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F O R E W O R D

This marks the eleventh consecutive year we have had a Forage Symposium to kick off the Kentucky Cattlemen's Convention. We challenge you to consider the content of the proceedings and the discussions of the day in light of your overall beef-forage program. It is our hope you will go away with at least one idea or practice that you can implement to improve your overall forage-animal program.

On behalf of the program committee, I want to thank Mr. Dave Maples and all the fine folks at KCA for their support, assistance and encouragement. In addition, I want to thank the Kentucky Forage and Grassland Council for their continued support of Forages in Kentucky. My thanks to Dr. Ray Smith, Dr. Bill Witt, Mr. Tom Keene, and Dr. Glen Aiken for their presentations and papers for the proceedings.

Special THANKS are extended to Mrs. Christi Forsythe for her extra effort in program planning and in preparing and editing the proceedings.

Let me close by extending a special invitation to attend the Heart of America Grazing Conference at the Cave City Convention Center on January 25-26 and our 26th Kentucky Alfalfa Conference to be held at the Fayette County Extension Office in Lexington, February 23.

Garry D. Lacefield
Program Chairman

T A B L E OF C O N T E N T S

USING LEGUMES TO RENEW GRASS PASTURES

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Legume content in Kentucky pastures has been reduced dramatically as a result of the drought and high temperatures of 2005 and very muddy conditions this past winter. In addition, late-winter early-spring seedings during 2004 were not as successful as normal due to excessive moisture during the establishment periods. As a result of our reduced amount of legumes in pasture and the many advantages legumes have for improving Kentucky pastures, serious considerations should be given to renovating pastures in 2006.

To renovate means to improve. When we apply the term "renovate" to pastures, it often leads to a variety of definitions. All cattlemen know that they can improve their pasture productivity and quality through proper fertilization, selecting improved species and varieties, controlling weed, disease and insect pests, and proper grazing and hay harvest management. All of these and other practices certainly can have a marked influence on pasture productivity, quality, and stand persistence. For the purpose of this discussion "renovation" is defined as the establishment of legumes into grass dominant sods.

There are three important reasons why grass pastures should be renovated: 1) legumes improve production, 2) legume-grass mixtures provide high quality feed, and 3) legumes are able to utilize atmospheric nitrogen.

1. Legumes Increase Production

Most of the growth of cool-season grasses (tall fescue, orchardgrass, bluegrass, timothy, etc.) occurs during the first one-third of the growing season. Deep-rooted legumes make more growth during the summer months than do cool season grasses. As a result, legume-grass mixtures improve the seasonal distribution of pastures over that of grass alone.

In addition to improved summer production, renovation of cool season grass pastures usually increases total yield. Many studies have shown increased dry matter production of cool season grasses when renovated with legumes. Table 1 shows dry matter production of tall fescue-red clover and tall fescue-nitrogen. In this study, six pounds of red clover renovated into tall fescue sod was worth more in total production than tall fescue fertilized with 180 lbs/N/Ac. Similar results have been shown with other cool-season grasses (Table 2). In addition to dry matter production, crude protein production per acre is also increased when legumes are present.

Table 1. Dry matter yields of fescue-clover vs. fescue-nitrogen – Lexington, 1978, 2 yr. average.

Treatments	Yields, lbs/a
Fescue-Red Clover	
6# Seed/Acre	11,100
Fescue + Nitrogen	
0 lb/A	3,900
90 lb/A	6,700
180 lb/A	9,900

Taylor, T.H., et.al. University of Kentucky

Table 2. Clover percentage, dry matter and crude protein yields of second year orchardgrass-red clover mixture – Lexington, 1974.

Total dry matter (lbs/A)	Clover, %	Crude Protein ((lbs/A)		
		Grass	Clover	Total
11,783	57	721	1,348	2,069

Templeton, W.C. 1975. University of Kentucky.

2. Legumes Provide High Quality Feed

Renovation of grass dominant fields usually improves the quality of the feed. Higher quality forages result in better animal performance. Legumes improve quality by their positive effects on such things as palatability, intake, digestibility, and protein and mineral contents.

Legumes are normally higher in quality than grasses, but within each group there can be a wide range of quality. When grasses and legumes are harvested at the proper stage of plant growth, legumes are usually higher in total digestibility, rate of digestion, protein, many minerals and vitamins. The acid test of any feed quality is animal performance. Many research studies have shown that legume or legume-grass mixtures stimulate liveweight gains, animal growth, milk production, and reproductive efficiency above that for grass alone or grass fertilized with nitrogen.

Tables 3 and 4 show improved performance of animals consuming legume-grass over grass alone. Conception rates are also improved when legumes are present in the diet (Table 5).

Table 3. Animal performance on grass vs. legume-grass mixtures.

Species	Length of Trial/Yrs	Gain/Head	Animal Class	State
		- lbs/day -		
Tall Fescue	3	0.12	Cows	Indiana
Tall Fescue-Red & Ladino Clover		0.74		
Tall Fescue	3	1.30	Calves	Indiana
Tall Fescue-Red & Ladino Clover		1.80		
Orchardgrass	10	1.07	Steers	Virginia
Orchardgrass-Ladino Clover		1.28		

Table 4. Average daily gain and gains per acre of steers grazing tall fescue and tall fescue-clover pastures.

Pastures	Average Daily Gain	Gains	
		Steer	Acre
	- Lbs -		
Tall Fescue-Ladino Clover	1.53	307	582
Tall Fescue + 150 lb N/Acre	1.06	203	374

Hoveland, C.S., et.al. 1981. Bulletin 530. Auburn.

Table 5. Conception rates on grass vs. grass-legume pastures.

Species	Conception Rate %	State
Tall Fescue	75	Illinois
Tall Fescue-Legume	89	
Tall Fescue	72	Indiana
Tall Fescue-Clover	92	

3. Fixation of Atmospheric Nitrogen

All plants must have nitrogen for normal growth and development. The only way most plants can get enough nitrogen for maximum growth is from commercial fertilizers. Legumes are different, and this difference is one of the most important reasons for growing legumes.

Legume seed can be inoculated with bacteria at seeding. These bacteria will infect the roots of the legume plant and form small "knots" or nodules on the plant roots. Properly managed legume plants supply energy in the bacteria which they use to change the form of the nitrogen taken from the air to one which the legume plants can use to make protein and other nitrogen containing compounds. Table 6 shows nitrogen fixing capacity of different legumes under Kentucky conditions and value of nitrogen fixed at current nitrogen prices.

Table 6. Value and amount of Nitrogen fixed by various legumes.

Crop	N fixed, lb/A/year	N value, $, @ 25¢/lb	35¢/lb	45¢/lb	55¢/lb
Alfalfa	150-250	38-63	53-88	68-113	83-138
Red clover	75-200	19-50	26-70	34-90	41-110
White clover	75-150	19-38	26-53	34-68	41-83
Vetch, lespedeza, and other annual forage legumes	50-150	13-38	18-53	23-68	28-83

Many techniques are now available for adding legumes to grass pastures including: overseeding, tillage followed by overseeding, chemical treatment followed by overseeding, and many types of drills and renovators. Each method has both advantages and disadvantages and producers should evaluate these methods in light of their own operation and select one or more method that will be most successful for them.

Regardless of the seeding method used, the following five steps are "keys" to successful renovation:

1) Graze or mow the grass close prior to renovating. This will let tillage tools tear into the sod more easily. Don't plant legume seed into tall grass. The grass shades legume seedlings and reduces their growth.

2) Test the soil and apply needed lime, phosphate and potash. If possible, lime should be applied several months before renovating. Don't use nitrogen when you renovate old grass fields. Nitrogen increases grass competition to the legume seedlings.

3) Suppress competition from existing grass by heavy grazing, tillage or herbicides. Seedings can be made with a variety of no-till drills. Broadcast seedings of lespedeza, white clover, or red clover made on top of the ground will often result in good stands if seedings are made in late winter, the grass is grazed extremely short and proper fertility is supplied.

4) Sow certified seed of adapted legumes at the rates recommended for seeding alone. Just before seeding, inoculate seed with proper nitrogen-fixing bacteria if seed is not pre-inoculated.

5) Renovated fields should be kept grazed short until the livestock begin biting off the young legumes. At that time, remove the livestock and allow clover (4-6 weeks) and alfalfa (6-8 weeks) to become established. Thereafter, mow and/or graze the field to best suit the particular legume that was planted.

To put legumes in hay and pasture fields is one thing—to keep a stand in balance with the grass is another. Legumes may disappear because of: (1) need for fertilizers and lime; (2) improper clipping management; (3) improper grazing management; (4) insect damage; (5) diseases; and, (6) drought or other weather related factors.

Pointers for Managing the Established Grass-Legume Mixture

1) Topdress with phosphate and potash according to soil test. Use fertilizer with boron if the legume is alfalfa or if red clover is to be grown for seed. Add lime as needed to maintain soil pH for the legume that is being grown.

2) Clip pastures as needed to remove grass seed heads and control weeds and woody vegetation.

3) Grazing Management: (a) Grass-clover pastures may be grazed from spring to fall, but do not overgraze. Leave 2 or 3 inches of top growth at al times. Some type of rotational grazing is highly recommended. (b) Grass-lespedeza pastures should be grazed hard in April and May, so the lespedeza seedlings will become established. Remove the animals and wait until the lespedeza is 5-8 inches tall before grazing again. (c) Grass-alfalfa mixtures may be grazed successfully if careful grazing management practices are followed. The best plan is to stock heavily and remove the herbage in 5 to 7 days, allow plants to make regrowth for a period of 4 to 6 weeks, then repeat the cycle.

ROUNDUP READY® ALFALFA, NOVEL ENDOPHYTE TALL FESCUE, RED AND WHITE CLOVER, BERMUDAGRASS, AND MORE

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Roundup Ready® Alfalfa

Finally, Roundup Ready® alfalfa is now available and currently varieties show excellent tolerance to Roundup, good disease resistance, and good yield potential. Before making plans to plant 100 acres know that the price in most states is over $7.00 per pound and pre-ordering seed is essential if you want to plant the spring of 2006. Roundup tolerance is a very useful trait in alfalfa, but remember that Roundup Ready® varieties are not superior for other traits. Some current advertisements promote Roundup Ready® varieties as higher yielding and higher quality. These statements are not untrue, but they are based on the fact that weedy stands are lower yielding and lower quality than clean stands. Therefore, if you keep your existing stands weed free, then you will also produce high yields of high quality forage.

The advantages of Roundup Ready® alfalfa are self-explanatory, but let me list a few advantages: Improved likelihood of successful establishment, decreased competition from weeds and/or cover crops, decreased crop injury from herbicides, increased management flexibility, no crop rotation restrictions, decreased herbicide costs, and ease of use. There are a few things to remember when planting these varieties. The first varieties released have about 90% Roundup tolerant plants and about 10% conventional plants. That means when you spray Roundup the first time, you will kill around 10% of your stand. Therefore, know that some alfalfa plant death is normal. Also, make sure to use an early spray even if weeds populations are low. Otherwise, if you did not spray until 6 months after planting, the death of the conventional plants might leave spaces in the field.

Roundup Ready® alfalfa varieties will be available in multiple brands with the same combination of traits/germplasm available to growers in conventional varieties. In August 2005 about 15 Roundup Ready varieties were released from FD3 to FD9. The estimated seed sales in 2005 were 1 million pounds. The estimated sales in 2006 are 4 million pounds.

Grazing tolerance varieties have not been left out and Alfagraze 300 and Alfagraze 600 will be in the marketplace soon. Although both have dramatically

improved disease resistance over the original Alfagraze, the 300 version has a fall dormancy (FD) rating of “3” and the 600 version a FD rating of “6”. Since lower FD ratings equate with greater winter survival, Alfagraze 300 would be the recommended grazing tolerant variety for most of the transition zone. Remember that alfalfa can cause bloat and the option to reduce bloat by mixing with a grass is eliminated during the Roundup spraying phase of the stand. Some producers have decided that it may worth dealing with pure stands of alfalfa for a couple of years in order to clean up a problem weedy field. Then once the stand is weed field they have the option to seed grasses like orchardgrass into the stand. Obviously, this kind of interseeding eliminates Roundup as a weed control option in the future.

Other Improved Alfalfa Varieties

Rather than list the more than 300 alfalfa varieties that are now available for sale in the U.S. and the attributes possessed by each one, I will overview some of the traits present in new varieties and traits to be looking for in the future. Standfast™ is the trademarked name for a new group of alfalfa varieties that have been developed for lodging resistance and faster regrowth. These varieties will be useful where good soils promote lush growth/lodging problems and faster regrowth will allow cutting at shorter intervals.

There are a number of new varieties with resistance to the potato leafhopper and these are much better than the first leafhopper resistant releases. They show high levels of resistance, have good yield potential, and have good resistance to a broad range of disease and insect pests. Hybrid alfalfa continues to make inroads with several new varieties. Grazing tolerance continues to be a useful trait for many producers, but the release of new varieties may slow down a bit due to the merger of two major companies. Almost all new varieties will have good resistance to multiple pests, but it still pays to look closely at the profile of any new variety before purchasing.

Novel Endophyte Tall Fescue

Tall fescue was first planted on a widespread basis in the USA in the 1940’s, and now occupies over 35 million acres across the southeast and transition zone. It is one of the most widely adapted and persistent forage grasses in the country. It’s greatest strength though is also it’s greatest limitation. Early varieties of tall fescue, including KY31, contain an endophyte (fungus) that lives within the plant. The endophyte dramatically improves plant survival and stress tolerance, but this also produces ergot alkaloids that cause fescue toxicosis in ruminant livestock. The most common symptoms of fescue toxicosis include: 1) reduced feed intake, 2) decreased weight gain, 3) lower milk production, 4) higher respiration rate, 5) elevated body temperature, 6) rough hair coat, 7) more time spent in water and/or shade, 8) less time spent grazing, 9) low blood serum prolactin concentration, 10) excessive salivation, and 11) lower

reproductive performance. Fortunately, fescue toxicosis symptoms are rare in horses, with the exception of sometimes severe reproductive problems during the last trimester in pregnant mares.

About 25 years ago, when researchers discovered the endophyte that causes the problem they also realized that it was relatively easy to develop “endophyte free” varieties. These varieties show higher animal gains, but shorter stand life. Along with the release of endophyte free varieties plant breeders have developed soft leaved varieties, the newest of which rival perennial ryegrass in palatability. Improved winter hardy varieties have also extended the range of tall fescue in the U.S. and areas of western Canada.

Recently, a breakthrough occurred with the discovery that some endophyte strains did not produce ergot alkaloids and these endophytes can be inserted into different fescue varieties. Survival and stress tolerance are dramatically improved over endophyte free varieties and livestock symptoms virtually eliminated. These strains are often referred to as novel or non-toxic endophytes with a code designation of E++. Although it is fairly simple for researchers to insert novel endophytes into new varieties, a lot of field research and testing is required to find the right novel endophyte for each tall fescue variety. In other words, just because a variety has a novel endophyte, it should only be planted in areas where the variety is well adapted.

AgResearch was the first company to commercialize novel endophyte tall fescue varieties. They have patented 7-8 novel endophyte strains and therefore have complete control over how these specific strains are used. Much like Monsanto patented the Roundup Ready gene and any company that wants to produce Roundup Ready varieties must work with Monsanto. Other companies and public institutions are also developing novel endophyte varieties, but as with any patent they must prove that their novel endophyte strain(s) are different from the ones patented by AgResearch.

The first novel endophyte variety released in the U.S. was Jesup MaxQ. It was developed as a joint project with AgResearch/University of Georgia/Pennington Seeds. Jesup refers to the tall fescue variety and MaxQ is the name of the novel endophyte strain put into this variety. This partnership is also producing other novel endophyte varieties as well as working with other companies to develop novel endophyte varieties. At present, the only other commercially available novel endophyte varieties are Flecha, a western variety adapted to areas where annual rainfall is less than 20 inches and Advance, a soft leafed variety that is still being evaluated for regional adaptation.

Other University and company labs are exploring their own techniques for developing novel endophyte tall fescue. For example, Dr. Chris Schardl at the University of Kentucky has developed novel endophyte strains in perennial ryegrass using molecular genetic “knock-out genes.” In other words, he has

halted the production of ergot alkaloids from an existing perennial ryegrass endophyte. Dr. Schardl and his lab are now transferring this technology to tall fescue endophytes.

Researchers and producers agree that combining novel endophytes with the best tall fescue varieties is a winning combination. There is still a lot of work to be done and long term survival studies are underway, but “breakthrough” is not too strong a word to use.

Red Clover

Although there are not a lot of new red clover varieties, several companies and Universities have active red clover breeding programs. In some ways, red clover is the easiest species to make variety recommendations for. Simply put, “only plant certified seed of improved varieties, never plant common seed.” University of Kentucky research has shown that the difference between improved varieties and common seed can be 6000 to 10,000 lb/acre in higher yield and 1 to 1 ½ years longer stand life. Sometimes you may “luck up” and find that the bag of cheap common seed you purchased was actually an overstock of an improved variety, but UK variety trials show that 9 times our of 10 certified seed of improved varieties showed higher yield and longer stand life.

Most red clover breeders continue to make small steady improvements in stand persistence through improved resistance to root and crown diseases, but no variety yet has the ability to dependably survive more than 3 growing seasons. There are two new traits that will be useful for producers coming out of breeding programs. One is improved grazing tolerance in red clover. Look at Kentucky’s and other state’s websites for the results from grazing tolerant trials. Another useful trait is the release of varieties with reduced stem and leaf pubescence. Less pubescence mean less dusty hay. About 3 years ago Dr. Norm Taylor (University of Kentucky) released the first low pubescent variety “Freedom!”. As with Roundup Ready alfalfa, seed quantities of Freedom will be tight so get your orders in to Barenburg distributors soon.

White Clover

It is getting a little hard to make sense of new white clover varieties. In the past, the recommendation was to plant an improved variety of ladino white clover. Ladino types are closely related to the common Dutch types that seem to grow everywhere, but ladino white clover is taller with larger leaves that Dutch white. Therefore, larger plants and larger leaves produce higher yields. While that is true, ladino types do not live as long as Dutch whites. In recent years, many producers have stated that they could sacrifice some yield for longer persistence. Therefore, companies are now starting to release intermediate types that are hybrids between ladino and Dutch whites. For the most part, these intermediates look to be a good compromise between their two parents. Make

sure though that you review yield and stand persistence information from variety trial publications before planting new intermediate varieties on your farm. In addition, at least one company and one University have released (or soon will) a true Dutch white ecotype with lower yield, but much better persistence that the ladinos. Ecotype simply means that the variety originated from surviving plants collected from one location or a relatively small area.

Bermudagrass

Improved bermudagrass varieties provide many advantages including high yields, tolerance to close and frequent grazing, dense sod formation with resistant to trampling damage, drought tolerance, excellent summer production, and efficient response to nitrogen. The first improved bermudagrasses were released in the 1930's by Dr. Glenn Burton, USDA-ARS, Tifton, GA. It was not until the development of Tifton 44 though that bermudagrass varieties were winterhardy enough for the transition zone. The limitation of all bermudagrass varieties until recently were that they were sprigged types. These types do not produce seed and have to be planted using above and below ground stem pieces (rhizomes and stolons) placed into the ground similar to rooting cuttings of ornamental plants. Fortunately once they are rooted they quickly spread, but sprigging is a labor intensive and expensive process that many producers have been reluctant to do. There are a number of adapted sprigged types available for the Heart of America region (KY, MO, IN, IL, and OH) including Midland, Midland 99, Hardie, Tifton 78, Quicksand, and others.

Fortunately, plant breeders in recent years have been developing improved seeded bermudagrass varieties. These can be planted with conventional seeders, as long as a shallow seed depth is assured. Many of these varieties produce forage yields almost as high close as the best sprigged types in the transition zone. Seeded types have been available for a long time for the southern U.S., with Arizona Common the most widely available. But these early seed sources did not have sufficient winterhardiness for the transition zone. One new variety that has performed very well is "Wrangler". It has demonstrated good winter survival in Kentucky and Virginia and other transition zone states. Other winterhardy seeded types are being released, but make sure to compare their winter survival to that of Wrangler from state or regional variety trial results. The best comparison is to review stand survival ratings after a severe winter.

AND MORE

Brassica's

Broad-leafed forage plants in the brassica family have long been used where high quality grazing crops are desired. Whether in New Zealand for fattening lambs or in the U.S. to put weight on stockers, the quality and palatability of brassicas is unparalleled. In fact, most brassicas are so rich that a recommended

practice is to fill your livestock up with dry hay before turning them into a brassica pasture. A common brassica for grazing is purple top turnip. Purple top is still available and can be very productive. One limitation of this variety though is that it expends considerable energy producing a large bulb like root structure (the turnip). Although some livestock will eat the turnip, the leaves are the most desirable and the highest quality part of brassicas for grazing animals. Therefore, if you are considering brassicas, then look into some of the newer hybrid taprooted types that produce higher yields, quicker regrowth, and many grow better in the warmer months.

There are many other species in the brassica family that produce high quality forage for grazing. Some are best suited for fall stockpile grazing, other for spring planting/summer grazing, and others are best known for their quick regrowth. There are a number of seed dealers that distribute brassicas including Ampac and Barenburg. Check with your local seed dealer for availability and for the brassica that best fits your situation.

Orchardgrass

Many good varieties are being released with improved disease resistance, stand longevity, and even improved grazing tolerance. Leafy grazing types like “Tekapo” are gaining in popularity for pasture. Several new varieties have been developed for the southeastern U.S. like Persist (TN), Prairie (KY), and a new variety from Georgia.

Festololium

Festololiums are a type of grass that is a hybrid between perennial ryegrass and fescue. Most varieties are crosses with meadow fescue. They are like perennial ryegrass but better with improved summer production, improved winterhardiness, and improved palatability. They are like fescue with high yields, and long term survival, but even the best festololium will not show stand persistence equivalent to an endophyte free tall fescue. Since they are highly palatable it is important to make sure they are not overgrazed.

Annual ryegrass

True annual ryegrass (Westerwolds type) shows rapid establishment with high seasonal productivity during the year of planting. It is a true annual species and produces seedheads during the year of planting. Commonly used to overseed warm season grass pastures across the southern U.S. in the fall.

Italian ryegrass has stand survival for up to two years. It provides high yields of quality forage, quick regrowth, early spring growth, and late fall growth. It requires longer rest periods than perennial ryegrass for maximum production.

Also, Italian ryegrasses rarely produces seedheads during the year they are seeded.

Intermediate or hybrid ryegrass. Developed by crossing perennial ryegrass with Italian ryegrass and shows advantages of both. Higher yield and longer growing season than perennial ryegrass and more persistent and winterhardy than Italian ryegrass.

Perennial ryegrass. Tetraploid varieties are usually higher yielding than diploids with larger leaves and tillers, less ground cover, more disease resistance, and tend to have higher digestibility. Diploid types tend to have finer leaves, produce more tillers, better stand persistence, and are more tolerant to heavy grazing.

Check out the University of Kentucky Forage Website (**www.uky.edu/Ag/Forage**) for more information on variety choices. If you are in Kentucky or a neighboring region simply go to the Forage home page and click on “Forage Variety Trials”. If you are in a surrounding state, then go to the home page and click on “Forage Variety Trials: Other States”.

NEW DEVELOPMENTS IN PASTURE WEED CONTROL

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Weeds in pastures continue to offer challenges to the producer for controlling these unwanted plants. The combination of forage grasses grown in pastures and the climate of Kentucky provides an environment that is conducive for having numerous weedy species. Most pastures have a combination of cool season (those that begin growth in fall and mature in spring or early summer) and warm season (those that begin growth in spring and mature in late summer or fall) weeds. Additionally, some weeds such as thistles severely restrict grazing while other weeds do not. The decision to apply a weed management strategy is often difficult because of the wide array of weedy species and because some weeds cause little forage reduction.

It is not economically practical to control all the weeds that occur in Kentucky's pastures. A pasture weed management plan should address control tactics for those weeds that inhibit grazing, reduce forage yield, are poisonous, or could 'take over' the pasture. Weeds that inhibit grazing possess characteristics that prevent the animal from feeding close to the plant; normally, these plants that contain spines or burs. Weeds in this group are musk (nodding) thistle, bull thistle, Canada thistle, and spiny amaranth (pigweed). All weeds have the potential to reduce pasture yield if they are present in great enough populations—this rarely occurs in pastures where animals graze. Poisonous plants include white snakeroot, wild cherry trees, poison hemlock, and many others. Those weeds that have the ability to 'take over' pastures include eastern red cedar, multiflora rose, and tall ironweed.

Another issue that frequently inhibits herbicide use is the presence of clovers in the pasture. Clovers are highly desirable component of pastures and producers want to maintain the clover stand as long as possible. Unfortunately, most herbicides used for broadleaf weed control in pastures will kill clovers. Because of this issue, producers must decide on a plan of action for weed management that addresses this issue. Weeds such as the thistles or tall ironweed are problematic enough to warrant herbicide treatment. In such pastures, the best approach is to control the weeds and then reseed to clovers.

Herbicides for pastures

The table below contains a list of products available for pastures in Kentucky. It is important to remember that some products are not registered for use in pastures, such as some ester formulations of 2,4-D. Attention to the label before purchasing the product is needed.

Table 1. Herbicide products registered for use in Kentucky. Information below describes those registered for sites related to cattle and products not registered for sites related to cattle.

Herbicide	Pastures	Hayfields	Pasture Fencerow
2,4-D[1]	Yes	Yes	Yes
Banvel	Yes	Yes	Yes
Clarity	Yes	Yes	Yes
Overdrive	Yes	Yes	Yes
Weedmaster	Yes	Yes	Yes
PastureGard	Yes	Yes	Yes
Redeem R&P	Yes	Yes	Yes
Remedy	Yes	Yes	Yes
Crossbow	Yes	Yes	Yes
Milestone	Yes	Yes	Yes
ForeFront R&P	Yes	Yes	Yes
Remedy RTU	Yes	Yes	Yes
Pathfinder II	Yes	Yes	Yes
Cimarron	Yes	Yes	Yes
Cimarron Max	Yes	Yes	Yes
Roundup WeatherMax[2]	Yes	Yes	Yes
Grazon R&P	No	No	No
Surmount	No	No	No
Tordon RTU	No	No	No
2,4-D ester (some products)	No	No	No

[1]Products containing only 2,4-D vary greatly as to what sites are on the labels. Many 2,4-D ester products are not registered for pastures while some are. Refer the label on the product for specific information regarding use in pastures.

[2]Roundup WeatherMax is one of many glyphosate containing products. Refer to the label on the product for specific information regarding use in pastures.

Herbicide active ingredients

Many products used for pasture weed control contain more than one active ingredient. Table 2 contains a list of products for pasture weed control and for control of unwanted vegetation around a farm site. Product names for 2,4-D are too numerous to list in this table; refer to your local pesticide dealer for 2,4-D products available in your area.

Table 2. Herbicide products and their active ingredients.

Product	Active Ingredient	LBS AE/Gal or % AI
2,4-D	2,4-D	3.8
Clarity, Banvel	dicamba	4
Overdrive	dicamba + diflufenzopyr	3.75 + 1.5
Weedmaster, Banvel+2,4-D	2,4-D + dicamba	2.87 + 1.0
Redeem R&P	triclopyr amine + clopyralid	2.25 + 0.75
Crossbow	2,4-D ester + triclopyr ester	2.0 + 1.0
PastureGard	triclopyr amine + fluoxypyr	1.5 + 0.5
Surmount	picloram + fluroxypyr	0.67 + 0.67
Stinger, Transline	clopyralid	3
Remedy	triclopyr ester	4
Remedy RTU	triclopyr ester	0.75
Pathfinder II	triclopyr ester	0.75
Milestone	aminopyralid	2
ForeFront R&P	aminopyralid + 2,4-D amine	0.33 + 2.66
Cimarron	metsufluron-methyl	60% AI
Cimarron Max	metsufluron-methyl +	60% AI
	2,4-D + dicamba	2.87 + 1.0 AE

Grazing and Haying Restrictions

Some herbicide products have restrictions on when cattle can be allowed to graze after application of the product. Also, the interval between product application and harvesting for hay is different for many products. Table 3 contains the number of days from time of application until grazing or haying is allowed. Generally, the most restrictive intervals are for lactating dairy cows. For some herbicidal products, the grazing or haying restriction depends on the amount of product applied.

Several products do not have a grazing restriction which means the animals can be in the pasture at the time of treatment. However, many herbicide users prefer to keep animals off the pasture until the herbicidal spray has dried.

Those products with a 0 day restriction have been approved for this use by the Environmental Protection Agency

Table 3. Grazing and haying restrictions for pasture herbicides registered in Kentucky.			
Herbicide	Beef, Non-lactating dairy	Lactating Dairy	Harvest for Hay
2,4-D amine	0	7 days	30 days
2,4-D ester	0	7	30 days
Banvel	0	<1 pt, 7 days	37 days
	0	1 pt to 1 qt, 21 days	51 days
	0	1 qt to 2 qt, 40 days	70 days
Clarity	0	<1 pt, 7 days	37 days
	0	1 pt to 1 qt, 21 days	51 days
	0	1 qt to 2 qt, 40 days	70 days
Overdrive	0	0	0
Weedmaster	0	7 days	37 days
PastureGard	0	Next growing season	14 days
Redeem R&P	0	Next growing season	14 days. Do not feed to lactating dairy animals
Remedy	< 2 qts, 0	< 2 qts, 14 days	< 2 qts, 7 days
	2-6 qts, 14 days	2-6 qts, next season	2-4 qts, 14 days
			> 4 qts or lactating dairy, next season
Crossbow	0	Next growing season	14 days
Milestone	0	0	0
ForeFront R&P	0	7	30 days
Remedy RTU	<2.5 gal, 0	< 2.5 gal, 14 days	< 2.5 gal, 7 days
	2.5 to 7.5 gal, 14 days	> 2.5 gal, next season	2.5 to 5 gal, 14 days
			> 5 gal or lactating dairy, next season
Pathfinder II	<2.5 gal, 0	< 2.5 gal, 14 days	< 2.5 gal, 7 days
	2.5 to 7.5 gal, 14 days	> 2.5 gal, next season	2.5 to 5 gal, 14 days
			> 5 gal or lactating dairy, next season
Cimarron	0	0	0
Cimarron Max	0	7 days	37 days
Roundup WeatherMax	< 2 qts, 0 days	< 2 qts, 0 days	
	> 2 qts, 8 weeks	> 2 qts, 8 weeks	

New and Relatively New Products

The introduction of new herbicides in any market is relatively rare in today's agriculture. The cost of developing and introducing a new pesticide exceeds $100 million. As a result, any product submitted for registration to the Environmental Protection Agency must have the potential to be used on large acreages. Commonly used pasture herbicides were introduced many years ago: 2,4-D in 1946; Banvel in 1965; triclopyr (active in Remedy, Redeem, Crossbow, Garlon) in 1973.

Below are some of the more recently introduced herbicides. See Table 2 for the active ingredients in the products available for Kentucky pastures.

Overdrive. Good control of many herbaceous weeds. Applied at 4 to 8 oz/A with the higher rates for biennial and perennial weeds. See Table 3 for grazing and haying restrictions.

PastureGard. Good control of woody species such as blackberry, multiflora rose, locust, and osage orange. Rate is 3 to 8 pt/A depending on species; always add nonionic surfactant. High volume spot spray at 1 to 2 % mixture (1 to 2 gallons PastureGard per 100 gallons of water). See Table 3 for grazing and haying restrictions.

Milestone. Registered in 2005 and provides control of musk thistle, bull thistle, Canada thistle, tall ironweed and many other weeds encountered in Kentucky. It should be applied at 3 to 7 oz/A, depending on the weed to be controlled. See Table 3 for grazing and haying restrictions.

ForeFront R&P. Was registered in 2005 and will be available in Kentucky. It has activity on a large number of weeds including the biennial thistles, Canada thistle and tall ironweed. See Table 3 for grazing and haying instructions.

HOW GOOD IS YOUR HAY?

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All hay that is made or produced should have a value placed on it. Because no matter what livestock enterprise that it is earmarked for, there were significant inputs that went into producing that hay. Therefore, it is imperative that we place a value on the hay product(s) that we have produced.

The only real conclusive way to put a monetary value on the hay is to have it analyzed in a certified laboratory recognized by the National Forage Testing Association. Then, designate that hay for the particular livestock enterprise that is best suited for it.

Now, how do we get to that point? It all starts when a particular field or farm is being designated for hay production. There are several questions that we need to ask when the hay making decisions are being made;

Is this hay that I am producing for my own livestock?
Is this hay going to be earmarked for cash hay sales?
Will this hay fulfill all the stored feed needs I have for the upcoming winter season?
If cash hay, what markets am I targeting?
Am I going to do my own marketing or have someone else do it?
Does the market dictate the package size?
What type and size equipment do I need?
Do I have adequate and proper storage?
If cash hay, who will transport?
WHAT TYPE OF HAY SHALL I PRODUCE?

As you can see from this list, many things have to be taken into consideration when making hay. However, just as important as all of these questions are; it is vitally important that we carefully document all inputs from the very beginning of the decision making process. This documentation must be kept from the initial thought “I am going to make hay” all the way through until we document its “sale price” either as a cash hay sale or through our own livestock enterprise.

Once we know what all of our input costs are, we can then begin to place a monetary value on the hay. We really don’t want to “sale” our hay for a loss so

a fair market value should be placed on the hay. That's fairly easy to do in the cash hay market. The cash hay is pretty much driven by supply and demand. You have various tools at your disposal to gauge the current cash hay market.

Word of mouth
Auction quotes
Internet
Local broker
Magazines and newspapers
Producer Meetings

Now comes the trickier part. How do you put a value (how good is my hay?) on hay that you feed to your own livestock enterprise?

We first need to divide our livestock into groups; dry cows, cows with calves at their side, etc. Once we do that we need to calculate what the feed needs (nutrient requirements) are of those particular groups. After that is done, we can then begin to allocate our hay supplies as they best fit each groups' nutrient needs. We surely don't need to feed that dry cow 22% CP alfalfa while feeding that cow with a calf at her side some very mature tall fescue.

That's where our "hay testing" can pay big dividends. Knowing those critical values for protein, fiber, digestibility, etc allows us to get the optimal value out of each particular lot of hay as well as maximum (dry cows probably don't need "maximum") production from each livestock group. This also provides us with a real dollar value for each lot of hay.

If we have excess hay, this may allow us to market our higher quality product for more dollars on the cash hay market. This might even be prudent if all we have is high quality hay….sale the high end hay and purchase other hay for your lesser livestock nutrient requirements at a lower price.

There are many components to making high quality hay. Some of these include; adjust pH and fertility to levels needed by the crop, prepare adequate seed bed, use certified seed and correct seeding rates, control insects and disease, cut at proper stage of maturity. And, after you do all of those correctly, hope and pray that Mother Nature will cooperate with timely rainfall. Brevity does not allow us to follow-up on all the details for making high quality hay.

Effect of various storage methods on hay losses.		
Storage method	Losses	
	Handling and storage	Animal refusal
On the ground	43	66
On gravel	32	49
On tires	37	43
On a wooden rack	31	38
On a wooden rack with plastic cover	12	14
In a pole barn	2	3

SOURCE: B.D. Nelson, L.R. Verma, and C.R. Montgomery IN Southern Forages, 3rd Edition, 2002.

One thing I do want to touch on is storage of the product afterwards. Table 1 shows total losses of up to 66% of our product if we do not do a good job of storage. That's 2 out of 3 round bales lost. Significant dollars are wasted if you do not store our hay properly. All of the input costs for those two bales are essentially ***lost***. The table also shows several storage methods that will reduce storage loss.

In summary, if you really want to know how good your hay is, ask many questions before the initial production begins, make good managerial decisions for production and harvest, have the proper storage necessary, finally market the hay to the appropriate enterprise and then do the math. Only then will you know "How Good Your Hay Is"?

FORAGE SYSTEMS FOR MINIMIZING *HAY AND CONCENTRATE FEED NEEDS*

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Cattlemen typically simplify their pasture management by relying on one or two forages that are well adapted and persist under their targeted levels of management and production. The 5.5 million acres of Kentucky-31 tall fescue in Kentucky is a strong indication how producers in the state rely on the cool-season perennial grass, sometimes in mixture with red or white clover, to meet their grazing needs. An advantage of this approach is that fertilization and grazing management is based on a single growth distribution and set of fertilizer needs. Disadvantages are that yield, growth distribution, and quality of forage may not meet targeted levels of cattle production, and that hay and costly concentrate supplements will be needed during lengthy periods of dormancy and inactive growth. Furthermore, dependence on endophyte-infected tall fescue as the sole pasture forage greatly increases vulnerabilities to fescue toxicosis, fescue foot, and fat necrosis, maladies caused by ergot alkaloids contained in endophyte-infected tall fescue.

Kentucky is located in the transition zone between the temperate north and subtropical southeast, which allows its producers an opportunity to maximize the annual distribution of forage by utilizing both high-quality cool-season grasses and productive warm-season grasses. Producers can plant pastures with different grasses and clovers that vary in their seasonal growth patterns and, therefore, provide forage growth for most of the year and cost effectively reduce a need for hay and supplemental feed. Three examples of forage systems with potential use in Kentucky will be presented and discussed. Considerations when choosing a stocking rate and grazing method also will be discussed.

Forage System: Kentucky-31 Tall Fescue, Novel Endophyte Tall Fescue, and Bermudagrass

This system utilizes both cool- and warm-season grasses to reduce the gaps in forage production. Although clover is not mentioned as a component of the system, over seeding clovers into both cool- and warm-season grasses is encouraged to boost forage quality and reduce the need for nitrogen fertilizer.

Soils and/or terrain may limit a producer's willingness to replace Kentucky-31 in certain pastures or areas of the farm. This is not a problem because these pastures can be restricted to stockpiling forage for late fall and winter grazing. Research conducted by the Universities of Arkansas and Missouri has shown that alkaloids produced by the fungal endophyte of Kentucky-31 are in a low concentration from late fall to early spring, which allows a management option to stockpile late summer and fall growth for grazing during the cold months when hay is typically fed. Nutritive value of stockpiled tall fescue is acceptable for dry cows, but supplemental protein and energy will be needed for other classes of cattle. Grazing of Kentucky-31 pastures in this system should be limited to fall and winter grazing to minimize the detrimental effects that endophyte-infected tall fescue can have on herd performance and health status. Stockpiling should be initiated in middle summer following fertilization Growth in the spring and early summer should be mowed or cut for hay.

Certain acreage can be planted to a novel endophyte tall fescue. Currently, the only novel endophyte tall fescue commercially available is Jesup Max Q, but others are presently being developed for commercial release. Novel endophytes do not produce the ergot alkaloids that cause the maladies associated with the endophyte that inhabits Kentucky-31 tall fescue. Therefore, a non-toxic tall fescue can provide quality grazing in the spring and fall.

Similar to Kentucky-31, the non-toxic fescues offer grazing in the summer; however, it should be mentioned that consumption by cattle grazing non-toxic fescue is not limited by the alkaloids and, as a result, carrying capacity of non-toxic fescue pastures in the summer will likely be lower than with toxic fescue pastures (cattle on non-toxic fescue will not spend their summer under the shade or in the ponds!). To reduce risk of losing stands of non-toxic fescue from abusive grazing in the summer, a warm-season perennial, bermudagrass, can be planted. Bermudagrasses have been released with the cold tolerance to withstand Kentucky winters (Quickstand, Wrangler, Greenfield, and Tifton-44, to name a few). In this system, bermudagrass provides grazing from early June to early September. Bermudagrass persistence and productivity is closely linked with a good fertility program but can provide quality grazing in summer, particularly with adequate rainfall. Furthermore, it can be harvested to produce moderate quality hay. Another component that could be added is to drill rye, wheat, or a mixture of both into bermudagrass sod. The small grain grasses provide grazing in the late winter and early spring before the non-toxic fescue initiates active growth, which further reduces hay needs.

Forage System: Kentucky-31 Tall Fescue, Novel Endophyte Tall Fescue, Bermudagrass, and Warm-Season Annual Grasses

This system uses grasses that were present in the first forage system, but with the addition of a small acreage of warm-season annual grasses, such as

forage sorghum or sorghum-sudangrass hybrids. Management of the perennial grasses is the same as with the first system. Annual, warm-season grasses offer a higher nutritive value than bermudagrass and are generally more productive with dry weather. Therefore, it can provide grazing during dry weather patterns when it is desirable to conserve bermudagrass. Warm-season grasses should be grown adjacent to the bermudagrass to serve a primary purpose of providing high quality creep grazing during the summer. Cows could also be periodically turned into the annual grass to control excessive growth and accumulation.

Forage System: Kentucky-31 Tall Fescue, Novel Endophyte Tall Fescue, and Alfalfa-Orchardgrass

In this system, an alfalfa-orchardgrass mixture replaces bermudagrass to provide high-quality summer grazing (dairy, breeders, pasture finishing, etc.). The mixture would need to be planted in well drained soils with inherent soil fertility. An advantage of this system is an ability to graze the toxic fescue through the early summer (this ability comes with good management!) to allow at least a single cutting of high-quality alfalfa-orchardgrass hay. Orchardgrass in the mixture can provide some grazing in the spring and fall, provided good grazing management is followed.

Stocking Rates and Grazing Management

Changing from a one or two forage system over the entire farm to a multitude of forages in different pastures will require an adjustment in cattle number. Reducing the acreage grazed within a season will substantially increase stocking density. However, it cannot be necessarily assumed that, for example, a reduction of 75% in grazeable acreage of forage will require a 75% reduction in herd size. Stocking rate decisions are typically based on expected forage growth during the most inactive pasture growth periods during the growing season (July and August for tall fescue). A forage system is designed to overcome periods of inactive growth (winter dormancy does not count since growth is nil) by moving cattle from one forage that is declining in growth to one that is actively growing. A reduction in herd size will be necessary reduce the chance of overgrazing, but this reduction in stocking should be compensated by improved consistency of cattle production with a greater growth distribution of quality forage, and a reduction in hay and feed costs.

Although overall stocking rates must be reduced, they must not be reduced to levels that are not profitable. Moderate stocking densities that are profitable can be sustained if grazing is managed using a rotational grazing system. Cost of establishing and managing forage systems justifies that rotational stocking be implemented to provide pasture regrowth and recovery for maintaining production goals.