Introduction
Standardized performance analysis (SPA) of beef cattle operations continues to demonstrate the importance of reducing feed related costs. As producers look for alternative methods to reduce feed costs the benefits of improved forage management become increasingly important due to the opportunity to reduce feed costs while improving animal performance. One note of caution related to maximizing beef production from pasture, maximizing anything must be done carefully, the difference between maximum success and a total disaster is a fine line.

To maximize beef production from grazing pasture several management practices must be followed, cattle must graze as many days as possible, cattle must graze high quality forage, and harvested forage losses must be minimized. This paper will address these three factors and their role in maximizing beef production from pastures.

Grazing Days

Before proceeding the term grazing day must be defined. Many consider a grazing day to be one animal grazing 1 day. This definition will work if all cows are the same weight, calves are not grazing with cows and you are not comparing your operation to another. The daily grazing pressure applied by a 1400 pound cow, a 1100 pound cow and a 300 pound calf do not represent the same stocking rate, therefore a grazing day should be standardized by weight to make reliable comparisons as changes occur within the operation. A grazing day should represent 1000 pounds of animal weight, using this standard allows beef, dairy, sheep, goat and horse producers to discuss pasture productivity without making conversions.

The mathematical example in Table 1 illustrates the importance of increasing grazing days on daily grazing costs.

<table>
<thead>
<tr>
<th>Pasture</th>
<th>Cost, $ / acre</th>
<th>Grazing days / acre</th>
<th>Cost / day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30</td>
<td>90</td>
<td>$0.33</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>120</td>
<td>$0.25</td>
</tr>
<tr>
<td>C</td>
<td>30</td>
<td>180</td>
<td>$0.17</td>
</tr>
</tbody>
</table>

This example suggests management practices extending the grazing season can reduce costs. There are three basic methods used to extend the grazing season, increase forage production, improve forage distribution and improve harvest efficiency.

Increase Forage Production

Increasing forage production can be accomplished in several ways. The most common and perhaps simplest is the application of nitrogen fertilizer to existing pastures. The key to fertilizer application is timing, increased forage production due to fertilization is only useful if current production is lacking or demand exceeds available supply. Spring fertilization of cool season pastures only exacerbates the
problem of excessive spring forage growth whereas a late summer nitrogen application, 60-90 days prior to the end of the growing season, will permit the accumulation of high quality forage suitable for fall and winter grazing. Stockpile grazing offers producers the advantages of increased forage production, extended grazing, and reduced stored forage needs.

Nitrogen fertilization can also be accomplished by incorporating legumes into the pasture. As the cost of commercial fertilizer continues to increase producers should consider using legumes to provide nitrogen to pastures. A grass pasture with 35% legumes will produce as much dry matter as a pasture fertilized with 70 pounds of nitrogen per acre. Legume establishment is a more cost effective N source than commercial fertilizer and lengthens the summer grazing season due to improved summer forage distribution and pasture quality. Legumes generally have deeper root systems and are more tolerant of the warmer, drier summer weather. Pasture quality is improved by legume incorporation due increased protein and lower fiber levels.

**Improve Forage Distribution**

Most pastures in the Heart of America consist primarily of cool season grasses producing abundant spring growth. To maximize the production of beef from pastures, grazing day distribution must be leveled out across the year to match the nutrient needs of the grazing animal. To level out the forage production curve producers must consider the addition of different forage species to the grazing system. Legume addition to grass-based pastures has already been discussed as a way to increase forage production during the summer grazing period. Utilizing warm season forages is another method to increase summer grazing days.

Warm-season forages include perennial species such as eastern gamagrass, indiangrass, switchgrass and the bluestems as well as the annual species of pearl millet, sudangrass and the sorghum hybrids. Incorporating warm-season forages into a grazing system offers graziers two distinct advantages; first, forage production during the hottest and driest portion of the growing season and second the opportunity to give cool-season pastures extended rest periods.

The number of grazing days available from warm-season forages should be considered when deciding on which forages to incorporate into the pasture system. Initially perennial species may seem more cost effective due to reduced annual seeding costs. IL-LIFT data has demonstrated annuals can be cost competitive to perennials by increasing grazing days. Annual pastures can be utilized later into the grazing season because root reserves are not necessary and the final grazing can result in total forage utilization. Another benefit to warm-season annuals is increased land flexibility, pastures can be developed during the growing season and land can be utilized by another enterprise after grazing. This flexibility does have the risk of weather related seeding failures.

Utilizing stockpiled cool season pastures is one method of improving fall and winter forage distribution. Using stockpiled pastures is the best method of extending the grazing season on ground where sod cover must be maintained. In areas where crops are produced and land remains fallow during fall and winter using winter annuals such as spring oats, cereal rye and brassica species can be advantageous to improving forage distribution. Incorporating winter annuals into forage systems further utilizes the fixed land base, aids in leveling the forage production curve across the year and provides grazing opportunities during times when many producers are utilizing stored feed resources.
**Improve Harvest Efficiency**

Increasing forage production and improving seasonal distribution can all be for not if harvest efficiency is low. Harvest efficiency is negatively correlated to length of the grazing period. As grazing period length increases harvest efficiency declines. Cattle allowed continuous access to the same pasture will only utilize 30-35% of the forage produced during the entire year. Conversely strip grazing can permit seasonal harvest efficiencies of 70%. These two contrasting management systems demonstrate the importance of developing a managed grazing system. Simply, moving cattle to new pastures once a week can increase forage utilization by as much as 40%.

Regardless of the harvest efficiency targeted by producers, the “Take half, leave half” principle must be employed to ensure continued pasture productivity. Overgrazing to maximize grazing days may reduce costs in the short term but the difference will be realized in later grazing periods.

**High Quality Forage**

Based on the examples from Table 1, decreasing grazing costs by increasing stocking rate would seem to be the best method to maximize beef production from pasture by improving per acre productivity, however, high stocking rates can depress individual animal performance.

The best method to balance individual animal performance and per acre productivity is to manage pastures for high quality forage. High quality forage is high in protein and low in fiber. Managed grazing systems improve forage quality by reducing animal selection and thus improving the persistence of plants sensitive to close grazing. In addition, forages are more uniformly grazed resulting in more vegetative pastures with less weed pressure and mature plant material.

High quality pastures many times are under utilized by beef producers. Mature cow nutrient requirements can be met using high quality pasture so long as there is sufficient supply. Beef producers could more effectively utilize pastures by grouping cattle according to nutrient needs and utilizing a leader follower grazing system. These systems maximize pasture beef production by providing the highest quality forages to animals with the highest nutrient requirements. Beef management groups may include:

- Young cows
- Heavy milking cows
- Growing and finishing cattle
- Average milking cows
- Developing heifers
- Dry cows

Rotating these management groups through high quality pastures will aid in maximizing pasture utilization.

**Minimize Harvested Forage Losses**

Beef producers may waste more money harvesting excess forage than any other input. Harvesting excess forage as hay is initially as efficient as any other grazing-based harvest method. Nonetheless, from the time excess forage is put into a bale and eventually consumed by the cow a tremendous amount of feed is lost due to storage and feeding methods.

**Storage**

Many factors affect forage storage losses. One of the most important is bale size. When comparing two bales with an equal spoilage depth of 5 inches, a 4 foot diameter bale will experience 40% greater dry matter losses than a 6 foot bale simply due to a greater percentage of the smaller bale contained in the surface layers. The potential for reducing storage related dry matter losses should be addressed prior to baler purchase.
The remainder of storage related forage loss can generally be attributed to storage method and site. The list of poor storage methods and sites is extensive, rather than discuss the losses producers should focus on these keys to effective hay storage:

- Butt flat bale ends together tightly
- Consider covering bale rows
- Leave 3 feet between bale rows
- Make high density bales
- Orient bale rows north and south
- Store hay in bright sunny location, barns are the only suitable dark location
- Store hay on well drained site preferably on stone, pallets, etc.

Minimizing stored forage losses will aid in maximizing beef production from pasture by reducing the cost of excess forage management.

**Feeding**

Feeding losses associated with stored forages can be as great as or greater than losses observed in storage. Given the opportunity, a cow will gladly eat the best forage and sleep on the rest. To minimize forage feeding losses producers should consider restricting access to hay by utilizing a hay feeder or limiting hay access time. Michigan State researchers (Buskirk et al., 2003) compared hay feeder types and concluded round-ring feeders and round feeders with a center cone are most effective in minimizing hay waste compared to square trailer and cradle-type hay feeders.

University of Illinois researchers (Cunningham et al., 2005) reported acceptable cow performance and reduced hay waste and manure production when daily hay access was restricted to 3, 4, 7, 8, or 12-hours compared to 24 hour hay access.

The simplicity of *ad libitum* hay access contributes hay feeding losses. Putting hay out twice a week allows producers to minimize feeding labor and time while potentially maximizing the stored forage requirements of the operation. Taking management steps to minimize storage and feeding losses as well as the need for stored forage will significantly increase the production of beef from pastures.

**References**


