

**26TH KENTUCKY
ALFALFA CONFERENCE
PROCEEDINGS**

*Volume 26, Number 3
Garry Lacefield & Christi Forsythe, Editors*

FEBRUARY 23, 2006
*Fayette County Extension Office
Lexington, Kentucky*

Sponsored by
University of Kentucky • College of Agriculture • Cooperative Extension Service
Kentucky Forage and Grassland Council

Schedule for the Day

- 8:00 Registration, Visit Exhibits, Silent Auction
- 8:45 Welcome – Dr. Mike Barrett
- 9:00 Selecting Alfalfa Varieties for Yield-Quality-Persistence - Dr. Ray Smith
- 9:20 Advances in Alfalfa Seed Coating – Mr. Bill Talley
- 9:40 Successful Alfalfa Establishment: Principles and Practices – Dr. Gary Bates
- 10:00 Break, Visit Exhibits, Silent Auction
- 10:20 Fertilizing Alfalfa for Profit – Dr. Greg Schwab
- 10:40 Alfalfa as a Grazing Crop – Dr. Garry Lacefield
- 11:00 Storing Alfalfa as Round Bale Silage – Dr. David Ditsch
- 11:20 Moisture Management in Hay Making & Storing – Mr. Tom Keene
- 11:40 Interpreting Forage Quality Test Reports – Dr. Donna Amaral-Phillips
- 12:00 Lunch, Visit Exhibits, Silent Auction
- 12:45 Awards, Silent Auction Results

Marketing Kentucky Alfalfa

Moderator: Mr. Tom Keene

- 1:00 Why are Top Producers Successful? – Mr. Jeff Stephens and Mr. Mike Jackson
- 1:30 Panel Discussion:
- Kentucky Alfalfa: Can We Compete in the Market Place

Panel Members:

Dr. Bob Coleman
Dr. Donna Amaral-Phillips
Dr. Michael Judge
Mr. Jeff Stephens

- 2:30 Adjourn

FOREWORD

This conference marks the twenty-sixth consecutive year we have come together to address problems and potentials of alfalfa. We are certainly encouraged with the interest in and opportunities for alfalfa in Kentucky. We are optimistic that we will observe expansion in acres, yield, and markets. It is our hope that the information presented herein and the discussions of the day will be of value to each of you in your alfalfa program.

On behalf of the Program Committee, I would like to express our thanks to each of you for your faithful participation over the past twenty-six years. I also want to thank all speakers, moderators, committee members, and workers for their many contributions.

My personal thanks to the Program Committee, the Kentucky Forage and Grassland Council, and the Kentucky Department of Agriculture for their encouragement and assistance. I also want to thank all the exhibitors for their important contributions and financial support. A special thanks is extended to Mrs. Christi Forsythe for her assistance in preparing and editing the program and proceedings.

Garry Lacefield
Program Chairman
XXVI Annual Kentucky Alfalfa Conference

**Don't forget to visit our Extension
Forage Website**

<http://www.uky.edu/Ag/Forage>

KENTUCKY ALFALFA AWARDS

The Kentucky Alfalfa Awards Program was initiated in 2000 at the 20th Anniversary of the Kentucky Alfalfa Conference. The Awards Program is funded annually from revenues generated each year for the Silent Auction during the Annual Conference.

Year	Warren Thompson Industry Award	Charlie Schnitzler Producer Award	Garry D. Lacefield Public Service Award
2006	Scott Cooper	George Eckler	Laurie Lawrence
2005	Barney Booher	Roy Reichenbach	Ken Johnson
2004	Gary Coughlin	Minos Cox	Mike Collins
2003	Phil Howell	Lee Robey	Monroe Rasnake Jimmy Henning
2002	Tom Keene	John Nowak	Billy Ray Smith
2001	Bill Talley	Larry Jeffries	Timothy H. Taylor W. C. Templeton, Jr.
2000	Warren Thompson	Sue Schnitzler*	Garry Lacefield

*Accepted on behalf of her father who was tragically killed in a farming accident on March 11, 1991.

TABLE OF CONTENTS

	PAGE
<i>New Alfalfa Varieties</i>	1
<i>S. Ray Smith</i>	
<i>Advances in Alfalfa Seed Coating</i>	6
<i>Bill Talley</i>	
<i>Principles and Practices of Successful Alfalfa Establishment</i>	9
<i>Gary Bates</i>	
<i>Fertilizing Alfalfa for Profit</i>	12
<i>Greg Schwab</i>	
<i>Alfalfa as a Grazing Crop</i>	16
<i>Garry D. Lacefield</i>	
<i>Storing Alfalfa as Round Bale Silage</i>	21
<i>David C. Ditsch</i>	
<i>Moisture Management in Hay Making and Storage</i>	26
<i>Tom Keene and Doug Overhults</i>	
<i>Interpreting Forage Quality Test Reports</i>	29
<i>Donna M. Amaral-Phillips</i>	
<i>Alfalfa Hay for Horses</i>	36
<i>Bob Coleman</i>	
<i>Why Dairy Farmers Need and Want High Quality Alfalfa Hay</i>	39
<i>Donna M. Amaral-Phillips</i>	
<i>Forage Testing Program</i>	41
<i>Michael Judge</i>	

NEW ALFALFA VARIETIES

S. Ray Smith
Forage Extension Specialist
University of Kentucky

Commercial alfalfa breeding companies have continued to make great strides in the development of new varieties with unique traits. New traits include Roundup Ready®, potato leafhopper resistance, hybrids, lodging resistance, rapid regrowth, higher quality, resistance to new diseases, and more... I will address some of these new developments in the following pages. In addition, producers often ask the question: "Are improved varieties really worth the higher seed cost?" Dr. Jimmy Henning recently summarized 24 location years of Kentucky alfalfa yield data and found that the best 5 varieties in each test yielded 0.9 tons/A higher than the checks. Over a 5 year stand life this conservatively translates into more that \$400 added profit. Similar to results summarized by Dr. Dan Putnam in California with greater than \$400 profit for improved varieties over a 3 year stand life. New varieties can make a difference!

Review recent variety test results by going to the Kentucky Forage Website at www.uky.edu/Ag/Forage and clicking on "Forage Variety Trials" or "Forage Trials: Other States".

Roundup Ready® Alfalfa

Finally, Roundup Ready® alfalfa is now available through the cooperative research of Forage Genetics International and Monsanto and these varieties show excellent tolerance to Roundup, good disease resistance, and good yield potential. Before making plans to plant 100 acres I should mention 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 definitely a useful trait in alfalfa, but Roundup Ready® varieties are not necessarily superior for other traits. Roundup Ready® varieties will be best used on fields where traditional weed control strategies have been unsuccessful. Some current advertisements promote Roundup Ready® varieties as significantly 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. For example, 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. Monsanto recommends that you use an early spray even if weeds populations are low. If you wait until the stand is more mature, the loss 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 across the U.S. The estimated seed sales in 2005 were 1 million pounds. The estimated sales in 2006 are 4 million pounds.

Potato Leafhopper Resistance

Plant breeding companies continue to make progress in the development of potato leafhopper (PLH) resistant varieties. These varieties not only show high levels of resistance to PLH feeding, but also have good forage production and high levels of disease resistance. The most recently released varieties have been through 4 stages of improvement since the first varieties were released about 10 years ago. For example, results from a regional trial seeded in Ames, IA and S. Charleston, OH in the spring of 2005 showed that the newest PLH resistant varieties yielded 15 to 50% higher than the checks during the seeding year when subjected to PLH feeding. Note: even the most resistant varieties may require an insecticide spray during the seedling year since young plants are the more vulnerable to damage. See www.oardc.ohio-state.edu/forage2005/table3.asp for results of this regional trial and other variety trials comparing potato leafhopper resistance in the field.

Standfast™ Technology

CalWest Seeds has recently released a line of alfalfa varieties with Standfast™ Technology. This trademarked phrase refers to varieties with improved lodging resistance. Company data indicates that these varieties showed minimal lodging in tests where other varieties were almost flat (note: try to cut any alfalfa before it lodges, but that's not always possible especially during rapid spring growth). Interestingly, the European genetics that provides lodging resistance also provides for faster regrowth with company claims of an average of 25% faster regrowth than standard varieties. At present there is limited University data to confirm the advantages of Standfast™ varieties, but several trials are currently underway. CalWest states that the real advantage of these varieties is under aggressive management including more frequent cutting intervals. Adam Probst, a new graduate student at the University of Kentucky, will plant a series of trials with these and other varieties spring 2006.

Hybrid Alfalfa

Dairyland Seeds released the first hybrid alfalfas in 2001 after many years of development. Research over the last 50 years has shown that hybrid alfalfa has the potential to significantly increase alfalfa yield. There is still some debate as to whether a hybrid variety will show significantly higher yield at each cutting, but a University of Wisconsin report indicated that hybrids consistently yielded in the top 10% of varieties over 25 test environments www.uwex.edu/ces/crops/uwforage/HybridAlfalfa.html. In other words, hybrids definitely appear to show strong yield stability from location to location. This translates into a variety that should show high yield on your farm. Additionally, Dairyland indicates that their hybrid varieties show faster regrowth and stronger stands over time. As with Standfast™ alfalfa, aggressive management may be the key to maximizing the benefits of hybrids.

Improved Quality

WL Alfalfa and other companies have made significant improvements in alfalfa quality over the last 10 years. WL's merger with Forage Genetics International in 2000 has meant a combining of forces in the development of improved quality varieties. If you are producing for a market that pays for top quality then a high quality variety may be an option for you. Remember though that cutting management is still the most important factor to insure high quality. When comparing varieties advertised for high quality, make sure to compare at the same stage of maturity. Almost without exception, an alfalfa variety cut at the bud stage will be higher quality than one cut at a bloom stage.

Grazing Tolerance

ABI alfalfa and other companies have released a number of grazing tolerant varieties during the last 15 years. In the last 5 years, grazing tolerance has been combined with traffic tolerance to provide further benefits from dual purpose alfalfa plantings. If you are planning to pasture your alfalfa stand for much of the growing season, then consider planting a grazing tolerant variety. Marketing and distribution of grazing tolerant varieties may change some with the recent purchase of ABI by Forage Genetics International, but the average producer will see little change. Before planting, consult variety test bulletins that show variety differences to grazing tolerance. In Kentucky, go to www.uky.edu/Aq/Forage, click on "Forage Variety Trials" and look at the Alfalfa Grazing Tolerance Reports from the last few years.

Grazing tolerant varieties have not been left out of the Roundup Ready® picture 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 including Kentucky. 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 be worth dealing with pure stands of alfalfa for one or two seasons in order to clean up a problem weedy field. Then once the stand is a weed field they can seed grasses like orchardgrass into the stand. Obviously, once a grass is interseeded, then Roundup is no longer a weed control option.

General Purpose Alfalfa

One of the major goals of all alfalfa breeding companies is the development of solid general purpose varieties with high yield, good disease resistance, and long stand life. Pioneer is one such company that continues to produce good general purpose alfalfas for their customers. In addition to solid varieties with proven performance, Pioneer has recently released varieties with varieties with potato leafhopper resistance, lodging resistant variety and other traits.

Alleopathy

During the last year I have often been asked if there are any varieties that can be planted directly following a previous alfalfa stand. My short and simple answer is “NO” and I really do not know of any major breeding work in this area. Alleopathy in alfalfa simply prevents recropping of alfalfa on alfalfa. The best advice with any variety is to wait at least a year before planting alfalfa into fields that previously contained alfalfa. This is especially true in no-till systems. Ideally, the field should be planted with an annual crop in between alfalfa stands.

Another question often comes up when discussing replanting alfalfa. Can I overseed alfalfa into a perennial grass pasture or hay field where a few alfalfa plants are still growing. Dr. John Jennings in Arkansas showed that plants rarely emerge within 8 inches of an old plant and new seedlings growing within 8 to 16 inches of old plants show a 25% reduction in growth. Therefore, you can no-till alfalfa into an old pasture stand with just a few plants, but there will be a sizable zone around each older plant where new alfalfa plants are not present or are weak.

Sclerotinia Resistance

Sclerotinia crown and stem rot is a disease that has limited fall planting of alfalfa in Kentucky and surrounding states during the last 15 years. It occurs as a late fall disease, but is usually not noticed until early spring when dead patches can be seen, often with a white cottony mold growing on the decaying plant material. There are no resistant varieties at present, although progress is being made. Current varieties marketed as resistant can still be infected, but they do provide some insurance against stand losses in years when disease severity is low to medium.

UK researcher Dr. Paul Vincelli offers the following advice: “Avoid planting alfalfa in late summer/early autumn where Sclerotinia occurs, especially no-till seedings in sod or fields previously sown to forage legumes. If fall seeding, seed as early as possible to

allow plants to develop larger, more resistant crowns. Deep plowing can reduce spore levels by burying sclerotia. However, plowing does not assure a disease-free stand since spores may arrive from neighboring fields

(www.ca.uky.edu/agc/pubs/ppa/ppa10d/ppa10d.pdf).

New Traits: Bloat Resistance, By-pass Protein, Pharmaceuticals, etc...

A tremendous amount of research is taking place on the development of biotech or genetically engineered alfalfa varieties. These include the development of bloat resistant alfalfa through the expressive of tannins. Low levels of tannins would also allow to have improved by-pass protein. Progress is being made on “low lignin alfalfa” that will result in improved fiber digestibility. The USDFRC estimates that a 10% increase in cell wall digestibility (from lower lignin) would increase milk and beef production by \$350 million/yr and reduce manure production by 2.8MM tons/yr. In Canada, a privately-held biotechnology company, “Medicago,” is developing biopharmaceutical products using alfalfa as the protein production platform. In other words, alfalfa is genetically engineered to produce pharmaceuticals which are later extracted from the plant material.

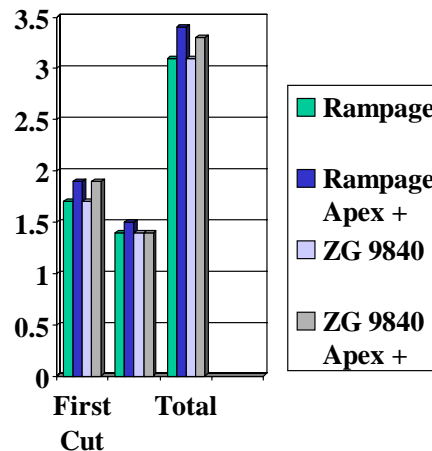
ADVANCES IN ALFALFA SEED COATING

Bill Talley
President
Summit Seeds, Inc.

Seed coating for alfalfa has been available since the mid to late 70's. Over the last 30 years, advances in the industry have made it the choice of many producers. The purpose of the coatings at that time was mainly to add weight to increase the ballistic properties and to be a carrier for the rhizobia. Through research and new technology, coatings have evolved and shown great agronomic benefits. Seed coating can provide an opportunity to supply effective quantities of needed materials to each seed, which can influence both the physical property, and the microenvironment of the seed. Coatings can protect the rhizobia and provide a microenvironment for quick nodulation, insuring good seed-soil contact. This improves the movement of water to the seed, and increases the seed weight and size, which improves seed plantability. Treating the seed with a precise loading of pesticides and /or fungicides, supplying of growth regulators, incorporating hydrophilic and/or hydrophobic materials in the coating regulates water imbibition and germination, and adds beneficial elements and micronutrients to the seed. Indeed the future of seed coating may develop into a prescription approach – coating the seeds with the necessary elements to fit the needs of the field and the crop for optimum growth.

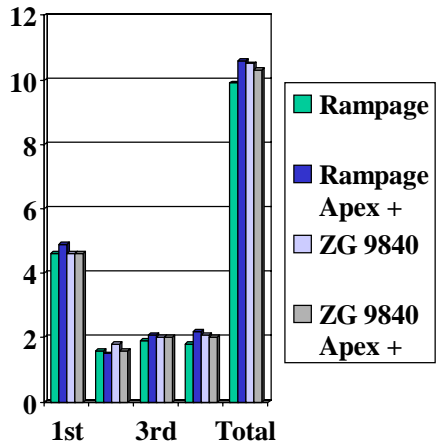
Currently Summit Seed coatings has a patent for a specialized coating for use in high ph soils. This has been a joint effort between Summit Seed Coatings and a seed company located in Idaho. The results have shown a significant improvement in university research trials and have been especially beneficial in farm trials. This product is marketed under the Apex Plus Coating name and Mico Rhizo brand name (Tables 1-3).

Table 1. University of Idaho Seed Coating Study



- Seeding Rate 16 # per Acre Pound for Pound
- Raw Preinoculated
- Apex Plus
- Two Varieties
- Apex Plus Significantly Higher at .05
- Spring Seeding

Table 2. University of Idaho Seed Coating Study



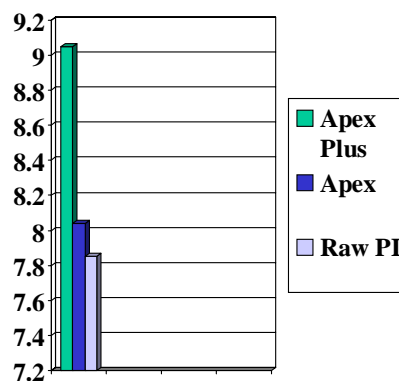
- Seeding Rate 16 # per Acre Pound for Pound
- Raw Preinoculated
- Apex Plus
- Two Varieties
- Fall Seeding

High ph soils are not a problem for Kentucky farmers, who generally have more problems with low ph soils. This is probably the number one problem seen when looking at a stand problem or establishment problem. It is extremely important to get the pH of the soil between six and seven before planting. Summit Seed Coatings has

started research with a southern university this past fall, to do an initial screening of different products that can be added to the seed coating aiding in establishment and nodulation in low ph soils. This is being done in lab tests at this time and will move out to field trials if any products look promising. We are planning to have a product commercially available in two years, if the research goes favorably.

Another area that I feel will benefit Kentucky alfalfa growers will be the addition of Micronutrients and plant growth regulators to the alfalfa seed coating. W-L Research and Caudill Seed are applying 3-D growth supplement to their alfalfa seed at this time. This was started spring of 2004 and had favorable field results and testimonies. We look for this to expand and we look for more micronutrients to be used. We also see the potential for the super absorbent starches and polymers to be added to the coating. These starches and polymers can greatly increase the water holding capacity of the seed and the germination zone to increase germination and seedling survival. The future holds many new possibilities for alfalfa seed coatings. The coating of the future may be a prescription coating based on your farm, its soil condition, and the weather and climate conditions at the time of planting. Summit works with several

Table 3. Utah State University Seed Coating Study



- Seeding Rate 16 # per Acre Pound for Pound
- Raw Preinoculated
- Apex
- Apex Plus
- Yield per acre

Alfalfa seed companies and farmers that want prescription seed coatings for their farms at this time. I foresee more of this in the future, but to make this work it takes lead-time of three–six months to bring all the logistics together. By working on this on a small scale we should be able to reduce lead times considerably and make prescription seed coatings a reality.

PRINCIPLES AND PRACTICES OF SUCCESSFUL ALFALFA ESTABLISHMENT

*Gary Bates
Forage Specialist
Plant Sciences Department
The University of Tennessee*

Alfalfa is the most widely known forage crop, due to its high quality and the versatility of use. There are few forages that are as widely distributed as alfalfa, and none that can produce the high yields and high quality. Even with all of the positives of alfalfa, growing this crop profitably is often difficult. An evaluation of alfalfa budgets shows that a key factor in the success with alfalfa is the stand life. Because of the establishment expense, an extra year or two of production can increase the lucrativeness of the stand. The start of having a long life of an alfalfa stand is at establishment. If an alfalfa hayfield or pasture is weak at establishment, then stand life will be short. Getting a good, thick stand of alfalfa provides the opportunity to harvest a field profitably for several years.

The principles of alfalfa establishment are the same as with any other crop. The difference between alfalfa and most crops is that the initial stand is as good as it will get. Autotoxicity prevents seeding into an old stand to thicken it up. Being perennial, you don't really get another chance next year to plant again. Your first effort needs to be a good one. Paying attention to the following details should provide the best opportunity to get a thick stand of alfalfa.

Steps prior to planting

Much of the work for alfalfa establishment should be done a year or two ahead of planting. Planning ahead can be the key to success. Following the guidelines below can prevent some major catastrophes in establishment.

- 1. Select the proper site.** Alfalfa should be grown on what is considered the best soil on the farm. A deep, well-drained soil is needed for the alfalfa to develop a vigorous root system. Poor drainage will increase disease problems, result in more winter kill, and cause lower yields and shorter stand life.
- 2. Get weeds under control.** If there is heavy weed pressure in the area, take the season ahead of planting to clean up these weed problems. Even though there are several herbicides that are labeled to use in alfalfa, it is easier to kill most weeds, particularly perennial broadleaves, when there isn't the concern of trying to kill weeds without killing alfalfa.

3. **Fertilize and lime according to a soil test.** The proper pH and fertility is essential for good seedling vigor. A pH of 6.5 - 7.0 is recommended for alfalfa. If lime is needed, apply the recommended amount of lime before soil cultivation for conventional planting, and at least six months ahead of seeding if no-till methods will be used. If the pH is below 5.8, seeding alfalfa no-till may not be desirable until a soil test shows an adequate pH. Be sure to apply the recommended amounts of phosphate and potash at seeding. Two pounds per acre of boron should also be applied.
4. **Select a recommended variety.** More alfalfa varieties are available than any other hay crop. There are large differences between varieties in yield potential, pest resistance and winter hardiness. One of the biggest mistakes that can be made is to pay attention to all the other details in establishment, and then decide to try and save a little money by selecting uncertified seed or seed of an inferior variety. Check with your local Extension office for the current list of recommended alfalfa varieties.

Most recommended varieties are pre-inoculated with the proper *Rhizobium* bacteria. If the seed is not coated, be sure to apply alfalfa inoculant to the seed prior to planting. Consider using some type of sticker material to help the inoculant stay on the seed during planting. Proper inoculation is required for root nodulation and nitrogen fixation.

Steps for successful seeding

Once the preparations are made, the process of seeding is relatively simple. There are a few details to pay attention to in order to get a strong establishment of alfalfa.

1. **Seed at the proper time.** Alfalfa can be seeded in both the spring and fall in the upper south. In the past, the predominant time of seeding has been fall. Fall seedings usually need six to eight weeks to germinate and grow before the first hard freeze. Alfalfa should be seeded from August 15 to September 15. Do not plant before adequate moisture is available in the soil.

It is important for the alfalfa to have adequate growth going into the winter because of the potential damage from sclerotinia stem and crown rot. Crown rot is a fungal disease that infects plants in the late fall/early winter. Young, fall-seeded plants are at the greatest risk of death because they are not big enough to withstand the disease. Early seeding allows plants to be larger, giving them a better chance to withstand the disease. However, early seeding does not necessarily ensure immunity. If sclerotinia has been a problem previously, consider establishing the alfalfa in the spring. **If you plan to use no-till, avoid fall planting.** Seedlings planted no-till do not establish as quickly as those planted conventionally, and will be smaller and more susceptible to crown rot damage.

If you will be spring seeding, plant from March 1 to May 1. Spring seedings generally require an early application of a grass herbicide to decrease crabgrass competition. Be sure to plant the alfalfa after the danger of frost has passed.

- 2. Place the proper amount of seed into a good seedbed.** Alfalfa should be seeded at the rate of 15 to 20 pounds of seed per acre for a pure alfalfa stand. The alfalfa can be seeded into a prepared seedbed, or seeded no-till into a killed sod. If no-till methods are to be used, be sure that all existing vegetation has been chemically killed. Seed should be placed $\frac{1}{2}$ to $\frac{1}{4}$ inch deep. If a no-till drill is used, be sure to take a few minutes to check the seeding depth. These drills are heavy enough that seed can be easily planted too deep for acceptable emergence.

Also be sure to calibrate the drill or other seeder used for planting. Do not take for granted that the calibration chart on the drill or in the manual are correct. Without checking the seed flow, all of the seed might be put on only half of the field, or you might have to travel over the field again to get all of the seed distributed. A few minutes before planting can save a lot of time.

In many cases, grasses must be seeded with the alfalfa to reduce soil erosion during stand establishment. In this situation, use 15 pounds of alfalfa with 6 pounds of either orchardgrass or tall fescue, or 4 pounds of timothy. If tall fescue is used, be sure to use an endophyte-free variety. The endophyte can still result in reduced performance in animals grazing or consuming hay from infected tall fescue, even if it is in a mixture with alfalfa. The effect of the endophyte may be reduced because of the alfalfa, but animal performance will be superior when an endophyte-free tall fescue, orchardgrass or timothy variety is used.

- 3. Control weeds during establishment.** Competition from weeds can be one of the major factors limiting alfalfa stand establishment. Most weed species grow very rapidly as seedlings, and are more competitive than the alfalfa seedlings for light and nutrients. Weeds such as henbit, chickweed and annual ryegrass can be problems in fall-seeded alfalfa, while crabgrass is a major competitor in spring-seeded alfalfa. Herbicides can be used to reduce this competition. If a grass is seeded with the alfalfa, grass herbicides cannot be used. Check with your local Extension office about current alfalfa herbicide recommendations.

Paying attention to details well ahead of planting, and then following recommended practices during the seeding process can help ensure that a good stand of alfalfa is established.

FERTILIZING ALFALFA FOR PROFIT

Greg Schwab
Extension Soil Management Specialist
University of Kentucky

Introduction

Alfalfa is a high quality, valuable forage crop that can be successfully produced on most well drained soils in Kentucky. Fertilizing alfalfa can be uniquely challenging because it is a perennial crop. In addition, high yielding alfalfa removes a tremendous amount of soil nutrients when compared to other crops grown in Kentucky. A thorough understanding of alfalfa's growth habits, nutrient requirements, and the soil nutrient supply mechanisms for alfalfa is necessary to effectively manage fertilizer inputs and maximize profitability.

Fertilizing Perennial Crops

The goal of any fertilizer management program should be to maximize the profitability of the crop. Growers should be aware, however, maximum yield and maximum profit are seldom the same. Often, additional yield can be obtained with additional inputs, but the cost of these inputs may exceed the value of the additional yield. Consider the example of an alfalfa producer who could increase his alfalfa yield five additional bales per acre by adding 50 lbs of potassium fertilizer. The additional fertilizer would only be a wise decision if the value of the five bales exceeds the cost of the 50 lbs of fertilizer.

Perennial crops like alfalfa present an added challenge: one year's productivity is not the only topic of concern, but also the overall longevity of the crop. Often, early management decisions will determine the number of years the stand will remain productive. Fertilizer decisions prior to planting are particularly of importance, since this is the only opportunity the producer will have to incorporate immobile soil nutrients like P and K. After planting, annual fertilizer applications can only be broadcast to the soil surface.

Alfalfa Establishment

One of the most common mistakes I see producers making is not properly preparing for alfalfa establishment. Soil samples should be collected from perspective alfalfa fields at least the fall prior to planting. Actually it is much better to sample a year and a half (two falls) before establishing. Early sampling gives the producer time to correct nutrient deficiencies and make adjustments in soil pH. Soil pH is probably the most important soil test measurement; the solubility of all other plant nutrients is a function of pH. In

addition to nutrient solubility, the survival of rhizobium (nitrogen fixing) bacteria is dependant on soil pH.

If the soil pH is below 6.4, lime should be applied according to the soil test recommendation. Soil test recommendations may need to be adjusted depending on the quality of limestone that is available and the depth of mixing into the soil. Your local county extension agent can help make the needed adjustments. Added lime should always be incorporated into the soil. If more than 4 tons of lime are required, the lime should be mixed into the soil by applying ½ of the recommended rate before plowing and the other ½ after plowing followed by disking. The reaction of limestone is not immediate, so if the soil is extremely acidic (pH 5.3 or lower), it is advisable to collect new soil samples in the spring to reassess pH and the feasibility of planting. If the spring pH is below 6.2, the producer has two options: 1) delay planting for one year to allow the limestone more time to react, or 2) apply 1 lb sodium molybdate (6.4 oz of molybdenum) per acre. Uniform distribution of sodium molybdate can only be achieved by mixing it in 20 to 40 gallons of water, and spray uniformly per acre followed by disking it into the soil. It is important not to add more than 2 lbs of sodium molybdate per acre during a given five-year period of time.

A productive stand of alfalfa removes many pounds of phosphorus (P) and potassium (K) per acre per year. The goal of your P and K fertilizer program should be to maintain soil test (Mehlich III) P at or above 60 lbs/a and soil test K at or above 300 lbs/a. Because of this goal, it is imperative to have soil test values at or above these levels at planting. If fall soil analysis shows low or very low levels of P or K, the producer should apply the recommended fertilizer in the fall, then resample in the spring and apply additional fertilizer if recommended. Phosphorus and K are very immobile in the soil, so incorporation of these elements is also beneficial. Once the alfalfa is established, rhizobium bacteria living on the roots will supply all of the nitrogen (N) required by the crop. However, research has shown that 30 lbs N/a applied at planting is needed for crop establishment.

Fertilizing Established Stands

Adequately fertilized alfalfa removes approximately 14 lbs P₂O₅ and 55 lbs K₂O per harvested ton. This is a much higher nutrient removal rate than any of our Kentucky grown grain crops or pastures. However, nutrient removal rates alone can not be used as the basis for fertilizer recommendations. Soils contain a large amount of nutrients in primary and secondary minerals. For example, a Crider silt loam in Princeton had 32,600 lbs/a of total mineral K just in the surface 7 inches. The nutrients in these minerals are not extracted by the soil test solution, but are slowly available to the plant. Additional nutrients can be taken up from the subsoil and are also not measured in a routine 6 inch soil sample. For these reasons, soil test results are not an actual measurement of plant available nutrients, but only give an indication of the amount of fertilizer that is required for maximum productivity. For these reasons, soil tests have been calibrated in Kentucky based on alfalfa growth and yield. The results of these calibration studies are the foundation to the fertilizer recommendations in AGR-1.

When soil test levels are above 50 lbs P/a and 300 lbs K/a, research studies show that yield is not limited by these nutrients. In order to assure that yield is not limiting, we continue to recommend some fertilizer until soil test values (for the composite field sample) are 60 lbs P/a and 450 lbs K/a. Phosphorus and K recommendations in AGR-1 are designed to maintain soil test levels near 60 lbs P/a and 300 lbs K/a. Unfortunately, not all soils in the state have the same ability to supply nutrients (especially K) to the crop. Soils in the Pennyroyal region of the state like the Crider mentioned above have a tremendous amount of mineral potassium and do not require as much fertilizer to maintain the 300 lb/a soil test level. Soils in the Bluegrass (especially outer Bluegrass) have an ability to convert fertilizer K to unavailable forms (K fixation), so these soils often require more potassium to maintain 300 lbs of soil test K. In order to accurately monitor soil test levels for crops like alfalfa, I believe it is important for alfalfa producers to collect soil samples annually. With good annual sampling procedures, the producer will be able to make changes (if necessary) to the fertilizer recommendations. These changes should be made when a clear downward or upward trend is observed.

Avoid Luxury K Consumption

Luxury consumption of K is a phenomenon that should concern all forage producers. Simply put, luxury consumption occurs when a plant is supplied with more than adequate amounts of K. When an alfalfa plant is adequately fertilized, the K concentration in the tissue is usually between 2.5 and 3%. If the soil supply of K exceeds the needs of the crop, higher tissue K concentrations can be as high as 4.5%. For our grain crops like corn or wheat, luxury consumption is not a problem since excessive K in the tissue is returned to the soil with the fodder. For alfalfa (and any other crop where the entire plant is harvested), the excessive K is removed and is not recycled in the soil. Luxury consumption can increase K removal rates to 90 lbs K₂O per ton (55 lbs is normal removal). Probably the main drawback to luxury consumption is that fertilizer applied to increase soil test K can be immediately removed with the first harvest, leaving low soil test K and possibly causing future K deficiency.

There are several ways to limit the risk of luxury consumption. First, try to maintain soil test K near 300 lbs/a, thus limiting the supply of K to the plant. At this soil test level, only small rates of K fertilizer will be recommended. Second, avoid applying any K fertilizer between the last fall harvest and the first cutting the following spring. The freezing and thawing of the soil through winter months usually releases enough K to supply crop needs for the first cutting. The first cutting is also the highest yielding cutting, so more hay harvested with a higher K concentration equals more lbs of K removed from the soil. If soil test K is allowed to slip below the medium range, then split applications during the summer months should also reduce the effects of luxury consumption.

Conclusions

Properly managed alfalfa stands can provide profitable yields for 6 or more years, while poorly managed fields may not last more than three years. Understanding and managing the fertilizer input is one of the keys to alfalfa stand longevity. It is critically important to have the appropriate soil pH, P and K levels prior to planting to obtain maximum plant density. Additionally, delaying nutrient application until after the crop has been established usually results in high fertilizer application rates, and increases the need for split application as well as the risk of luxury K consumption. Because of the valuable nature of alfalfa and the high rate of nutrient removal, I recommend soil samples be collected in the fall of each year after establishment. Lime and phosphorus fertilizer can be added anytime, but K fertilizer should not be applied in the period after the last fall cutting to the first cutting in the spring. Taking these steps will maximize nutrient use efficiency and help to minimize the effects of rising fertilizer prices.

ALFALFA AS A GRAZING CROP

Garry D. Lacefield
Extension Forage Specialist
University of Kentucky

Over the past decade we have had several people address “Alfalfa as a Grazing Crop” including Warren Thompson, Jim Moutray, Gary Bates, Ken Johnson, Jason Sandefur, Byron Sleugh, and myself. Each has done an excellent job discussing the merits of this remarkable crop and the opportunities it offers for grazing. At the end of the Conference last year, I (as I always do) asked for your suggestions concerning topics for this year’s conference. As it has been for the past decade, “Grazing” was the most requested topic. In today’s presentation, let’s go back and revisit the question, “Is Grazing Alfalfa Right for You?”

Alfalfa is a high yielding, high quality, deep-rooted, versatile forage legume well adapted throughout the U.S. Gains per animal and per acre can be excellent with acceptable stand persistence when present technology is used. Is grazing alfalfa right for everyone? Only you can answer that question. This presentation attempts to give you information that will hopefully help you with that answer.

Alfalfa is the most important forage legume grown in the United States. Grown over a wide range of soil and climate conditions, it has the highest yield potential and feeding value of all perennial forage legumes. This versatile crop can be used for hay, pasture, silage, green-chop, pellets, cubes and soil improvement. Because of its many merits, especially yield, quality and versatility, it can be used successfully in many animal feeding programs.

As we begin to look at this topic “Grazing Alfalfa”, let’s first assume you have land capable of growing alfalfa successfully and let’s assume you have animals to feed on the farm and finally let’s assume you want to do the best job possible of supplying pasture that meets the animals’ needs and has the potential to make you money.

Let’s approach the topic by simply asking a few questions:

Do you need a high-producing pasture plant? With proper grazing management, alfalfa’s **high yield potential** can be converted to high levels of animal production per acre. Liveweight gains per acre are quite high for grazing beef cattle, with total season gains of 500 to over 800 lb/acre in research trials and on-farm demonstrations. Milk production per acre and per animal can be high when grazing alfalfa.

Do you need a high quality pasture plant? Alfalfa’s **quality for grazing** is excellent, resulting in total season average daily gains over 2 lb/day in grazing trials and demonstrations.

Do you need pasture legumes that grow well during summer? Alfalfa’s deep root system makes it more **drought tolerant** than our other cool-season legumes and grasses. Although alfalfa does not make maximum growth during summer droughts, it usually provides good summer pastures. During extreme drought this aspect becomes even more important since cool-season grasses become dormant.

Do you want a versatile pasture plant? Alfalfa can be ideal on farms where it can be used for hay, silage, or grazing. Virginia workers studied systems of grazing alfalfa based on need and environmental conditions. Systems of grazing the early spring growth provided quality feed and delayed the first hay harvest until more favorable weather for curing. Other systems provide grazing during midsummer when cool-season grasses are often less productive. Comparing the systems shows that total season yield as not reduced by any graze-hay systems.

Do you want to extend the productive life of some of your alfalfa hay fields? For old alfalfa fields that have been used for hay but where some of the stand has been lost or become weedy, grazing can extend the stand’s useful life a year or more. Grazing may also rejuvenate some stands by reducing grass and weed competition. *Research results* – When alfalfa stands decline to less than 3 plants/sq ft, optimum hay yields usually cannot be achieved. Excellent beef gains have been made on alfalfa stands with as few as 1 plant/sq ft although productivity per acre suffers.

Do you want to reduce your machinery cost and lower your fertilizer expenses? Over 40% of the cost of producing alfalfa hay is machinery and equipment. In a total grazing system, this cost can be eliminated or certainly minimized. Under grazing, most of the plant nutrients are returned as dung and urine. Annual fertilizer needs therefore would be lower than where plant nutrients are removed from a field as hay. In addition, alfalfa is our highest nitrogen fixing forage legume (Table 1). As nitrogen prices rise, the factor of “home-grown” nitrogen becomes an even greater factor.

Table 1. 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

Do you want a pasture plant that has a high potential for profit? One of the most comprehensive analysis that I am aware of was presented at the 26th National Alfalfa Symposium in Michigan by Dr. Al Rotz. The following was excerpted from his presentation:

“Grazing of alfalfa is an economically viable option for dairy farms. The grazing strategy used and other assumptions of the analysis will effect the benefit received. With the strategy evaluated in this study where grazed alfalfa is used to supplement confined feeding through a total mixed ration, many of the inputs in feed production are reduced and the need for purchased feeds is reduced. The overall result is an annual return to management or farm profitability of \$100 to \$240/cow.

When deciding between grazing and confined feeding systems, other factors such as bloat control and general animal health must be considered as well. Bloat is a recognized problem, particularly when alfalfa is grazed. Feed additives such as sodium bentonite are sometimes used to reduce the risk of bloat, but the risk still exists. Other health issues are not conclusive, but other than risk of bloat, animal health is generally recognized as maintained or improved through grazing. To evaluate the possible detrimental effects of bloat, an analysis was done where the culling rate of the herd was increased to 40% to model a greater loss of animals. Livestock expenses were also increased by \$5/cow/year to cover feed supplements and medication related to bloat control. With a greater number of primiparous cows, milk production may decline. Given that production can be maintained at 20,000 lb, this change had little effect on the total feed and manure cost, but the return to management decreased by about \$30/cow (Table 2).”

Table 2. Sensitivity of the total feed and manure cost and the net return over this cost to changes in various assumptions used to describe the grazing system for a herd producing 20,000 lb/cow.

Change in grazing system	Reduction in feed & manure cost (\$/cwt)	Increase in net return (\$/cow)
Base grazing system	.73	142
20% lower yield of grazed alfalfa	.50	98
6 year alfalfa stand life	.77	150
20% greater fence costs	.68	132
10 h/wk for grazing management labor	.66	128
14 year machinery life	1.05	238
Smaller equipment and forage structures	1.08	212
40% culling rate and bloat control additive	.71	111

SOURCE: Rotz, C.D. 1996. 26th National Alfalfa Symposium, East Lansing, Michigan. March, 1996.

Is alfalfa right for you? If you answered YES to some of the previous questions, it is at least worthy of your consideration; but wait, let me tell you some of the problems and make a few comments about them.

The most frequent concern of producers considering grazing alfalfa is bloat, but it can be minimized with precautions. Producers may lose more money from the fear of bloat than from bloat itself if it keeps them from efficiently using the alfalfa pasture.

Additional Fencing – Alfalfa must be grazed on a rotational basis. Doing so requires that fields be subdivided so that cattle are restricted to one area for a time, and then moved to another area. This system gives the grazed area time to regrow before grazing again. Fencing does not have to be elaborate or complex. Simple low-cost electric fences that restricts animals to a given area are adequate. Access to water and minerals is also important.

Greater Management and Labor Inputs – Although some consider this category to be a disadvantage, advocates of controlled grazing do not always agree. Once the necessary fencing is in place, time studies have shown that the amount of additional labor required for rotational grazing is quite small compared to harvesting hay. In addition, regularly moving cattle to new pastures lets the producer observe them more closely and therefore permits greater cattle-pasture management efficiency.

Stand Decline – If alfalfa plants are not grazed properly, stands decline. Grazing animals may damage alfalfa crown during wet and muddy conditions. In addition, damage to new crown shoots can occur when cattle are left on an individual paddock after new shoots develop. These disadvantages can be minimized with the following practices:

- To avoid damage to stands, use a “sacrifice paddock” next to the alfalfa where you can put cattle during extreme wet and muddy conditions.
- Do not let cattle graze an individual paddock for over 7 to 10 days to minimize damage to newly developed shoots. Exceptions to the 10-day rule include the first grazing in spring and times when alfalfa is dormant (during drought and after freeze-down).
- Use a grazing tolerant variety.

Now, Alfalfa Grazing – Is it right for you? Only you can answer that question; however, I hope you will agree that Alfalfa – Queen of the forage Crops based on its merits, its long standing track record throughout the World, its well documented research and demonstration results, and the many satisfied farmers, it is certainly worthy of your consideration.

Selected References

Ball, D.M., C.S. Hoveland, and Garry Lacefield. 2002. Southern Forages. Phosphate & Potash Institute and Foundation for Agronomic Research, Norcross, GA.

Lacefield, G.D., J. Henning, R. Burris, C. Dougherty, and C. Absher. 2002. Grazing Alfalfa. U.K. Cooperative Extension Service ID-97.

Henning, J., G.D. Lacefield, M. Rasnake, R. Burris, J. Johns, K. Johnson, and L. Turner. 2000. Rotational Grazing. U.K. Cooperative Extension Service ID-143.

STORING ALFALFA AS ROUND BALE SILAGE

David C. Ditsch
Associate Professor
UK Department of Plant and Soil Sciences
UK Robinson Station

Hay is the most popular method for storing alfalfa because it stores well for long periods and is better suited to cash sale and transportation than silage. However, silage may be a suitable option when and/or where hay curing is difficult. Due to numerous improvements in baling and wrapping equipment, it is possible to make high quality round bale silage using long (unchopped) alfalfa crops.

Round bale silage (or balage) is the result of cutting forage crops with conventional hay mowing equipment, allowing the forage to wilt to between 40 and 60 percent moisture, baling it into tight bales and wrapping the entire bale in plastic so oxygen is excluded. The forage in the bale then goes through the ensiling process. The plastic wrap keeps air out, allowing anaerobic microorganisms to ferment carbohydrates to lactic acid which lowers the pH of the forage and inhibits the growth of other detrimental microorganisms. The ensiling process uses some dry matter or energy, but this loss is small compared to dry matter losses that commonly result from field curing tedding, raking, baling, outside storage and feeding of hay (Table 1).

Table 1. Losses Associated with Hay and Silage Production.

Activity	Hay	Silage
Field Curing	25%	6%
Harvesting	15%	6%
Storage	35%	5%
Feeding	30%	8%

Advantages of making round bale silage include:

- Plastic cost per bale is low (\$3-4);
- Capital investment required is lower than conventional silage storage;
- Higher quality feed is produced;
- Harvest and storage losses are lower;
- Weather damage is less than hay stored outside;
- Individually wrapped silage bales are more portable;
- Silage can be stored in small packages; and
- Feeding round bale silage does not require specialized machinery.

Disadvantages of round bale silage include:

- Some hay balers cannot handle wilted (40-60 percent moisture) forage;
- Silage bales can be very heavy, leading to larger tractor requirements;
- Plastic wrap material can tear or puncture, leading to spoilage;
- Disposal of used plastic is necessary.

All of the major forage crops grown in Kentucky can be harvested and stored as round bale silage. To improve the odds of success, these recommendations should be followed:

- 1) harvest at the reproductive stage of maturity;
- 2) bale when the moisture content of the cut crop is between 40 and 60 percent;
- 3) time between baling and wrapping should be as short as possible (< 8 hrs);
- 4) a minimum of 4 layers of plastic are required to form an airtight seal; and
- 5) repair holes made during bale transport and storage immediately by taping.

In general, harvesting forage crops between the vegetative (leafy) and reproductive (flowering) will result in the best compromise between yield and quality. Harvest losses (usually from leaf shatter) are greatest for very dry forage but are low for crops handled soon after cutting. However, silage baled and wrapped too wet (>70% moisture) is subject to excessive storage losses due to deterioration from seepage that accumulates within the wrapped bale.

The moisture levels recommended for baled silage are generally between 40 and 60 percent, covering the range between wilted silage and haylage. The ideal moisture content appears to be 40 to 50 percent because fermentation is adequate and heat damage is minimized. In producing bales for silage, it is important to remember that forage in the 50 percent moisture range will weigh about twice what the same size bale would weigh as hay. Bale size is frequently reduced to restrict bale weight to 0.75 to 1.0 ton. Heavier bales may be difficult to safely transport.

Machinery Requirements

Mower-conditioners are not required for making round bale silage, but they are useful because they speed up the wilting process and concentrate the cut forage into a narrow swath. These narrow swaths allow baling without raking.

Bales for silage should be formed as tightly as practical in order to exclude oxygen and help bales retain their shape during storage. Some producers claim belt-type balers make a more uniform bale than chain-type balers, but no research supports this claim. Fixed-chamber balers lack the flexibility of variable-chamber balers to vary bale diameter as a means of reducing bale weight with high moisture crops.

Some baler manufactures recommend retrofitting older balers with kits that aid in baling high moisture forage for silage. Many manufactures produce balers designed specifically for making balage. Some recent models of both fixed and variable chamber balers include knife mechanisms to chop the forage allowing increased density. University of Kentucky research found that using a “chopping” fixed-chamber baler increased silage bale weighs by about 300 pounds at the same bale diameter.

Traditional bale spears have the disadvantage of puncturing the plastic if the bale is moved after wrapping. Therefore, wrapping the bales after they have been moved to their place of storage will avoid punctures in the plastic and the need for repair. Another more expensive option is the hydraulic bale squeeze that mounts on a front end loader. This implement allows the movement of wrapped bales without making holes in the plastic. Tractors with 50 or more horsepower have sufficient weight and power for safe lifting.

Bale-Wrapping and Bagging Equipment

Individual bags, tubing machines and individual or group bale-wrapping machines all operate on the basic principle of quickly sealing out oxygen from the bale and keeping it airtight until feeding. Use of quality plastic manufactured to withstand the damage of ultraviolet radiation in sunlight is strongly recommended. Some plastic manufacturers also warn that the oil from treated sisal twine can break down the ultraviolet radiation inhibitor in the plastic and recommend using untreated sisal twine or plastic twine instead.

Individual bags

Placing individual round bales in plastic bags is the least popular method for making balage. However, extra equipment is not required and the bags have the potential to be reused to reduce cost. In practice, however, few bags can be salvaged for use the following growing season. The biggest disadvantage to using individual bags for make round bale silage is the difficulty of getting all the air out of the bags and maintaining a good seal on the open end of the bag. Rodent damage also appears to be more prevalent with individual bags compared to wrapped bales.

Individually or in-line wrapped bales

The most popular machines available for making round bale silage are the platform and in-line wrappers. Platform wrappers wrap individual bales. In-line machines line bales up end-to-end and wrap the entire line in a continuous, overlapping spiral of plastic.

The major advantages of platform wrappers are:

- 1) lower equipment cost compared to in-line machines;
- 2) spoilage due to a hole in the plastic is limited to an individual bale;
- 3) greater transportation and feeding flexibility.

The greatest disadvantages of a platform wrapper are higher plastic cost per bale and more time required to wrap each bale.

The major advantages of in-line wrappers are:

- 1) 50% less plastic required compared to platform wrappers;
- 2) requires less labor per bale;

The greatest disadvantage of the in-line wrapper is the higher equipment cost.

Time between baling and wrapping

The time between baling and wrapping is critical to the success of the ensiling process and should be as short as possible. Prior to wrapping, high moisture forage is subject to very high respiration rates and to the growth of undesirable microorganisms. Respiration reduces forage quality by consuming readily digestible carbohydrates. Significant increases in bale temperature are also associated with excessive delay between baling and wrapping of silage bales. Data from the University of Missouri illustrate the importance of rapid bagging after baling (Table 2). Based on these data, even an eight-hour delay between baling and wrapping can result in greater temperatures during storage compared with those bales wrapped immediately after baling.

Table 2. Silage bale temperature (°F) as affected by time between baling and wrapping.

Days after Ensiling	Interval between baling and wrapping (hrs)		
	0	8	24
1	118	129	125
2	111	140	135
3	113	127	132

Source: University of Missouri, 1983 Research Reports.

Round bales should be moved to the storage area before wrapping. This allows the wrapping process to be done on more level, uniform ground. Minimizing the movement of bales after wrapping will reduce the odds of puncturing the plastic and risking spoilage.

Storing alfalfa as round bale silage allows for more timely cutting and harvesting of high quality forage when curing conditions, time and labor may be limiting. In a University of Kentucky research study, baled alfalfa silage at three moisture levels (54, 49 and 43%) was compared with field-cured hay (stored outside on the ground). Baled silage retained initial protein and *in vitro* digestibility levels of the fresh forage better than the field cured hay. Field-cured hay declined significantly in digestibility and had large dry matter losses compared to baled silage.

Summary

Round bale silage offers a convenient and inexpensive way for Kentucky farmers to salvage their high quality alfalfa crops that might otherwise be lost due to poor hay curing conditions and reduce leaf losses associated with tedding, raking, baling, storing and feeding of hay.

MOISTURE MANAGEMENT IN HAY MAKING AND STORAGE

Tom Keene, Extension Hay Marketing Specialist
Doug Overhults, Extension Agricultural Engineer
University of Kentucky

Making hay in central Kentucky can be one of the most trying on farm endeavors a producer can undertake. Our plentiful moisture, rolling topography, and climate make Kentucky ideal for producing high quality forage for either grazing or hay making. However, that same moisture, either in the form of rain or high humidity, can sometimes make it devilishly hard to make hay here in Kentucky.

Having traveled this country extensively in the past sourcing high quality hay, I can say beyond the shadow of a doubt that we can produce as high quality a forage as anyone in the country but getting that hay in a package that can be stored appropriately or that can be shipped a long distance is where we here in Kentucky struggle.

Tools like mower conditioners, preservatives, tedders, multiple packaging options, etc. now give us the opportunity to make high quality hay here in Kentucky. Use of these new innovations and tools does not however totally eliminate the possibility of producing some “wet” hay.

After you cut your hay, the question then becomes, “When do I bale the hay and at what moisture level will it keep?” Research tells us that for small square bales we need to have a moisture level of 20% or less and for round bales 18% or less. Even if we reach those levels sometimes we can still have problems with hay heating, especially if not stored properly.

How do we check for moisture in hay that we need to bale? The most reliable and accurate way is by using the microwave method (Table 1). There are also commercially available moisture meters that do a good job of telling moisture levels. Bale a couple of small square bales or a couple of round bales and then use the moisture meters according to the supplied directions. (Some commercial testers also come with a temperature reading on them). This should give a fairly accurate moisture reading. If the hay is above the previous mentioned percentages put off baling until those levels are within the desired range. Preservatives will allow for baling at higher moisture levels however special care should always be taken when using preservatives and ALWAYS read and follow label directions.

Table 1. Determining Forage Moisture Content Using a Microwave Oven.

1. Chop fresh forage into 1 to 2 inch lengths for ease of handling.
2. Weigh out approximately 100 grams (3.5 ounces) of chopped forage.
3. Spread forage thinly on a microwave-safe dish and place into microwave. Putting a cup of water in the microwave will reduce the chance that this hay will ignite.
4. Heat for 2 minutes and reweigh.
 - a) If forage is not completely dry, reheat for 30 seconds and reweigh. (Microwaves vary considerably in drying capacity. It is better to dry for short intervals and reweigh until the last two weights are constant, than to overdry and run the risk of burning and damage to over.) Continue this process until back-to-back weights are the same or charring occurs.
 - b) If charring occurs, use the previous weight.
5. Calculate moisture content using the following equation:
$$\% \text{ Moisture Content} = \frac{W1 - W2}{W1} \times 100$$

W1 = weight of forage before heating
W2 = weights of forage after heating

Dry matter (DM) is the percentage of forage that is not water. DM equals 100% minus percent water.

Example: moisture content 14%

$$DM = 100 - 14 = 86\%$$

Results on an "as-fed basis" reflect total nutrient concentration including water of sample analyzed or to be fed.

(Source: Southern Forages 1996. D.M. Ball, C.S. Hoveland and G.D. Lacefield. Page 246.)

Now that the hay is in the bale is it dry enough and cool enough to put in the barn. Most hay goes through one or more heating cycles (a sweat) immediately after baling. It is not unusual for internal bale temperature to exceed 100 F and it may go as high as 130 F if enough moisture and oxygen are present. As moisture levels increase in the baled hay the probability of heating increases also.

As temperatures increase in the hay the risk of fire also begins to come into the picture. If you see temperatures rising above that 130 F level, it would be imperative to continue to monitor that hay on a daily basis. If temperatures continue to rise, begin to think about moving the hay out of your storage structure. When temperatures reach 150 F start moving hay immediately. If temperatures reach over 160 degrees call the fire department before moving the hay. At these higher temperatures, an influx of oxygen can ignite a fire and then it is probably too late to call the fire department for fire prevention but rather you will be calling them to put the fire that is burning your hay as well as your storage structure.

When building a hay storage structure be very careful to insure adequate ventilation which will allow for the proper curing of your hay crop. As hay cures, it emits warm moist air. That air rises and needs an escape route at the top of the building. That air needs to escape in order to prevent condensation on the roof which will in turn fall back onto the hay which can cause storage losses and can contribute to the risk of fire. If possible, it is desirable to allow for the inflow of air from the bottom of the building which can help with air flow to remove the warm moist air from the top of the building.

In order to facilitate the proper curing of your hay, store small square bales on edge with the cut side up. This will allow the warm moist air to escape the bale better and rise to and out of the top of the building. Rounds bales should be left outside until temperatures have approached ambient temperature.

In closing, moisture management is critical in packaging and storing hay. The two moisture levels that need to be monitored are baling at the point of baling and when put into storage. If you are relentless in your moisture management, your chance of producing a high quality hay crop is greatly enhanced.

INTERPRETING FORAGE QUALITY TEST REPORTS

*Donna M. Amaral-Phillips, Ph.D.
Department of Animal and Food Sciences
University of Kentucky*

Forages are the foundation for building diets for beef and dairy cattle, horses, sheep and goats. The quality of these forages directly impacts forage intake, animal performance, and, ultimately, the profitability to their owners. As the quality of forages decline, consumption of that forage decreases and the amount of grain or byproducts which must be fed increases. The cost for a unit of performance increases and/or the animal can not perform (i.e. milk or gain) to the optimum level thus lowering profitability to the animal owner. These relationships are especially true with young and high performance ruminants, such as high producing dairy cows and stocker beef cattle with expected high rates of gain. To determine the quality of forage and its best use, a representative sample of the forage needs to be analyzed for its nutrient content by a forage testing laboratory. These results then can be used to not only market this forage but also to balance rations for livestock for optimum and profitable performance.

Why Test Forages?

One question often asked is, “Why should I test my forage before I sell or feed it to my livestock?” The answer to this question depends on whether you are the grower of the forage or the livestock owner. These reasons can be described as the following:

Livestock Owner: Forage analysis results are used to balance rations to support an expected level of animal performance. You want to purchase forages based on a forage analysis so that the forage matches the needs of your livestock and that you pay an appropriate price for that forage.

Forage Grower: First, forage analysis results are used to target the sale of specific lots of hay or other forages to specific animals that the quality will support expected performance. This can improve the satisfaction of the buyer and improve chances for future sales of your product.

Secondly, results from forage analyses should be used to evaluate a grower’s cropping methods. Specifically, the question becomes, “Are there ways to improve the quality of the hay or other forages being sold?” Often times, we use the weather as the reason for lower

quality forages being harvested when the more pressing reason is lack of timely harvest irrespective of the weather.

Representative Samples Are Critical

To determine the quality of a forage, representative samples must be collected and these samples need to be analyzed by a forage testing laboratory. For bales of hay, 15 to 20 separate bales from each lot of hay should be cored using a hay probe. (A lot of hay or silage is defined as forage from the same field that has been cut, handled, and stored under similar conditions.) For square bales of hay, the hay probe should be inserted between the string or wire in the center of the bale on the butt end. For round bales of hay, a sample should be taken from the curved side with the hay probe perpendicular to the side. The entire half pound sample (approximately a quart of material) should be packaged in a “zip lock” plastic bag and sent to a forage testing laboratory for analysis.

Grab samples or flakes of hay will not provide uniform samples for analysis and will not indicate the true nutritive content of the hay when fed to livestock. As shown in table 1, samples collected from a single “flake of hay” are higher in fiber (ADF) and lower in crude protein than the hay sampled using a hay probe. The nutrient content of grab samples reflects the percentage of leaves and stems which are retained in the sample submitted for analysis and do not reflect the quality of the forage available to livestock.

Table 1. Effect of sampling technique on the nutritive values of alfalfa hay.

Sample Technique	Dry Matter (%)	ADF (%)	Crude Protein (%)
22 bales sampled with hay probe	86.6	29.9	16.4
Flake of hay	85.6	34.2	14.5
Grab sample - mainly stems	84.9	39.7	11.6
Grab sample - mainly leaves	83.8	23.1	20.8

Coleman and Milligan, 1989

For silage samples, 15 subsamples should be collected from various locations across the face of a bunker or pile or throughout the unloading process. The samples should be mixed within a bucket and approximately a quart of material should be double bagged and sent for analysis. Samples should be sent at the beginning of the week to ensure they arrive at the laboratory in a timely manner.

Wet Chemistry Versus NIR Method of Analysis

Forage samples are analyzed by forage laboratories using either wet chemistry or near infrared reflectance spectroscopy (NIR) method of analysis. With wet chemistry methods, forage samples are analyzed by a series of chemical methods to determine their nutritive content. In contrast, NIR methods utilize light to quickly determine the nutritive content of a forage. NIR machines are calibrated with equations developed from data collected by wet chemistry methods. For traditional forages raised under “normal” growing conditions, either method is accurate in determining the nutritive content of a forage.

Terminology Used on a Forage Analysis Report

Dry Matter Content – Amount of forage remaining after all the water has been removed from the sample. The results are reported on a percentage basis. Dry matter percentage plus the moisture percentage equals 100 percent.

Moisture Content – Amount of water contain in a forage sample reported on a percentage basis. Dry matter percentage plus the moisture percentage equals 100 percent.

Acid Detergent Fiber Percentage (ADF%) – ADF refers to the fiber fraction containing the cell wall components of cellulose, lignin and silica. Lignin is indigestible whereas cellulose can be digested by the rumen microbes or bugs. Generally, ADF has been used to predict digestibility and thus energy content of a forage . The lower the ADF content, the higher the digestibility and the higher the energy value of a forage.

Neutral Detergent Fiber Percentage (NDF %) – NDF refers to the fiber fraction containing all cell wall components including hemicellulose, cellulose, and lignin. As the NDF content of a forage increases, the amount of the forage a ruminant will consume generally decreases.

NDF Digestibility – refers to the extent that NDF is digested within a defined time period (generally 30 to 48 hours) when the forage sample is cultured in rumen fluid in a laboratory setting. The greater the NDF digestibility, the more nutrients cattle will receive from a given amount of forage, intake of the forage may be improved, and animal performance may be increased.

Relative Feed Value (RFV) is an index used to compare the quality of a tested hay or balage to full-bloom alfalfa hay which is assigned a value of 100. Only the ADF and NDF content of the hay is used to calculate the relative feed value. The protein content of a hay is not reflected in the relative feed value. Within a type of hay, the higher the RFV, the greater the quality of the forage. Because alfalfa generally contains less fiber, alfalfa hay or balage has a higher relative feed value than grass hay at the same stage of maturity.

Relative Forage Quality (RFQ) – is an index to compare the quality of tested hays. This index takes into account the NDF digestibility of a forage. Again, the higher the index, the higher the quality of forage tested.

Crude Protein Percentage – is calculated by forage testing laboratories by measuring the nitrogen content of a forage and multiplying that result by 6.25 - the nitrogen content of an “average amino acid.”

Ruminally Degraded Protein (RDP) – is the fraction of protein which is broken down to ammonia within the rumen. The rumen bacteria then use the ammonia along with an energy source to synthesize microbial protein. Microbial protein is broken down to amino acids in the small intestine and can supply 60 to 80% of the amino acids or protein needs of cattle.

Total Digestible Nutrients (TDN) – is the percentage of digestible material and reflects the amount of energy cattle can derive from a forage or feedstuff. TDN values are calculated through mathematical equations and are not measured in the forage analysis laboratory. Laboratories calculate TDN and other energy values using ADF values or, more recently, equations incorporating the values for various nutrients such as crude protein, NDF, fat, ash, and non-structural carbohydrate content of forages.

Net Energy for Lactation (NE_L) – the concentration of energy (expressed as Mcal per pound) available to support maintenance and milk production of a lactating cow. This unit is the preferred measure of energy for lactating dairy cows. Like other energy values, laboratories use mathematical equations to generate these values. They are not measured in a forage testing laboratory.

Net Energy for Maintenance (NE_M) – the concentration of energy available to support the maintenance requirements of non-lactating cattle and other ruminants. Equations are used to generate these numbers and they are not measured in the forage testing laboratory.

Net Energy for Gain (NE_g) – the concentration of energy available for body tissue or weight gain in non-lactating cattle and other ruminants. Cattle use energy less efficiently for gain than maintenance thus reflecting the lower value. Equations are used to generate these numbers and they are not measured in the forage testing laboratory.

Forage Quality Reports

The format for presenting results on a forage analysis report varies from lab to lab, but, generally, all contain information on the dry matter, moisture, crude protein, acid detergent fiber, neutral detergent fiber, relative feed value, total digestible nutrients, and net energy for lactation content of forages. Additional nutrients also can be analyzed and the results displayed on the report. Additional nutrients can include content of specific minerals both macro and trace minerals (i.e. calcium, phosphorus, zinc, copper), crude fat or ether extract, non-structural carbohydrates and ruminally degradable protein content to name a few.

Figure 1. Example of a forage Analysis Report

Lab #	010		
Identification	Alfalfa-Grass	Dry Matter Basis	As Fed Basis
Moisture		0%	10.4%
Dry Matter		100%	89.6 %
Crude Protein		19.3%	17.3%
Acid Detergent Fiber		29.8%	26.7%
Neutral Detergent Fiber		39.3%	35.2%
RFV		155	
Total Digestible Nutrients		66.2%	59.4%
Net Energy Lactation		0.68 MCAL/LB	0.61 MCAL/LB

Compare Nutrients on Dry Matter Basis

On a forage quality report, the nutrient analysis is presented on both an as fed and dry matter basis. The “as fed basis” numbers reflect the concentration of the various nutrients as they were received by the laboratory with all of the water in the sample. The “dry matter basis” column reflects the concentration of the nutrient after all the water is removed from the sample. Because water dilutes the concentration of nutrients, the concentration of a particular nutrient is higher on a dry matter basis. When comparing the concentration of nutrients found in a forage, comparisons should be made using the dry matter column. Making comparisons on a dry matter basis removes the variation caused by differing moisture content of hays, balages, or haylages.

Moisture Content of Hays

Hay should contain less than 14 percent moisture or more than 86 percent dry matter. Wetter hays are prone to molding. In addition, the purchaser will be paying additional money for the water in the hay which does not provide needed nutrients to livestock.

Quality of Hay = Performance and Profitability

With advancing stage of plant maturity, fiber digestibility and protein content of legume and grass plants decreases while the amount of fiber increases. Consequently, less energy is available to livestock when they consume more mature plants. Energy is the

nutrient that most often limits performance in dairy and beef cattle and other ruminants – not protein.

With energy being the hardest nutrient to provide cattle and other ruminants, **the most important numbers on a forage analysis report are acid detergent fiber (ADF) and/or neutral detergent fiber (NDF) content.** These numbers ultimately relate to the amount of energy available to support milk production, growth, and reproduction. The ADF content reflects the digestibility and amount of energy cattle can obtain from the forage. The NDF content reflects the potential intake of the forage. As the fiber content increases (both ADF and NDF), the digestibility, energy content and potential forage intake decreases. These changes ultimately affect performance and profitability. Protein content is a distant second in importance to fiber content when determining which hay, balage, or haylage to purchase or feed to a group of livestock.

Within a type of hay, the higher the relative feed value, the greater the quality of the forage. Because alfalfa generally contains less fiber, alfalfa hay generally has a higher relative feed value than grass hay at the same stage of maturity. Table 2 lists the different quality standards for alfalfa or grass hay and their corresponding nutrient composition.

Table 2. Alfalfa, Alfalfa/grass mixture, or grass quality.

Category	Relative Feed Value	ADF (%)	NDF (%)	Crude Protein
Prime	> 151	< 30	< 40	> 19
1	125 - 150	31 - 35	40 - 46	17 - 19
2	103 - 124	36 - 40	47 - 53	14 - 16
3	87 - 102	41 - 42	54 - 60	11 - 13

Source: *AGR 131, Alfalfa Hay Quality Makes the Difference*

The quality of hay, balage or haylage needed by a particular animal is governed by the animal's nutrient needs. The higher the nutrient demands on the animal, the higher the quality of forage needed to economically support that performance level. Table 3 illustrates this concept as it relates to various qualities of alfalfa hay fed to dairy or beef cattle.

Table 3. Recommended uses for various qualities of alfalfa.

Relative Feed Value	Uses for dairy cattle	Uses for beef cattle
Over 180	Excellent forage but needs to be fed with other forages	
150 to 180	High-producing dairy cows and calves under 3 months of age	
120 to 150	Low-producing dairy cows and young heifers over 4 months of age	Background or stocker cattle, fresh beef cows or heifers
100 to 120	Dry cows (check potassium level in diet of close-up dry cows) and older heifers when fed with corn silage	Dry beef cows 3 months before calving
under 100		Mid trimester beef cows

ALFALFA HAY FOR HORSES

Bob Coleman, Ph. D/PAS

Extension Horse Specialist

Department of Animal and Food Sciences

University of Kentucky

When horse owners consider hay for their animals a number of criteria are generally considered. Of major importance is the hay must be free of mold and dust, it needs to contain nutrients needed by the horse and it must be palatable. If these criteria are met, the type of hay should not matter. However, that is not the case with many horse owners. When discussing hay, many owners first consider the type of hay. Can it be alfalfa or should it be a grass or how about a mix of grass and a legume. If a group of horse owners were to be polled the results would reflect some who felt alfalfa was the best hay for horses, some would suggest it never be fed and a few would ride the fence being neither strongly for or against alfalfa hay.

It is widely known that alfalfa hay is an excellent source of nutrients. In table 1, there is a comparison between a mid bloom alfalfa and a mid bloom timothy hay. From the comparison, it is evident that the alfalfa can supply more digestible energy, more crude protein and calcium than the timothy hay. If nutrition is a concern for the horse owner then why not alfalfa over a lower nutrient grass hay.

For those horse owners who prefer to feed alfalfa hay the fact that it is a good source of the major nutrients is often the reason for their selection. If alfalfa hay is comparatively priced with a grass hay, cost per unit of nutrients make it a better buy.

So why the reluctance? For some horse owners they feel that alfalfa hay will provide too much in the way of energy and protein for the horses they are feeding and that is not good. In table 2, there is a comparison of the percentage of required nutrients supplied by specific daily intake of hay. In the examples, the daily intakes were held to 2% of body weight or less. For a horse at maintenance eating alfalfa hay at 1.65% of its body weight per day, both digestible energy and protein requirements are met. In fact, the protein requirement for that horse is greatly exceeded. The same horse being fed the timothy hay in the example would need to be fed more hay in order to meet its nutrient requirements or have a supplemental concentrate added to the program. For some horse owners feeding more feed per day is the preferred situation as the extra time spent eating hay may keep the horse from developing certain behaviors that have been linked to boredom. For the maintenance horse eating such a small amount of alfalfa hay each day the total time spent eating will be short and may lead to bored horses that may develop bad habits such a wood chewing.

A more common concern for horse owners using alfalfa hay is providing more nutrients than the horse requires. Again using the maintenance horse eating 1.65% of its body

weight could easily eat 2.0 % or more of a good quality alfalfa hay. The result of this scenario is an overweight horse if access to feed is not restricted. The reality is horses can get fat on alfalfa hay but it is because the owners will not limit the intake of the hay.

In all examples found in table 2, those horses consuming the alfalfa hay will have crude protein intakes that exceed their requirements. This excess protein will be excreted resulting in greater water needs by the horses and wetter stalls. It is not uncommon for a farm feeding alfalfa hay to horses in the barn to have a significant ammonia problem in the barn because of the excessive protein intake.

As with any feeding program, the selection of the feeds to be used should reflect the nutrient needs of the horses being fed. As noted in table 2, the lactating mare's requirements for protein are met when fed alfalfa hay. The intake indicated in the table also provides over 70% of the mare's digestible energy needs as well. If the grass hay is the basis of the lactating mare's diet a concentrate that includes a higher level of protein plus more digestible energy would be needed to meet requirements. The alfalfa based diet allows the horse owner to use a concentrate with a lower protein content and generally feed less concentrate the horse.

As with the maintenance horses and the broodmare the horse at light work consumes a greater portion of its nutrient requirements, when alfalfa hay is the basis for the feeding program. However concerns with feeding levels of protein in excess of the horse's requirements and concerns with wet stalls and ammonia in the barn may cause horse owners to go to more of a grass hay and not a straight alfalfa hay.

Horse owners are or should be concerned about the presence of mold in the hay they are feeding regardless of what type of hay it is. It has been noted by some horse owners that there is an increase presence of mold in alfalfa hay. While there is potential for this to be true the mold may be the result of hay producers putting up hay with a slightly higher moisture content in order to preserve the leaf content of the hay. The presence of the mold is more a function of hay production, not the fact it is alfalfa. However it is a concern especially when as a hay feeder you want to take advantage of the nutrients found in the leaves.

For horse owners, alfalfa hay can be an effective feed, however it is important that intakes of nutrients are controlled for certain classes of horse in particular those horses with lower nutrient needs.

For those supplying hay, what does the horse owner want?

- 1) A hay that is free of mold and dust. Moldy hay has been implicated as a cause of the respiratory condition called heaves. The moldy hay causes an allergic reaction which affects the horse's ability to exhale. The hay fed to horses must be free of mold.
- 2) A consistent product. Hay that is green, leafy with a fresh odor. In addition, bales need to have an assistant makeup throughout the lot of hay. Not always easy to do if a mixed hay is produced.

- 3) Free of trash and other potentially harmful things.
- 4) A bale size that is consistent with the management practices of the horse owner. If the horse owner does not have equipment to move larger packages of hay or appropriate places to store hay, then a small square bale may be the package most desired. It is difficult for the owner to change how they care or feed their horses to accommodate large hay packages.

The bottom line, in my opinion, is alfalfa hay does have a place in feeding programs for horses. It is generally a hay that is well accepted by the horse and provides significant levels of nutrients. Alfalfa hay and horses are a good mix when good feed management is provided.

Table 1. A Comparison of nutrient content of Alfalfa Hay and Orchardgrass hay (on Dry Matter Basis).

	DM %	DE mcal/kg	Crude Protein %	Calcium %	Phosphorous %
Mid Bloom Alfalfa	91.0	2.28	18.7	1.37	0.24
Mid Bloom Timothy	08.6	1.99	9.7	0.48	0.23

Adapted from the Nutrient Requirements of Horses. Fifth Revised Edition 1989.

Table 2. The Percentage of Nutrient Requirements Provided to a 1100 lb (500 kg) horse fed either with a Mid Bloom Alfalfa Hay or Mid Bloom Timothy Hay % of Requirement Provided.

Horse Type	Hay Type	Hay Intake*	DE	Crude Protein
Maintenance	Alfalfa	18	102	118
	Timothy	18	88	60 169
Lactation**	Alfalfa	22	73	118
	Timothy	22	62	60
Light Work***	Alfalfa	18	82	169
	Timothy	18	70	86

* as fed

** first 3 months of lactation

*** Horses used for pleasure riding and showing.

Based on Nutrient needs for a 1100 lb (500 kg) Horse as published in Nutrient Requirements of Horses. Fifth Revised Edition 1989.

WHY DAIRY FARMERS NEED AND WANT HIGH QUALITY ALFALFA HAY

QUALITY OF HAY = PERFORMANCE AND PROFITABILITY

*Donna M. Amaral-Phillips, Ph.D.
Department of Animal and Food Sciences
University of Kentucky*

Why do dairy farmers want high quality forages, including alfalfa hay, to feed to their milking herds? Feeding high-quality forages results in greater feed intake and as a result, dairy cows produce more milk, and they often times can produce this milk more economically. With advancing stage of plant maturity, fiber digestibility and protein content of the alfalfa plant decreases while the amount of fiber increases. Consequently, less energy is available to the cow when it consumes more mature alfalfa. Energy is the nutrient that most often limits performance in dairy or beef cattle - not protein. The take home message here is that the quality of alfalfa hay fed to dairy cows governs performance and profitability.

High producing dairy cows need alfalfa hay, which , after harvest, contains a relative feed value greater than 150. Hay or silage that tests lower than this will increase feed costs, decrease milk production and decrease profitability for the dairy herd. Forage that tests lower can be fed to those cattle that require lower amounts of nutrients relative to the high-producing dairy cow. Table 1 lists the recommended uses for various qualities of alfalfa.

Table1. Recommended uses for various qualities of alfalfa.

Relative Feed Value	Uses for dairy cattle
Over 180	Excellent forage but needs to be fed with other forages
150 to 180	High-producing dairy cows and calves under 3 months of age
120 to 150	Low-producing dairy cows and young heifers over 4 months of age
100 to 120	Dry cows (check potassium level in diet of close-up dry cows) and older heifers when fed with corn silage

Classical studies done at the University of Wisconsin with mid-lactation dairy cows fed alfalfa hay as the sole forage found that for each 1 percent increase in NDF above 40 percent, the amount of alfalfa hay consumed by these cows decreased by 0.5 pound, and milk production decreased by 1 pound per day. Feeding additional grain with lower quality forages did not increase production to the amount seen when early-cut, higher quality forages were fed with lower amount of grain.

This decrease in milk production can be seen even when as little as 5 pounds of alfalfa hay is fed. If we compare the difference in energy supplied by 5 pounds of alfalfa hay with an RFV of 150 versus 115, the lower quality alfalfa hay (RFV = 115) supports 1.5 fewer pounds of milk. At current milk prices, a dairy farmer would generate \$0.23 less daily income per cow with the lower quality alfalfa hay if the ration was not rebalanced. For a 100-cow herd, this reduction in milk production could decrease milk income by \$700 per month. Put another way, profitability for this farmer would be equal if he or she spent an additional \$90/ton for the higher quality alfalfa hay. With the lower quality alfalfa hay, intake is often times decreased. If we take into account a 3-pound decrease in intake of the poorer quality hay, milk production could decrease by as much as 7 pounds of milk, especially in early lactation cows. The bottom line is that dairy farmers need to buy quality hay that has been tested for its nutrient content.

What about feeding western alfalfa hay, which has an RFV over 200? Alfalfa hay with a relative feed value (RFV) of 200 contains considerably less fiber than hay with a slightly lower relative feed value. Alfalfa hay with an RFV greater than 200 acts like a concentrate in a milking cow diet, and these diets need to be balanced as such. In order to use these supreme quality hays, consult your nutritionist to make sure you have adequate amounts of effective fiber (chew factor) in the diet. These hays can be used effectively in diets for the milking herd, but they must be properly balanced to reflect their nutrient composition.

FORAGE TESTING PROGRAM

Michael Judge

Kentucky Department of Agriculture
Marketing & Product Promotion
Frankfort, KY

Livestock farmers who need hay can find it right here in Kentucky. Listings of farms with hay for sale can be found on the Hay and Forage Program page of the Kentucky Department of Agriculture's Web site, www.kyagr.com.

"Last summer's drought has affected pastures and hay crops through much of the Commonwealth, but farmers in some parts of the state have been able to make a hay crop," Agriculture Commissioner Richie Farmer said. "The Hay and Forage Program page enables buyers and sellers to find each other."

KDA offers a hay testing service. KDA staff will take samples of hay and haylage at the farm and analyze them in the KDA Forage Laboratory located in Frankfort. If the hay is to be sold, the staff will make a visual evaluation of the forage to use in the listing on the Hay Sales Directory page. The producer receives an analysis of the forage's nutritional value and a "Interpreting Forage Quality Report" guide.

Tested forages can mean higher profit, whether feeding cattle, horses, goats or other livestock. Forage testing helps to determine fair market value and an equitable price. By keeping a forage journal, testing helps in comparing forage quality year-to-year. The Department charges a \$10 fee per lot for the service. The Kentucky Department of Agriculture's Forage Testing Program follows standards outlined by the National Forage Testing Association (NFTA). Your local Extension Agent can assist you with your winter feed ration.

Listings on the Hay Sales Directory page can be sorted by any combination of county, relative feed value (RFV), bale size and type of hay. Each listing describes a lot's type, cutting date, cutting number, bale size and weight, color, odor, RFV and other characteristics. Some listings contain digital images of the forage.

There are four people who work with the Forage Testing Program; Kimberly Field and Bryn Fallis work the lab in Frankfort, Jim Wade covers the middle western area and Gary Green covers the far western part of the state (see region listing below). The Frankfort lab and Gary Green take appointments for the Forage Testing Van.

The Forage Testing Van is outfitted and used for educational purposes. There are certain criteria for running the van. Four (4) separate 20 amp outlets designated for the hay van, accessible location, and an alternate location for inclement weather. The "Van" can be booked for hay contest, association meetings, fairs, etc.

We work closely with Dr. Garry Lacefield, Extension Forage Specialist; Dr. Ray Smith, Extension Forage Specialist; and Tom Keene, Hay Specialist with the University of Kentucky. There is a great forage website sponsored by the University of Kentucky that contains forage information, publications and links; their website is www.uky.edu/Ag/Forages.

For more information on the Forage Testing Program, call the toll-free Hay Hotline 1-800-248-4628, or contact Kimberly Field by e-mail at kimberly.field@ky.gov.

Following is a list of counties per region:

Gary Green (270) 779-4930		Jim Wade (270) 776-2172		All other counties, please contact the hay lab at (800) 248-4628
Henderson	McLean	Meade	Hardin	
Muhlenberg	Union	Larue	Green	
Webster	Hopkins	Hart	Metcalfe	
Christian	Crittenden	Monroe	Breckinridge	
Caldwell	Trigg	Grayson	Edmonson	
Lyon	Livingston	Allen	Warren	
McCracken	Marshall	Hancock	Ohio	
Calloway	Graves	Daviess	Todd	
Ballard	Carlisle	Logan	Butler	
Hickman	Fulton	Barren	Simpson	

