
<td>Lespedeza and</td>
<td>6.1-6.5</td>
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<td>lespedeza-grass establishment</td>
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<td>Overseeding legumes</td>
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<tr>
<td>sudan/sorghum crosses</td>
<td>5.6-6.0</td>
</tr>
<tr>
<td>All row crops</td>
<td>6.1-6.5</td>
</tr>
<tr>
<td></td>
<td>6.1-6.5</td>
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</tbody>
</table>

6. What fertilizer rate is needed for this pasture?

Fertilizer recommendations for a specific forage crop are shown in the "Nutrient Requirements" section of the University of Missouri soil test report. Up to four different forage crops may be shown under the "Cropping Options" heading. Two types of fertilizer recommendations are given for each forage crop - establishment recommendations and production recommendations. Establishment recommendations should be used when a new forage is being planted. Production recommendations should be used for pasture production of the existing forage. Each crop listed is assigned a "yield goal" or desired yield level. Establishment fertilizer recommendations have a yield goal of zero since no yield is expected at establishment time. Yield goals for pasture are shown as CD/A which stands for "cow days per acre". One CD/A is 30 pounds of forage dry matter which is the average amount of forage needed for a 1000 lb. cow with a three to four month old calf. Recommendations for pounds of nitrogen (N), phosphate (P₂O₅), and potash (K₂O) needed to reach those yield goals are given for each crop.

NOTE: Each crop option will be identified on the left side by a three-digit number in the cropping options section. The student must choose the correct crop option from one of the reports used in the contest and write the corresponding identification number on the scorecard.

7. What limestone rate, in tons per acre, is needed for this pasture?

Limestone recommendations are shown in the "Limestone Suggestions" section of the soil test report. The recommendation is reported as pounds of Effective Neutralizing Material (ENM) needed per acre to raise the soil pH to a desirable range for a particular crop. The
limestone rate, in tons per acre, recommended for that field is calculated by dividing the ENM recommendation from the soil test report by the ENM guarantee of the limestone dealer. For example, if the ENM recommendation from the soil test report is 1600 lbs. and the limestone dealer guarantees 400 lbs. per ton of agricultural limestone, the amount of limestone that should be spread per acre is 4 tons (1600/400 = 4 tons limestone per acre).

NOTE: The ENM value must be selected from the soil test report that corresponds to the desired crop.

Matching livestock and forage

1. When does this livestock herd have the highest forage quality requirement?
   A. Spring
   B. Summer
   C. Fall
   D. Winter
   E. Requirement high year round

Livestock nutritional requirements change throughout the year as the animals go through different stages of production. Forage quality must be higher for growing animals than for mature animals. Growing animals, such as steers or heifers, need a constant supply of high quality feed through the season to maintain growth. Shortages in quality will sharply reduce gain and profit. As an animal matures its nutritional needs change. The forage quality and quantity needed by mature animals also changes with production stage through the year.

A mature beef cow goes through four stages of production each year (Figure 3). Nutritional needs will be different for each of these stages. Stage One is post-calving and lasts 90 days. Since the cow has just had a calf, her nutritional needs are now the highest of the entire year. She is lactating at her highest level, she is undergoing uterine involution, and she must cycle and re-breed within 90 days of calving to stay on a 12-month calving schedule in the herd. Lack of nutrition during this period results in lower milk production and failure to re-breed on time. A cow must re-breed in time to have a calf every 365 days. Failure to do this results in an unprofitable operation due to added costs of maintaining open, unbred cows.

In Stage Two the cow is pregnant and lactating. This stage usually lasts 115 days. Nutritional needs will be dropping slightly during this period. The cow is in the early stages of pregnancy while still nursing her calf. She should be gaining some weight now.

Stage Three is mid-gestation and lasts about 100 days. The cow has just weaned her calf and is dry. Her nutritional needs are at the lowest point of the entire year since she only has to maintain herself and the developing fetus. She can get by on much lower quality pasture now than in Stage One.

Stage Four is pre-calving. This stage lasts about 60 days and is the second most important period nutritionally during the year. Seventy to 80 percent of fetal development is occurring. The cow is gaining weight and preparing for lactation. Inadequate nutrition during stage four will often cause weak calves and poor re-breeding success during stage one. Cows
Figure 3. Seasonal total digestible nutrient (TDN) requirement for a spring-calving, 1,100 lb. beef cow with average milk production.
need to be in good body condition now. She needs good quality pasture or hay to make sure both herself and calf will be strong and healthy. First or second calf heifers need higher quality forage than mature cows during all four of these stages since their bodies are still growing plus they are producing a calf. This makes it very important to feed these animals separately from the mature animals to ensure proper development. Mature bulls also need good quality feed during the breeding season but can get by on lower quality forages other times of the year.

A cow herd has its highest forage quality requirement during stage one which is during calving and rebreeding. This stage usually occurs in spring and fall in Missouri. Herds that have not set calving season or those that calve year-round need high forage quality year-round to support the cows calving at any given time. Year-round calving is not recommended. Calving seasons of 90 days or less are recommended to optimize forage production, breeding, and marketing.

2. Does the growth cycle of this pasture match the seasonal peak nutritional needs of this livestock herd under present management?
   A. Yes
   B. No

Now that you know some basic concepts of forage production and changes in livestock nutritional needs you still face the challenge of matching these production schedules together. A good manager relies on his ability to combine the production of forage and livestock along with the environment into an economically and biologically sound program.

Spring time is the period when forage is abundant and the weather is favorable for calf survival and rapid growth. Most pastures in Missouri are made up of cool season forage species. A spring calving program matches the cool-season grass seasonal growth pattern rather well. The cow’s greatest nutritional needs are between calving and re-breeding. The growth and quality of a cool season grass is also the high at this time (Figure 2). Forage production and quality drop off in summer along with a slight drop in nutritional requirement by the cow. Adding a warm season grass or other summer forage to a cool season grass program fills the summer forage deficit and maintains livestock production until the cool season grass begins growing again in fall.

Summer calving is not recommended in Missouri. The reason for this is not entirely related to forage production since warm season forages are available and of high enough quality to maintain adequate nutrition. The primary reason not to have a summer calving season is due to weather. In summer, high temperatures and humidity reduce breeding activity and conception rates. Research has shown much lower conception rates in cattle breeding during hot weather because of higher embryonic mortality. The number of calves weaned per cow exposed to the bull has much greater impact on profitability than any other single factor. If a calf is never conceived it cannot be weaned.

Fall calving works well in Missouri since the combination of forage quality and cooler temperatures are again favorable for high conception rates in cows. Cool season grasses produce about one third of yearly production in fall. The quality of this fall growth is very
good. Cows calving in September will have adequate nutrition on properly managed fall pastures. Re-breeding will take place after the cows have been flushed with high quality fall pasture. Warm season pastures (warm season grass, annual lespedeza, alfalfa) can improve a fall calving program by increasing the nutrition level of the cows during STAGE 4, which occurs during July and August for a fall calving herd. This improves milk production, calf vigor, and re-breeding success. Warm season pastures also work well if fall born calves are kept till they are yearlings before they are sold. The calves are weaned in spring and put on high quality spring pasture. In early summer the calves are rotated to warm season pastures to maintain good weight gains until they are sold later that summer or in fall.

NOTE: Transparencies of Figures 2 and 3 can be overlain to illustrate how to match livestock nutritional needs with seasonal growth of cool-season grasses.

3. How many pounds of forage dry matter does this herd need to consume per day during each of these seasons?

<table>
<thead>
<tr>
<th>Lbs. D.M. needed</th>
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<tbody>
<tr>
<td>Spring</td>
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<tr>
<td></td>
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<tr>
<td>Summer</td>
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<tr>
<td>Fall</td>
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Calculating Forage Dry Matter Intake Requirements

Although cattle need certain forage quality at specific stages of production, they also need adequate quantity. Estimating the total forage need is not difficult, but will require some calculation. The pasture stocking rate and hay supply can both be estimated in advance if animal needs and forage production is known.

Forage requirements vary not only with the animal’s stage of production, but also by body size. Large animals need more feed to maintain themselves than do smaller animals. The following table gives guidelines for estimating forage Dry Matter Intake (DMI) by certain classes of animals. These figures are given as a percent of body weight (BW) to account for the difference in forage requirement due to body size. NOTE: Notice that the percentage of forage DMI changes for each stage of production as already discussed in question 1. of this section.

Approximate Daily Forage DMI Requirements For Different Classes of Cattle

<table>
<thead>
<tr>
<th>Animal</th>
<th>Daily Forage DMI Requirement (% of BW)</th>
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<tbody>
<tr>
<td>Dry beef cow</td>
<td>2 %</td>
</tr>
<tr>
<td>Lactating beef cow (avg. milk prod.)</td>
<td>2.5 %</td>
</tr>
<tr>
<td>Lactating beef cow (Superior milk prod.)</td>
<td>3 %</td>
</tr>
<tr>
<td>Bull (during breeding season)</td>
<td>2.5 %</td>
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</tbody>
</table>
Bull (not during breeding season) 2 %
Growing steers and heifers 3 %

The following example illustrates how to calculate forage DMI requirements.
Example: Calculate the daily forage dry matter needs of this herd during the spring grazing period:

Spring-calving beef herd
30 cows - lactating (avg. prod.) (avg. weight = 1,100 lbs.)
1 bull - 2,000 lbs.
10 heifers - avg. weight = 750 lbs.

Solution: 
30 lactating cows X 1100 lbs. = 33,000 lbs.
1 breeding bull X 2000 lbs. = 2,000 lbs.
10 heifers X 750 lbs. = 7,500 lbs.

The cows are lactating so their requirement is 2.5 % of their body weight per day. During the breeding season the bull still needs 2.5 % of BW also. The growing heifers need 3 % BW per day.

\[
\begin{align*}
33,000 \times 0.025 &= 825 \\
2,000 \times 0.025 &= 50 \\
7,500 \times 0.03 &= 225
\end{align*}
\]

\[
1,100 \text{ lbs. forage dry matter needed per day}
\]

Example: Calculate the daily forage dry matter requirement for the same herd if the cows are dry in STAGE 3.

Solution: The herd needs less forage because the cows are dry and their nutrient and dry matter requirements are lower. The heifers are still growing so they still need 3 % of their BW per day. The cows and bull can be calculated at 2 %.

\[
\begin{align*}
30 \text{ dry cows (1100 lbs. avg. wt.)} &= 33,000 \text{ lbs.} \\
1 \text{ bull (2000 lbs.)} &= 2,000 \text{ lbs.} \\
10 \text{ heifers (750 lb. avg. wt.)} &= 7,500 \text{ lbs.}
\end{align*}
\]

\[
\begin{align*}
33,000 \times 0.02 &= 660 \text{ lbs. per day for cows} \\
2,000 \times 0.02 &= 40 \text{ lbs. per day for bull} \\
7,500 \times 0.03 &= 225 \text{ lbs. per day for heifers}
\end{align*}
\]

925 lbs. dry matter needed per day for this herd.

4. Is forage availability adequate for this herd in each of these seasons?
   Spring (100 days)
   _______ Adequate
   _______ Not adequate
Summer (100 days)
  ______ Adequate
  ______ Not adequate

Fall (100 days)
  ______ Adequate
  ______ Not adequate

Calculating Forage Dry Matter Requirements For A Specific Season

To calculate the forage DMI requirements for a specific period use the following calculation:

(lbs. dry matter needed per day) X (number of days in season)

Example: What is the forage DMI requirement for this same herd during the spring (100 days). This is a spring calving herd.

Solution: Since the herd is spring calving, the cows will be in STAGE ONE. They are lactating and preparing to re-breed. Their requirements will be 2.5% of BW per day. The bull will be working during this time so his need is 2.5% of BW per day. The heifers will be bred this spring so their need is 3% of BW per day.

The total daily forage DMI need is 1,100 lbs.
1100 lbs./day X 100 days = 110,000 lbs. forage DMI needed for spring season.

Calculating actual forage availability required for different grazing management systems

To determine if forage availability is adequate for the herd, you must also consider the harvest efficiency of the grazing system. No harvest system is 100% efficient, especially grazing animals. In a pasture system animal utilization of the forage is between 30 and 65 percent of what is actually grown. In continuous grazing systems cattle are allowed to continually graze a pasture with no restrictions on rotation. Much of what is produced is wasted. Only 30 to 35 percent of the total forage produced is actually eaten by the livestock. The other 65 to 70 percent is trampled, soiled by mud, manure, and urine, or used as bedding areas.

As grazing management restricts the grazing habits of the animals, forage utilization increases. When management-intensive grazing (MIG) is used, forage utilization can be as high as 65 percent of the forage produced. This level of utilization can only be achieved with a multiple paddock system with frequent pasture rotations of 3 days or less.

The following example gives a guideline for calculating the actual amount of forage dry matter production needed in a pasture to carry the same herd during the spring season.

Example: (Same herd as used previously) Calculate the actual amount of forage DM needed for this herd for the spring grazing period for continuous and management-intensive grazing systems.
Solution: The daily dry matter intake was calculated to be 1,100 lbs and the total spring season DMI was 110,000 lbs. Forage utilization in the continuous grazing pasture management system is only about 35 percent. This means that forage dry matter availability needs to be almost three times the amount the herd will actually eat per day.

\[
110,000 \text{ lbs. DMI per day} \\
0.35 = 314,285 \text{ lbs. forage DM needed for that season}
\]

In an intensive grazing management system, forage utilization is about 65 percent so actual forage DM needed is only about 1.5 times as much as what is actually eaten.

\[
1,100 \text{ lbs. DMI per day} \\
0.65 = 169,230 \text{ lbs. of forage DM needed for that season}
\]

It becomes quite clear that by using good grazing management a producer can harvest almost twice as much forage with little extra cost except for fencing materials. The added utilization of forage and extra livestock gain per acre can often pay that cost very quickly.

**Pasture Improvement**

The answers to questions 3, 4, and 5 in this Pasture Improvement section are based on the choice for question 2.

1. **What changes should be recommended in livestock management?**
   - A. Continue present management
   - B. Reduce livestock numbers
   - C. Change calving season to different time of year
   - D. Shorten calving season to a period of < 90 days.
   - E. Provide higher quality pasture for heifers and steers
   - F. Switch to a management-intensive rotational grazing system

   **Continue present management:** Use this option when the livestock management practices matches with the landowners goals and forage management.

   **Reduce livestock numbers:** Use this option when the livestock numbers exceed the carrying capacity of the farm even when calculated for a different grazing management system. Calculating the forage requirement using the percentage utilization for management-intensive grazing may allow the farmer to keep the herd at its current size if livestock numbers are too high for a continuous grazing system.

   **NOTE:** The goals stated by the landowner may also dictate reducing livestock numbers regardless of the carrying capacity of the farm, but this will be specifically stated for the contest.

   **Change calving season to a different time of year:** Spring or fall calving are recommended for Missouri conditions. Summer calving should be avoided due to the potential
of low cow conception rates caused by hot weather.

**Shorten calving season to a period of <90 days:** Use this option when the calving season is spread out over more than one season for that single herd or when year-round calving is being practiced.

**Provide higher quality pasture for heifers and steers** This option should be chosen when the farm scenario states that the farmer has problems with low weight gains in growing animals or when fescue endophyte is a problem.

**Switch to a management-intensive rotational grazing system** Switching to a management-intensive rotational grazing system may improve forage availability if the carrying capacity of the farm is exceeded under continuous grazing management. Management-intensive grazing can also reduce problems with spot-grazing in pastures.

2. **What type of additional forage is needed to improve this pasture system?**
   - A. Cool-season grasses
   - B. Warm-season grasses
   - C. Legumes
   - D. Grass/legume mixture
   - E. No additional forages needed - use existing pastures

Additional forages should be chosen based upon information given in the farm scenario and the forage availability calculations. The options listed above can be used as shown in the following situations, however information given in the farm scenario will be specific enough so that only one will be the best answer. **Examples:** Cool-season grasses can be used when forage production is not adequate in spring and fall forage but is adequate for summer. Warm-season grasses can be added to the system when summer forage production is not adequate. Legumes can be selected overseeding legumes in winter is needed. Grass/legume mixtures can be used for providing high quality pasture. If the system is functioning well, choose answer E. No additional forages needed - use existing pasture.

3. **How should this additional forage be planted?**
   - A. Plant on a clean, firm seedbed
   - B. No-till plant in a killed sod
   - C. Overseed or interseed in a closely grazed sod
   - D. No additional forages needed - use existing pasture

   **Plant on a clean, firm seedbed:** Planting a stand of forages is best done on a clean-tilled, firm seedbed when conditions allow. This allows better weed control, fertilizer and lime incorporation, and better seed to soil contact. This option should be chosen when field renovation is desired and lime and fertilizer need to be incorporated into the soil.

   **No-till plant in a killed sod:** No-till planting into a killed sod is should be chosen
when soil erosion could be a hazard if the field is plowed or if the field is too rocky to be plowed. No-till planting allows the seed to be planted by a no-till drill directly into a sod that has been killed by herbicides. This option should be chosen for fields to be renovated having over 5% slope.

Overseed or interseed into a closely grazed sod: This option should be chosen when adding legumes to a grass pasture to improve forage quality. Overseeding is done during the winter months so that freezing and thawing of the soil will cover the legume seed. Legumes can also be interseeded with a no-till drill into the existing live sod.

No additional forages needed - use existing pasture: Choose this option for fields with adequate stands of desired forage and which require no additional forage species.

4. What fertilizer rate is needed for this forage?
Fertilizer recommendations should be selected from the soil test that corresponds with the crop chosen in question 2. If you chose to establish a new forage in question 2 you must also choose a fertilizer recommendation for establishment of that forage. If you choose to continue with the present forage, use a recommendation for pasture production of that forage.

5. What limestone rate, in tons per acre, is needed for this forage?
Limestone recommendations should be selected from the soil test that corresponds with the crop chosen in question 2. The amount of limestone needed in tons per acre should be calculated using the same method as in question 7 of the “Appraisal of existing conditions” section.