STOCKPILING TALL FESCUE: COST & RETURN

Greg Halich
Assistant Extension Professor
Agricultural Economics
University of Kentucky
Phone: (859) 257-8841
E-mail: Greg.Halich@uky.edu

Introduction:

An opportunity that Kentucky cattle farmers have in reducing their hay requirements is to apply nitrogen on select pastures to stockpile for fall and winter grazing. By increasing the total pasture production during this time period, the grazing season can be extended and the amount of hay required can be reduced.

While this concept is pretty straightforward, the challenge each year is to determine the likelihood that this practice will be profitable given the economic and agronomic conditions present at mid-summer. While there can be significant benefits from this practice, there are also significant costs. These benefits/costs must be quantified and compared in order to assess the overall profitability of the practice. The model used in this analysis has the ability to quantify and the costs and benefits, and to make adjustments each year to match current conditions.

Agronomic Basics for Stockpiling Pastures:

Stockpiling late summer pastures in Kentucky typically means applying nitrogen (N) to tall fescue pastures in August, letting them grow through the fall, and then grazing during the late fall and early winter. The best pastures to target are those with the thickest stands of fescue. Fescue responds extremely well to N applications in late summer and has an amazing ability to retain its nutrient value through the winter. Targeted pastures should have low concentrations of weeds and low amounts of clover since legumes do not stockpile well after frost and the yield benefit of added N is less than in pure fescue stands. Moreover, N has the potential to reduce the clover component of the sward as the additional fescue growth will compete with the legumes. A good rule of thumb is that where clover makes up more than 20% of the stand, the short-term yield increase from nitrogen will not typically outweigh the long-term forage quality and nitrogen fixation benefit of the lost clover.

Pastures should be grazed or mowed to reduce fescue height to 2 to 3 inches during early to mid-August. Grazing or mowing removes low quality summer growth and allows the plant to produce high quality leaves. With adequate soil moisture, a considerable amount of growth will occur within four to six weeks, but waiting 8 to 12 weeks before grazing is preferable.

The optimal time to apply N is in early to mid-August. Prior applications may encourage the growth of weedy grasses like crabgrass. Waiting until September will reduce the efficiency of N conversion into plant growth. For example, one Kentucky study showed that N conversion efficiency (lbs dry matter fescue growth per unit N) was 27:1 on Aug 1, 26:1 on Aug 15, 19:1 on Sept 1, and 11:1 on Oct 1. N response efficiency also depends on soil moisture. Without rain and/or adequate soil moisture, N response will be low, but even with small amounts of rain tall fescue has an amazing potential for fall growth.

Traditional "stockpiling" involves keeping cattle off the pasture until late fall, but this practice may be difficult when pasture production is low. If forage is needed, N fertilized pastures can be grazed in the early fall, but it is recommended that cattle be kept off these pastures for at least a month. An alternative strategy is to feed hay during the stockpiling period to supplement the pastures that cattle are on.

There are several forms of N available for pasture use, but the two main types are ammonium nitrate and urea. Ammonium nitrate is an excellent form to use in late summer because it is not subject to surface volatilization. However, ammonium nitrate is becoming increasingly difficult to purchase due to Homeland Security measures. Urea is generally a cheaper source of N, but a significant amount of N can be completely lost under hot, humid, and dry soil conditions favoring volatilization. Typical urea losses in late summer range from 15-30%, but can approach 40-50% when there is no rainfall for several weeks after application. Fortunately, urease inhibitors (e.g. Agrotain) have been recently developed to reduce volatilization losses with urea (see AGR-185 at http://www.ca.uky.edu/agc/pubs/agr/agr185/agr185.pdf). Even though they add to the overall cost, urease inhibitors are recommended in the summer for urea due to the unpredictable rainfall in August. The most effective urease inhibitors will typically prevent volatilization for two weeks without rain, compared to pure urea where volatilization begins immediately after application. Be aware that all urease inhibitors are not equally effective.

Besides the application of N, it is important that stockpiled fields be limed and fertilized with P and K to acceptable levels (see AGR-1 at http://www.ca.uky.edu/agc/pubs/agr/agr1/agr1.pdf).

Where possible, stockpiled tall fescue fields should be strip grazed and stocked heavily enough to graze down each paddock in 7 to 10 days or less. This allows the forage to be efficiently utilized without excessive trampling and waste. Since tall fescue does not re-grow in the winter, a back fence is not needed when strip grazing stockpiled growth.

Greater detail of the stockpiling process can be found in the UK extension publication AGR-162 "Stockpiling for Fall and Winter Pasture" which can be found at: http://www.ca.uky.edu/agc/pubs/agr/agr162/agr162.pdf

Agronomic Summary:

1. Mow or graze pasture early to mid August.
2. Remove cattle from pasture.
3. Apply 30-80 units N per acre.
4. Allow pasture to grow into late fall.
5. Strip graze if practical.

Potential Savings from Applying Nitrogen to Tall Fescue Pastures:

The analysis used here accounts for the major factors that impact the profitability of nitrogen applications to late summer tall fescue pastures, and includes the price of nitrogen, price of hay, response rate of nitrogen, labor costs of feeding hay and stockpiled fescue, waste rates, nutrient recycling of hay, and forage quality. For example, as the price of N increases, profitability of the practice will decrease. As the price of hay increases, profitability will increase. As soil moisture conditions improve, profitability will increase. This analysis determines the changes in net revenue from late summer nitrogen applications of 40 and 80 units (120 lbs and 240 lbs of ammonium nitrate respectively) compared to the no application situation. Changes in profitability are based on a 30-cow, spring-calving herd.

Two of the most important factors in this analysis are the price of nitrogen and the price of hay. The price of nitrogen was evaluated on an elemental (lbs actual N) or unit basis[1] in 2011 between $.65-.85 per unit[2] which were representative of prices in mid-July. For urea, you need to multiply the actual price by 1.2-1.4 to get an effective price (or use a lower response rate). Hay values were evaluated on a per ton basis between $40-70. These values should capture most of the variability in market conditions that is likely to occur this year. Multiple scenarios are evaluated and you need to use their best judgment for anticipated price(s) including those outside the range presented here.

The application cost for spreading the nitrogen was set at $5/acre. Waste rates for both grazing and hay feeding (the latter includes both losses from weathering and feeding) were set at 35%. Machinery and labor costs were set to be representative of the average Kentucky cow-calf operation in both size (30 cow herd) and management intensity. This resulted in a labor cost of $.06 per cow day for grazing[3], and machinery and labor cost of $.25 per cow day for hay feeding. Feeding hay results in imported

---

[1] To convert elemental N to urea: Multiply elemental value by 2.17. E.G. 100 units N = 100x2.17 = 217 lbs urea. To convert elemental N to ammonium nitrate: Multiply elemental value by 2.99. E.G. 100 units N = 100x2.99 = 299 lbs ammonium nitrate.

[2] $.65/unit N = $435/ton AmmNit and $600/ton Urea; $.75/unit N = $500/ton AmmNit and $690/ton Urea; $.85/unit N = $570/ton AmmNit and $780/ton Urea.

[3] Assumes open-access to stockpiled pasture (not "strip grazed").

nutrients being deposited in pastures. It is assumed that 50% of the P and K from feeding hay are effectively recycled into the soil at $.57/lb for P_2O_5 and $.52/lb for K_2O.

Three nitrogen response rates were used in the analysis: low, medium, and high. Consult Table 2 to determine which nitrogen response curve is most appropriate for your specific condition. *The choice of response rate is probably the single most important determinant in the analysis*. These response rates are based on a four-year Missouri study. The high response rate used in the model was actually the average of the four years from this study that included both wet and dry years. However, the study site was on deep, fertile soil and would be representative of the best soil types in Kentucky. Thus adjustments needed to be made from this base response rate depending on the soil quality and the specific soil moisture conditions present. University of Kentucky agronomists (Drs. Lloyd Murdock and Ray Smith) adjusted the response functions for various combinations of soil quality and moisture conditions (see Table 2).

In addition to the response rates, the model also separately evaluates pastures that are predominantly fescue, and stands that are a fescue-clover mix. “Fescue-clover” stands in the Missouri study had an average of 20-30% clover (mostly red). “Fescue” stands were on average about 95% tall fescue. Thus if you have a fescue-clover stand that contains 10-15% clover you would probably want to average the results for the two stand types. As mentioned earlier, nitrogen has the potential to reduce the clover component of the sward, so nitrogen applications are not normally recommended where clover makes up more than 20% of the stand.

Results (2011 Example):

Table 1 summarizes the likely cost savings from applying 40 or 80 units of nitrogen on a per acre basis in 2011. Using the most likely price estimates for nitrogen ($.75/unit or actual lbs N for ammonium nitrate) and hay ($50/ton), applying nitrogen resulted in a net loss compared to feeding hay with a low nitrogen response rate for both pure fescue and fescue-clover stands. With a medium response rate applying nitrogen resulted in a net loss in fescue-clover stands and was about a break-even proposition in pure fescue stands. The high response rate resulted in net savings of $14-17 per acre in pure fescue stands and a net loss in fescue-clover stands for these mid-range prices. Thus the only situation (at the most likely hay and nitrogen prices) in which applying nitrogen looks to be profitable this year is in pure fescue stands that have good to excellent soil moisture conditions. Note that even where potential cost savings in the fescue-clover stands exist with the high response rate (if you assume higher hay prices and lower nitrogen prices), this needs to be balanced with the potential loss of clover due to N applications.

Use Table 2 to determine which response function is most appropriate for your soil conditions and then use Table 1 to estimate potential savings (if any) based on your estimates for hay and nitrogen prices. *Make sure to use an appropriately lower nitrogen response rating if applications are to occur after mid-August*.

If you plan to use urea (without an effective urease inhibitor) as your nitrogen source, you need to make adjustments in Table 2 to reflect volatilization losses generally experienced at this time of year. There are two ways to do this: 1) Increase the effective price of the nitrogen. An increase from $.75 to $.85/unit N will approximate a 12% volatilization loss, while an increase from $.65 to $.85/unit N will approximate a 24% volatilization loss. 2) Use a response rating one level below what you would have otherwise. This will approximate a 25% volatilization loss. In either case, you will have to adjust the nitrogen application rates upward by the expected volatilization loss (e.g. if you expect a 33% loss multiply the rate by 1.33).

If your assumptions for waste rates, labor and machinery costs, nutrient recycling rates, etc. are much different than those used here, you will want to run your specific parameter estimates through the model. Please contact me (contact information on the last page) to run custom scenarios.

Looking Back at 2011 Estimates:

Applying N in late summer is always somewhat of a gamble in terms of response rate. In late July, there were few areas in Kentucky that had good soil moisture conditions. Many areas in the state were already dry or quickly approaching this status. Consequently, it appeared that the probability of having a high response rate to the N applications was not very good. August continued this dry pattern and toward the end of the month it did not appear that we would get much fall growth. In early September however, most of Kentucky had a significant rain event from a hurricane aftermath and replenished soil moisture conditions. But given that the beginning of the stockpiling period was very dry (August) the medium response rate is probably the most likely response outcome.

Estimates for Future Years:

As mentioned earlier, the challenge each year is to determine the likelihood that this practice will be profitable given the economic and agronomic conditions present at mid-summer. From a practical standpoint, this is accomplished by using the best information given prices and soil moisture conditions in late July or early August. Each year, multiple scenarios are evaluated in late July and a summary publication disseminated so that users can choose which of these scenarios best fits their situation.

You can go to the following site to find the updated publication (usually available by the end of July): http://www.ca.uky.edu/agecon/index.php?p=169 or contact me directly at Greg.Halich@uky.edu

Table 1 - Cost Savings of Applying Nitrogen to Late Summer Pastures Kentucky (2011)

		Low Response to Nitrogen				*Medium Response to Nitrogen*				*High Response to Nitrogen*			
		Fescue[1]		*Fescue-Clover*[2]		*Fescue*[3]		*Fescue-Clover*[4]		*Fescue*[5]		*Fescue-Clover*[6]	
Price Nitrogen ($/unit)	*Price Hay ($/ton)*	40 units N Savings ($/acre)	80 units N Savings ($/acre)	40 units N Savings ($/acre)	80 units N Savings ($/acre)	40 units N Savings ($/acre)	80 units N Savings ($/acre)	40 units N Savings ($/acre)	80 units N Savings ($/acre)	40 units N Savings ($/acre)	80 units N Savings ($/acre)	40 units N Savings ($/acre)	80 units N Savings ($/acre)
$0.65	*$40*	($11)	($23)	($19)	($36)	($2)	($9)	($14)	($28)	$9	$10	($8)	($17)
$0.65	*$50*	($6)	($15)	($16)	($31)	$4	$2	($10)	($21)	$18	$25	($2)	($7)
$0.65	*$60*	($1)	($6)	($13)	($26)	$11	$13	($6)	($14)	$27	$40	$3	$2
$0.65	*$70*	$4	$2	($10)	($20)	$17	$24	($2)	($7)	$35	$56	$9	$11
$0.75	*$40*	($15)	($31)	($23)	($44)	($6)	($17)	($18)	($36)	$5	$2	($12)	($25)
$0.75	*$50*	($10)	($23)	($20)	($39)	$0	($6)	($14)	($29)	$14	$17	($6)	($15)
$0.75	*$60*	($5)	($14)	($17)	($34)	$7	$5	($10)	($22)	$23	$32	($1)	($6)
$0.75	*$70*	($0)	($6)	($14)	($28)	$13	$16	($6)	($15)	$31	$48	$5	$3
$0.85	*$40*	($19)	($39)	($27)	($52)	($10)	($25)	($22)	($44)	$1	($6)	($16)	($33)
$0.85	*$50*	($14)	($31)	($24)	($47)	($4)	($14)	($18)	($37)	$10	$9	($10)	($23)
$0.85	*$60*	($9)	($22)	($21)	($42)	$3	($3)	($14)	($30)	$19	$24	($5)	($14)
$0.85	*$70*	($4)	($14)	($18)	($36)	$9	$8	($10)	($23)	$27	$40	$1	($5)

Note: Results are applicable for ammonium nitrate. For urea, use a lower response rating or a higher effective N cost to approximate volatilization losses.

Note: $.65/unit N = $435/ton AmmNit and $600/ton Urea; $.75/unit N = $500/ton AmmNit and $690/ton Urea; $.85/unit N = $570/ton AmmNit and $780/ton Urea.

Assumptions Cattle: Spring Calving (late pregnancy in mid-winter); 30 cow herd.

Assumptions Grazing: TDN=65%; Waste=35%; Application cost N = $5/acre; labor cost = $.06/cow/day with open access to entire pasture.

Assumptions Feeding Hay: TDN=55%; DMI=2.0% hay+grain; Waste=35%; labor and machinery cost=$.25/cow/day.

Assumptions Nutrient Value of Hay: Assumes 50% of P and K effectively recycled into pasture; $.57/lb P_2O_5; $.52/lb K_2O.

Fescue[1]: 15.5 lb avg. dry matter response per lb N (80 lb application)

Fescue-Clover[2]: 9.9 lb avg. dry matter response per lb N (80 lb application); savings need to be balanced with potential loss of clover due to N applications.

Fescue[3]: 21.1 lb avg. dry matter response per lb N (80 lb application)

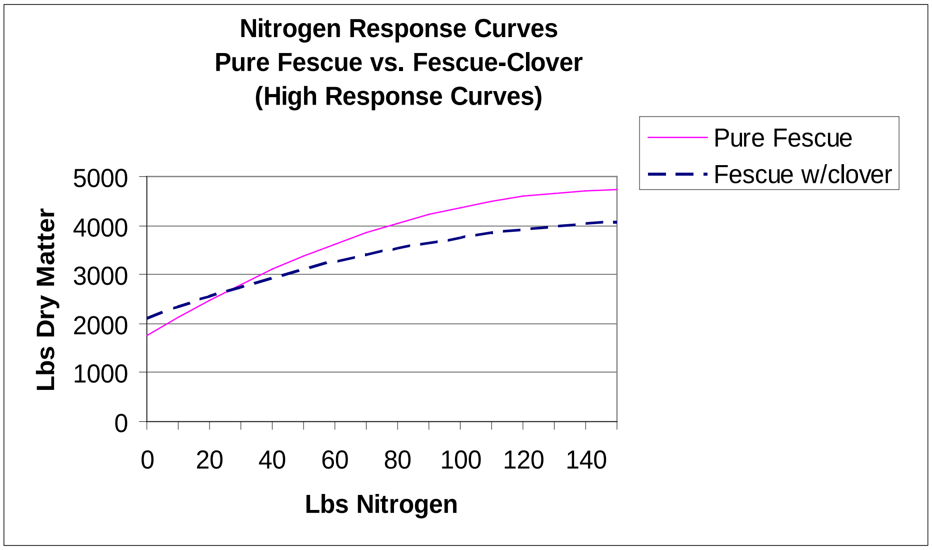
Fescue-Clover[4]: 13.3 lb avg. dry matter response per lb N (80 lb application); savings need to be balanced with potential loss of clover due to N applications.

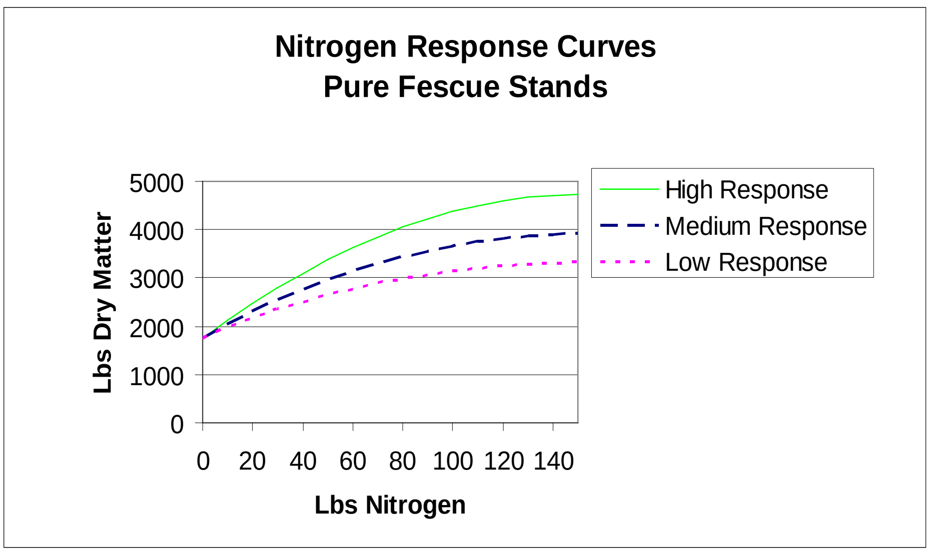
Fescue[5]: 28.8 lb avg. dry matter response per lb N (80 lb application)

Fescue-Clover[6]: 17.8 lb avg. dry matter response per lb N (80 lb application); savings need to be balanced with potential loss of clover due to N applications.

Greg Halich, University of Kentucky Department of Agricultural Economics; 859-257-8841; Greg.Halich@uky.edu

Table 2 – Recommended N Response Rating Based on Soil Type/Moisture Condition			
	Soil Moisture Conditions		
Soil Type	***Ideal***	***Avg.***	***Low***
Excellent	High	Med/High	Low/Med
Good	High	Medium	Low
Fair	Med/High	Low/Med	Low
Note: *N should be applied by mid-August for maximum effectiveness. Use appropriately lower N response rating for later applications.*			
Based on consultations with faculty at the University of Kentucky, Department of Plant and Soil Sciences.			





Options for Getting Water in every Paddock

Kevin Laurent
Extension Associate – Animal Sciences
University of Kentucky
Phone: (270) 365-7541, Ext. 226
E-mail: klaurent@uky.edu

Whether you call it rotational grazing, intensive grazing or management intensive grazing, the economic benefits of controlling how and where your cattle graze are well documented. Increased forage utilization, greater stocking rates, greater legume persistence, reduced hay feeding and more uniform nutrient recycling are just some of the many benefits producers can take advantage of when practicing some form of controlled grazing. However, one of the greatest challenges to implementing a controlled grazing system is the delivery of stock water to the grazing animal.

Water Affects Cattle Performance and Behavior

Water intake drives dry matter intake. In other words, when water intake is limited, dry matter intake decreases and, as a result, performance or gain declines. Research has also shown that when water is available in the paddock near the grazing animal, average daily gains are higher.

The location of water not only affects performance, but also affects the social and grazing behavior of the herd. Studies at the University of Missouri have shown that when cattle must travel more than 800 feet to water, they tend to move as a herd and spend more time loafing at the water point. Conversely, when water was less than 800 feet away, cattle tended to go to water in smaller groups and spent less time at the water point. They also found that grazing distribution was more variable when cattle were forced to travel farther to water. Forage utilization ranged from 50%, closer to the water point (200 feet), to less than 20% farther from the water point (1,100 feet).

System Design and the 800 ft Rule

The overall goal of any water system design should be to keep cool clean water within 800 feet of the grazing animal. This will enhance water intake and performance, increase forage utilization and discourage loafing at the water point. Less time spent loafing at the water trough means improved nutrient recycling. Since cattle excrete approximately 80% of the N, P, and K they consume, encouraging this return of nutrients to the growing pasture is obviously more beneficial than it being deposited in waste areas at the water point.

Building permanent water points in every paddock is a costly proposition and restricts paddock design changes. In most cases, it is more economical to base your design off of existing water resources. Natural water points such as ponds, creeks and springs may be utilized if cattle access is limited. Use electric fencing to limit cattle access to the entire pond or creek bank. Additionally, coarse rock and geotextile fabric can be used at these areas to prevent erosion and discourage wading or loafing. Cattle do not like to stand on coarse rock for any length of time.

Permanent Water Points and the Use of Lanes

The use of lanes leading to a central permanent water point has in some cases been a viable solution to water access for controlled grazing systems. Lanes have a distinct advantage when it comes to moving or sorting cattle for treatment or artificial breeding. But the continued use of lanes can lead to erosion and adversely affect nutrient recycling. Missouri research has shown that when lanes were used for water access, 13% of manure was deposited in the lane and not on the pasture. These potential problems must be weighed against the convenience of utilizing lanes for delivering stock water.

The Seasonal Water System Concept – Move the Cattle and Move the Water

A low cost option for delivering water to grazing cattle, which has evolved over the last 20 years, is the use of lightweight 60 gallon portable tubs with full flow valves. These tubs combined with quick coupler fittings, borrowed from the irrigation industry, have revolutionized water delivery in controlled grazing systems. The quick couplers work much like a hydraulic coupler on a tractor. Water from the pipeline only flows into the tub when the hose leading to the tub is plugged into the coupler. So by strategically locating quick couplers along the pipeline, water can be accessed anywhere it is needed. Logically, couplers should be located where they can serve multiple paddocks, however, at $18 a piece the added flexibility of including extra couplers in the system is money well spent. The concept is very simple. When you move the cattle to the next paddock or pasture, you simply uncouple the tub, dump the water and move the tub to the quick coupler in the next paddock. In essence, the water moves with the cattle.

There are basically two options of pipe to use in a seasonal water system. Conventional PVC which must be buried and high density UV- stabilized polyethylene pipe (PE3408/ASTMd2239) which can be used in above ground applications. The cheapest and simplest short term option is an above ground application using the high density pipe. For most small operations, one day of rolling out pipe and attaching couplers is all that is needed to have water in every paddock. From a personal standpoint, I have used this type of system for nearly ten years on rented property and it has held up very well. However, it does have some obvious drawbacks. The pipe is exposed to field work and mowers and although the pipe is very flexible and can be driven over, it must protected anywhere it will be crossed repeatedly such as gateways. Also, the system must be drained at the end of each grazing season to prevent bursts from winter freezing. One great advantage of an above ground system is flexibility. Any changes in paddock design can easily be accommodated by simply dragging the water line to a new location. Also, location of couplers can be changed to reduce waste areas around the water point.

Over the long haul, a below ground system is probably the best option, especially on land you own. Water from below ground systems will be cooler and PVC pipe, which is slightly cheaper than the high density pipe, can be used. The longer life of a below ground water line should more than offset the extra cost of burying the line. Access to quick couplers in a below ground installation can be accomplished by using 6-inch Schedule 20 PVC pipe, drain tile or plastic water meter housing. If using PVC as an access tube, a 6-inch PVC cap (which is pretty costly) or an old disk blade will serve as a cover when not in use.

Keys to Making it Work

There are several rules to follow to ensure success with small portable tanks.

1. **Keep water within 800 feet of the grazing animal.** This will discourage herd movement and loafing time at the water point.

2. **Protect the tank and coupler.** Never allow cattle to have full access to the tub. This can be accomplished by locating the tub slightly under a polywire fence.

3. **Maintain a minimum flow rate of 6 gallons per minute.** A properly placed 60-gallon tub allows three cows to drink at one time. Since cattle can drink approximately 2 gallons per minute, a 6-gallon flow rate will allow the tank to recharge as the cattle drink. Pipe size, pressure and elevation all affect flow rate. Seek help from your county extension agent or local NRSC before purchasing pipe.

4. **Do not provide shade at the water point.** Shade + water = mud and waste. Anything that encourages cattle to loaf in one area means fewer nutrients are being recycled on the growing pasture.

Stock Water for Winter Grazing

One of the great resources we have in Kentucky is our fescue forage base which, when Mother Nature cooperates, can provide a tremendous amount of low cost winter grazing. Obviously, seasonal systems with exposed tubs are not an option for winter stock water. However, the beauty of the seasonal system is that it is not needed during the winter anyway. Cattle water intake during the winter is approximately half of summer intake. Additionally, cattle are not as attracted to the water source as they are during the summer and are willing to graze further from water. The 800-feet rule can be broken at this time of the year. So strip grazing stockpiled fescue, beginning at the permanent winter water source, becomes a simple and effective strategy. Cattle spend most of their time during winter grazing out on pasture next to the strip graze fence. Therefore, this is where most of the dung pads will be found providing yet another advantage to strip grazing.

Will Water Development Pay?

Most producers will agree that the money they spent on water development was one of the best investments they ever made for their operations. In 1995, Missouri researchers found that by keeping water within 800 ft. of cattle, carrying capacity could be increased by 14% due to better forage utilization. They estimated this advantage to be worth an additional $35 per acre in gross annual income at the time of the study.

Costs for water development can vary a great deal depending on the system. The table below gives current estimates for an above ground, below ground and a combination of below/above ground systems for a 50 acre farm. Total costs per acre ranged from $23 to $162. Using the additional gross annual income of $35 from the 1995 Missouri research, water development could possibly pay for itself in as little as 1-5 years. Producers should also check with Extension and NRCS personnel for the availability of cost share assistance and for professional help in designing watering systems.

Estimated Costs for Water Development – 50 acre farm

Item	No	Unit cost	Below Ground	Above Ground	Combined System[1]
Below ground pipe (1" PVC 480 psi)	2000 ft.	$2.25/ft.	$4500		$3375
Above ground pipe (1" Poly 160 psi)	2000 ft.	$0.50/ft		$1000	$250
Insulated drinkers	3	$1200	$3600		$2400
Portable tank (60 gal.)				$165	$165
Total costs			$8100	$1165	$6340
Total cost per acre			$162	$23	$127
Annual cost/acre[2]			$5.40	$2.30	$3.85
Required annual increase in output to pay for the system			$270	$115	$193

[1]Combined system - 1500 feet of buried pipe and 500 feet of above ground pipe
[2]Annual cost/acre - 30 year life for buried system and 10 year life for above ground system