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Grazing Stockpiled Forages to Reduce Hay Feeding During Fall and Winter

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Introduction

The cost of hay and purchased feed for winter feeding is the largest expense of maintaining a livestock herd. Estimates in 2009 showed that combined costs of producing and harvesting hay were at least $25 per round bale. All too often, producers finish harvesting hay in the fall and then begin feeding it soon afterward. Adopting pasture management practices that extend the grazing season avoids investing more cost into forage that could be grazed instead of being harvested for hay. In Arkansas, the use of stockpiled forages has reduced winter feeding expenses for producers across the entire state.

What Is Stockpiling?

Stockpiling forage is the practice of accumulating forage growth intended for grazing in a later season. Stockpiling forages beginning in late summer works well in Arkansas for providing late fall and winter grazing. During the spring and summer, stockpiling is seldom advantageous, except during severe drought, because forages become mature and poor quality due to stem and seedhead production. However, cooling night temperatures and shorter days of late summer and fall tend to reduce forage fiber content, thus promoting leafy, high-quality forage.

Which Forages Are Best for Stockpiling?

Tall fescue and bermudagrass are the most commonly stockpiled forages, but bahiagrass and dalligrass have also been stockpiled successfully. Other forages may produce good fall growth but deteriorate quickly after frost. Some forages, such as crabgrass, are excellent quality during the growing season but become unpalatable and degrade quickly after a killing frost and are often refused by cattle.

Stockpiling Warm-Season Grasses

Bermudagrass is the most popular perennial warm-season grass in Arkansas. It is persistent, productive and is adapted to a wide range of conditions. It produces most of its annual yield during late spring and summer with little growth occurring during early spring and fall. However, research in Arkansas showed stockpiled bermudagrass can produce significant forage yield in late summer that can be grazed during late fall to reduce hay feeding. Bahiagrass and dallisgrass have similar growing seasons as bermudagrass and can also be stockpiled for fall grazing by following the same recommendations as for stockpiling bermudagrass.

The optimum temperature range for bermudagrass growth is 85° to 95°F. Bermudagrass growth sharply declines when night temperatures drop below 60°F. Therefore, stockpiling should begin by early to mid August in north Arkansas and by late August in south Arkansas to produce acceptable forage growth. This allows enough time for growth accumulation before cooler autumn night temperatures slow the grass growth.

Rainfall during late summer can be erratic with high risk of drought stress, but an early start date maximizes the opportunity for acceptable

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Table 1. Fall yield of stockpiled bermudagrass for two locations when stockpiling was initiated in early August or early September and percent decrease resulting from delayed initiation.

	Dry Matter Yield (pounds/acre)					
	Batesville			Fayetteville		
Year	August	September	% decrease	August	September	% decrease
2000	662	196	71	1,438	506	65
2001	1190	464	61	4,227	657	84

stockpiled forage yield. Arkansas research (Fayetteville and Batesville) demonstrated the importance of an early stockpiling initiation date for attaining a high forage yield (Scarbrough et al., 2002). Dry matter yields were highest when stockpiling was initiated in early August compared to early September. Delaying the initiation of stockpiling from early August until early September reduced forage yield by 61% to 84% (Table 1). In extension demonstrations on farms, stockpiled bermudagrass yields averaged over 2,900 pounds per acre and ranged up to 6,000 pounds per acre.

Stockpiled warm-season grasses such as bermudagrass, bahiagrass and dallisgrass are not as tolerant to freezing temperature as tall fescue and are best used during mid to late fall. The warm-season grasses become dry after a killing frost and lose leaves and forage quality due to repeated rainfall and freeze events. In Arkansas research, dry matter digestibility of stockpiled bermudagrass declined from acceptable quality for dry cows in October to very low levels in January (Scarbrough et al., 2006). Ice and snow can ruin stockpiled bermudagrass because cattle often refuse grazing it after the ice or snow melts. Because of the steady decline in quality after onset of freezing weather and increasing chances of freezing precipitation in late winter, plans should be made to finish grazing stockpiled bermudagrass by mid to late December unless adequate supplementation is provided.

Stockpiling Tall Fescue

Tall fescue is the most widely grown perennial cool-season grass in Arkansas. It has two distinct periods of growth during the year – spring and fall. The fall growth can account for up to a third of the annual dry matter yield. The optimum temperature range for fescue growth is between 68° and 77°F, and growth ceases below 40°F. Stockpiling should begin in early September in north Arkansas to allow enough time before cold weather to produce acceptable stockpiled forage yield. In south Arkansas, many fescue pastures are mixed with warm-season grasses. In that case, stockpiling should begin in late September to early October when growth of the warm-season grass has slowed or stopped to avoid excessive competition with the fescue.

Stockpiled fescue forage is very resistant to freezing temperature due to the heavy waxy cuticle on the leaves and the fact that it possesses a chemistry that preserves cell function at cold temperatures. Because of its cold weather tolerance, stockpiled fescue can provide palatable forage through the winter. Stockpiled fescue maintains green color and forage quality late into the winter and can be grazed until March. Fescue managed for fall growth out-yields sod-seeded annual ryegrass or small grains during the same period. Research conducted at the University of Arkansas Southwest Research and Extension Center near Hope found that tall fescue stockpiled from mid September to early January yielded over 3,000 pounds per acre with a forage analysis of over 20% crude protein (CP) and 60% total digestible nutrients (TDN) (Beck et al., 2006). In Extension demonstrations on farms, stockpiled fescue yielded over 2,500 pounds per acre and ranged up to 5,700 pounds per acre.

Steps for Stockpiling Forages

Specific steps are recommended to increase the likelihood of having good stockpiled forage growth. These steps are similar for bermudagrass and fescue, but the schedules differ. Bermudagrass is stockpiled from late August to late October and is grazed from late October through mid December. Tall fescue is stockpiled from September through late November and is grazed from late November through February. Practices for successful stockpiling of bermudagrass and fescue are as follows.

Management for Stockpiled Bermudagrass	Management for Stockpiled Fescue
1. Remove existing forage residue in late July to early August to leave a stubble of 2-3 inches	1. Remove existing forage residue in late August to early September to leave a stubble height of 3-4 inches
2. Fertilize with 50-60 pounds of nitrogen per acre in early to mid August (late August in south Arkansas)	2. Fertilize with 50-60 pounds of nitrogen per acre in early September (mid to late September in south Arkansas)
3. Defer grazing until late October to allow growth to accumulate	3. Defer grazing until late November to allow growth to accumulate
4. Strip or rotationally graze to extend the grazing period of the stockpiled forage	4. Strip or rotationally graze to extend the grazing period of the stockpiled forage
5. Grazing period is October to December	5. Grazing period is late November to February

Fertilizer Application

Perhaps the single major factor that prevents producers from trying stockpiled forages is the mistaken perception that nitrogen fertilizer applied during dry weather in late summer will be lost. If ammonium nitrate is used as the N source, losses will be negligible since the ammonium portion of that fertilizer does not volatilize. If urea fertilizer is used during warm weather, some nitrogen losses can occur from volatilization if rainfall does not occur soon after application. Research has shown variable results from late summer urea applications, but N losses from urea are usually less than 20% and are lower if rainfall occurs within a week after fertilizer application.

Arkansas research showed that urea applied in August for stockpiled bermudagrass was nearly as effective as ammonium nitrate and produced forage yields averaging 90% of that from ammonium nitrate (Jennings et al., 2006). In that study, stockpiled fescue yield was not different for ammonium nitrate, urea or urea + Agrotain™ when applied in early September. Nitrogen applied on September 1 produced the highest stockpiled fescue yields, while nitrogen applied on October 15 produced no more forage than the unfertilized control treatment. Phosphorus (P) and potassium (K) fertilizer should be applied according to soil test recommendations. If adequate P and K were applied in spring or summer and not removed in a hay crop, then only N should be needed for fall forage growth. Poultry litter or animal manure can be used as a fertilizer source with good results.

Stockpiled Fescue and Horses

Although tall fescue is not a preferred forage grass for horses, many acres of it are grazed by horses. Toxic fescue can cause serious disorders for pregnant mares; however, it can be a suitable forage for nonbreeding horses. Stockpiled fescue can provide good quality forage for horses though the winter just as for cattle. A three-year demonstration grazing horses on stockpiled fescue was conducted with a mixed herd of 25 to 31 geldings and nonpregnant mares per year from an Arkansas trail ride operation (Jones et al., 2008). Body condition scores were assessed and weights were estimated with weigh-tapes before and after the grazing period for each animal. Grazing began in December and continued until available forage was depleted (35 to 42 days). Forage quality exceeded nutrient requirements for maintenance of mature horses. Average CP was 18.7%. Forage utilization was estimated at 45 AU grazing days per acre. Horses increased body condition score and increased body weight (32 pounds). Grazing horses on stockpiled fescue compared to feeding hay and supplement resulted in an average savings of $14.40 per AU for the grazing period.

Stockpiled Forage Quality

Forage quality of stockpiled fescue and bermudagrass can be very good (Figures 1 and 2). In extension on-farm demonstrations, the quality was generally above CP and TDN requirements for dry cows, and a majority of samples met TDN

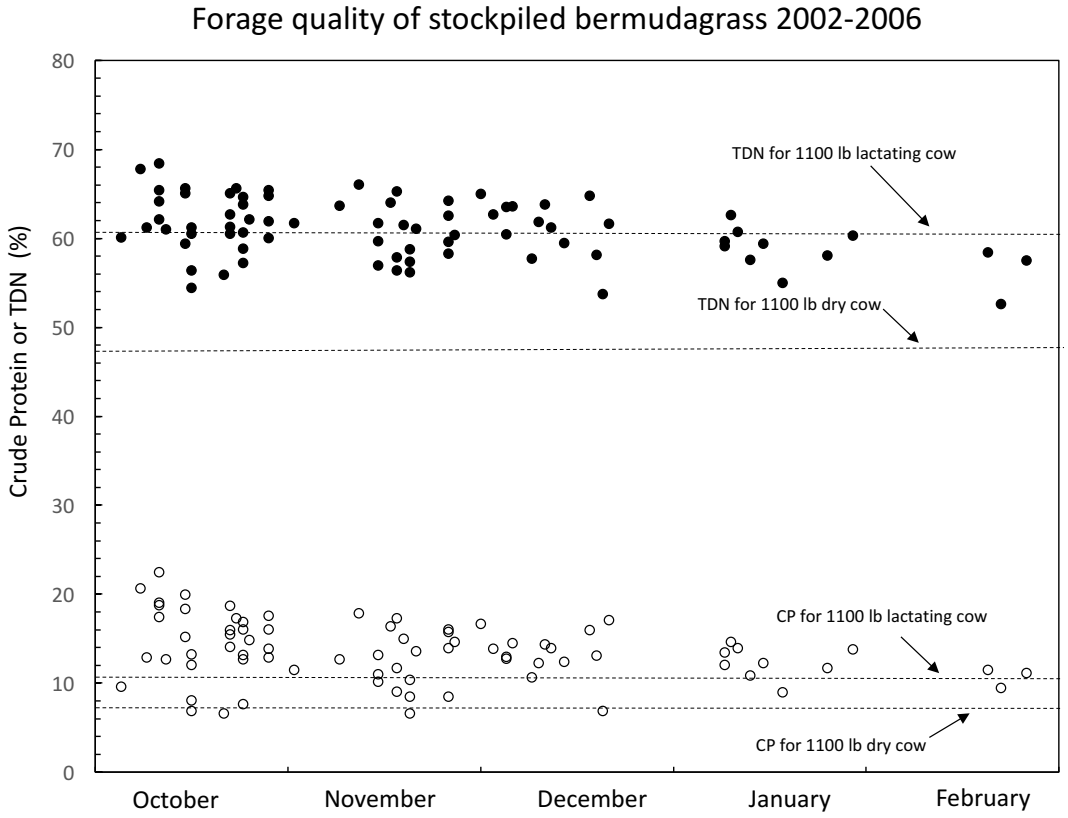

Figure 1. Crude protein and TDN content of stockpiled bermudagrass from October to February in Arkansas on-farm demonstrations from 2002 to 2006.

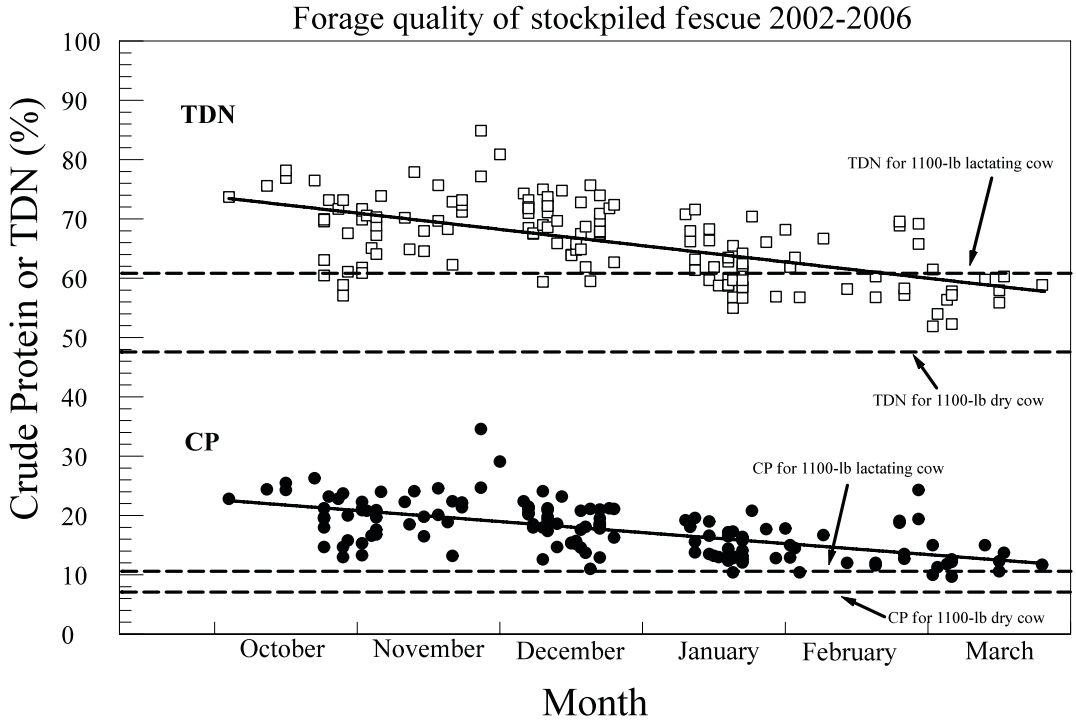

Figure 2. Crude protein and TDN content of stockpiled fescue from October to March in Arkansas on-farm demonstrations from 2002 to 2006.

requirements for lactating cows. Stockpiled bermudagrass quality averaged 13.4% CP and 60% TDN from October through late December. Supplementation may be required in some cases for lactating cows on stockpiled bermudagrass. Forage quality was highest in October and November and declined through the winter.

Although the forage analysis indicates moderate to high forage quality for stockpiled fescue, daily gains of growing cattle grazing stockpiled fescue are often lower than expected for this range of forage quality. The cause is likely due to lower forage intake caused by toxic effects of the fescue endophyte. When stocker calves grazed stockpiled fescue from a nontoxic endophyte fescue variety, weight gains were much higher and were similar to gains on ryegrass pasture (Beck et al., 2008). Growing cattle grazing toxic stockpiled fescue respond well to feed supplementation. Crude protein is usually adequate in the forage, so high-energy supplements provide the most benefit. Supplementation at rates of 0.3% to 1.5% of BW (body weight) has increased average daily gains by 0.1 to 0.5 pound per day.

Most fescue pastures are infected with an endophyte that produces toxicosis in grazing animals. Fortunately, research in Missouri and Arkansas has shown that the level of the ergovaline toxin declines through the winter (Kallenbach et al., 2003) when grazing of stockpiled fescue would occur. However, cows grazing highly infected toxic endophyte fescue pastures during winter occasionally develop a disorder called fescue foot, especially following periods of bitterly cold weather. Typical symptoms include lameness, particularly in the hind feet, loss of tail switches or ear tips, and loss of rear hooves in extreme cases. Animals should be observed for fescue foot symptoms while grazing highly endophyte-infected stockpiled fescue pastures, especially if animals have shown symptoms in the past or are naïve to toxic fescue. If the problem is detected early, affected mature animals usually recover when they are removed from the fescue pasture and fed nontoxic hay or supplement. Fescue foot and fescue toxicosis are not known to occur in cattle grazing varieties of endophyte-free fescue or nontoxic novel endophyte fescue.

Research and Demonstration Results

Producers often ask how many acres of forage should be stockpiled. On many farms, only certain pastures may be available for stockpiling. To determine the optimum acreage to stockpile, a study was conducted at the Livestock and Forestry Research Station at Batesville comparing stockpiled fescue systems where 0, 33% and 50% of the total pasture area were stockpiled. Stockpiling 33% of the pasture area reduced hay fed by 380 pounds per cow over a 49-day grazing period and provided better animal performance than when 50% of the available pasture was stockpiled (Caldwell et al., 2009).

A long-term demonstration project called "Reducing Winter Feed Costs" was conducted in Arkansas with excellent success. Ninety on-farm stockpiled forage demonstrations including fescue, bermudagrass and bahiagrass were conducted across 32 Arkansas counties over a four-year period. Savings from stockpiling forages were estimated based on the cost of fertilizer to grow the stockpiled forage compared to the value of hay and supplement that would have been required to replace the grazing time and animal performance gained from the stockpiled forage. All savings estimates were converted to an AU (animal

unit) basis for comparison across farms. One AU is defined as the daily energy requirement for a mature 1,000-pound non-lactating cow. Average savings per AU for stockpiled bermudagrass (including stockpiled bahiagrass and dallisgrass) were $22.74, $13.93 and $23.76 for 2003, 2004 and 2005, respectively. Average savings per AU for stockpiled fescue were $17.79, $18.85, $12.52 and $29.07 for 2002, 2003, 2004 and 2005, respectively. The amount of forage produced during the stockpiling period was calculated as AU grazing days per acre. This value describes the carrying capacity of the stockpiled pasture and is calculated as the number of AU × number of grazing days divided by number of acres grazed. Over the duration of the project, the average forage production ranged from 68 to 93 AU grazing days per acre. Some farms were able to achieve between 100 and 200 AU grazing days per acre. For stockpiled fescue, strip grazing increased the average savings by $10 per AU compared to farms using continuous grazing. Based on our surveys, 89% of producers planned to continue the practice, and 100% of county agents planned to continue promoting stockpiling forages.

Grazing Management

Stockpiled forage can be valuable under any grazing method, but length of the grazing period can be increased substantially by using improved grazing practices. If cattle are allowed to continuously graze the entire pasture with unrestricted access to the stockpiled forage, the potential grazing period will be shortened because of waste and trampling damage to the ungrazed forage. However, strip grazing stockpiled forages using temporary electric fence can offer the highest utilization of the pasture. In Arkansas demonstrations, strip grazing management doubled the number of AU grazing days per acre compared to continuous grazing of the entire stockpiled pasture. For strip grazing, a single strand of temporary electric fence wire is placed across the field to allow the herd access to a strip of pasture large enough for a two- to three-day grazing allotment. After cattle graze each strip of forage, the electric wire is advanced across the field to provide fresh strips of forage. Some producers found that two wires work better for strip grazing. One wire limits the cattle to the strip being grazed and the other wire is placed one strip ahead to prevent the cattle from moving across the entire field each time a new strip is offered. Only one wire needs to be moved each time in an alternating pattern to provide a fresh strip of forage. Grazing should begin on the end of the field nearest the water source. This reduces trampling damage to the remaining forage because the cattle travel back across the grazed area for water. A back wire is not needed when grazing dormant stockpiled forages so the cow's loafing area becomes larger as each strip is grazed. For pastures with the water source near the middle of the pasture, simply strip graze each side of the pasture starting at the water source. Place a second fence wire to restrict access to the half of the pasture that is not being grazed until grazing of the first half is finished.

Estimating Strip Length for a Strip Grazing System

Fairly accurate estimates can be made for how much pasture to allocate for the herd in a strip grazing system. The three pieces of information needed are: 1) the daily forage dry matter requirements of the livestock being grazed, 2) an estimate of the forage yield available in the pasture and 3) the width of the pasture to be grazed. The following example shows how to determine strip size.

EXAMPLE: A herd of 50 dry nonlactating beef cows with an average weight of 1,100 pounds each will graze on stockpiled fescue. The forage is 10 inches tall and is thick with uniform density across the pasture. The pasture is 25 acres and is 650 feet wide. The field will be strip grazed using a single electric fence wire that will be moved twice a week to provide a new strip of pasture.

An overall equation for this method is shown here but will be simplified in this example:

$$\frac{\text{Number of head} \times \text{average weight} \times \text{forage intake as \% BW} \times \text{number of days} \times 43{,}560}{\text{Forage height} \times \text{lb forage/inch of height} \times \text{\% grazing utilization} \times \text{field width}}$$

Step 1. Estimate animal forage intake requirements.

Number head x average weight x daily forage intake as % of body weight = lb per day for the herd

The daily forage intake as a percent of body weight for nonlactating dry cows is about 2% of their body weight; for lactating beef cows, it is about 2.5% of body weight; and for stocker calves, it is about 3% of body weight. In this example, the cows are dry, so the daily forage dry matter requirement is 2% and is calculated as follows:

50 cows x 1,100 lb x 0.02 = 1,100 lb of forage dry matter needed per day for the entire herd

Step 2. Calculate the amount needed for moving the fence twice a week.

1,100 lb needed per day x 3.5 days = 3,850 lb of forage dry matter needed twice a week

Step 3. Estimate the forage yield.

Forage height x estimated lb per inch of height per acre = lb forage per acre

Use the table at right to select the average yield of forage per inch of height. Sincethe fescue stand is uniformly thick over the field, an above-average value of 300 lb/acre/inch is selected.

10 inches x 300 lb per inch = 3,000 lb of forage dry matter available per acre

Estimated forage dry matter yield per acre based on forage height

	Dry Matter - Pounds per acre per inch of height*	
	Average	**Range****
Bermudagrass	260	150-500
Fescue	210	100-350

* Average yields assume forage in good growing condition.
** Range represents thin, unmanaged stands up to thick, highly managed stands.

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Step 4. Estimate forage needed based on grazing utilization.

Cows don't eat all the forage, so a utilization factor must be used. With strip grazing and moving to new strips twice a week or more, forage utilization is high, and the cows will eat about 70% of the available forage. In this example, the total amount of forage available to graze based on estimated utilization is calculated as follows:

3,000 lb/acre of forage per acre x 0.70 utilization = 2,100 lb available to graze per acre

Step 5. Calculate the number of acres needed for a 3.5-day period.

Divide the pounds of forage needed by the pounds of forage available per acre.

3,850 lb needed / 2,100 lb available = 1.83 acres needed for 3.5 days

Step 6. Calculate the distance to advance the wire for 3.5 days of grazing.

There are 43,560 square feet in an acre, so the strip length is calculated as follows:

(43,560 / field width) x number acres needed = length of strip in feet

The pasture is 650 feet wide and 1.83 acres are needed per 3.5 days, so

(43,560 / 650) x 1.83 acres = 123 feet

A strip of 123 feet by 650 feet should provide this herd grazing for 3.5 days. Close observation of grazing for the first strip will show the accuracy of this estimate. If the estimate proves to be incorrect under actual grazing conditions, simply make the next strip larger or smaller as needed.

Plugging all the above information into the original equation gives the same result:

$$\frac{50 \times 1{,}100 \times 0.02 \times 3.5 \times 43{,}560}{10 \times 300 \times 0.70 \times 650} = \text{123-ft strip for 3.5 days of grazing}$$

Summary

1. Stockpiled forages are a cost-effective alternative to feeding hay during winter in Arkansas. Stockpiled forages can reduce winter feed costs by $20/AU or more compared to feeding hay and supplement.
2. Forage quality of stockpiled forage is adequate for nonlactating cows and for lactating cows through much of the fall and early winter.
3. Stockpiled fescue can be an effective winter pasture for non-breeding horses.
4. Ammonium nitrate fertilizer can be applied in late summer without N loss. Nitrogen from urea is expected to be as efficiently used in stockpiled forage growth as ammonium nitrate.
5. Strip grazing can increase the savings per AU and can double the grazing days per acre over continuous grazing.

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