35th Kentucky Alfalfa Conference Proceedings

Volume 35, Number 1
Garry Lacefield & Christi Forsythe, Editors

FEBRUARY 26, 2015
Cave City Convention Center
Cave City, Kentucky

Sponsored by
University of Kentucky ● College of Agriculture ● Cooperative Extension Service
Kentucky Forage and Grassland Council
Kentucky Department of Agriculture
Schedule for the Day

8:00 a.m.  Registration, visit exhibits and silent auction

8:45   Welcome - Garry Lacefield

9:00   Kentucky Alfalfa Conference Reflections after 35 Years - Garry Lacefield

9:15   Alfalfa is our Family Farming Operation - Myron Ellis

10:00  What's Required to Break the "beef per acre" Kentucky Record - Ken Johnson

10:15  Grazing Alfalfa: Real Cost of "Fear" of Bloat - Ray Smith

10:30  Break

11:10  Red Meat, Our Health and Alfalfa - Separating Scientific Fact from Opinions, Policy, Politics, and Bureaucracy - Peter Ballerstedt

12:00  Lunch, Awards Presentation

1:00   Silent Auction Results

1:30   Alfalfa and the Environment - Don Ball

2:00   Hay Quality: What is it? - Garry Lacefield

2:15   Farmer Panel - What Hay Quality Means to ME -
       Clayton Geralds
       Ben Cox
       John McCoy
       Dennis Wright
       Minos or Glenn Cox

3:30   Final Comments and Adjourn - Garry Lacefield
FOREWORD

This conference marks the thirty-fifth 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 thirty 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
XXXV Annual Kentucky Alfalfa Conference

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.

<table>
<thead>
<tr>
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</tbody>
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# Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Alfalfa Conference Reflections After 35 Years</td>
<td>1</td>
</tr>
<tr>
<td><strong>Garry Lacefield</strong></td>
<td></td>
</tr>
<tr>
<td>Alfalfa is our Family Farming Operation</td>
<td>7</td>
</tr>
<tr>
<td><strong>Myron Ellis</strong></td>
<td></td>
</tr>
<tr>
<td>What's Required to Break the “beef per acre” Kentucky Record</td>
<td>9</td>
</tr>
<tr>
<td><strong>Ken Johnson</strong></td>
<td></td>
</tr>
<tr>
<td>Grazing Alfalfa: Real Cost of “Fear” of Bloat</td>
<td>11</td>
</tr>
<tr>
<td><strong>Ray Smith</strong></td>
<td></td>
</tr>
<tr>
<td>Red Meat, Our Health and Alfalfa - Separating Scientific Fact from</td>
<td>17</td>
</tr>
<tr>
<td>Opinions, Policy, Politics, and Bureaucracy</td>
<td></td>
</tr>
<tr>
<td><strong>Peter Ballerstedt</strong></td>
<td></td>
</tr>
<tr>
<td>Alfalfa and the Environment</td>
<td>31</td>
</tr>
<tr>
<td><strong>Don Ball</strong></td>
<td></td>
</tr>
<tr>
<td>Hay Quality: What is it?</td>
<td>37</td>
</tr>
<tr>
<td><strong>Garry Lacefield</strong></td>
<td></td>
</tr>
<tr>
<td>Farmer Panel - What Hay Quality Means to ME</td>
<td>53</td>
</tr>
<tr>
<td><strong>Clayton Geralds</strong>, <strong>Ben Cox</strong>, <strong>John McCoy</strong>, <strong>Dennis Wright</strong>,</td>
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This event today marks the 35th consecutive year we have come together for a full day’s conference featuring "Alfalfa - Queen of the Forages" as the theme and focal point. Only one other state (California) in the U.S. has such an annual event.

The Beginning – I have always had respect for alfalfa and even selected alfalfa as the crop that I did my Ph.D. work on at the University of Missouri. Warren Thompson had a very active and effective alfalfa extension program throughout his career. Ken Evans and I had an active extension program on alfalfa during the seventies. Two key events during 1980 resulted in a renewed emphasis on alfalfa in Kentucky and the beginning of the Alfalfa Conference.

In the summer of 1980, I was invited by the Certified Alfalfa Seed Council to participate in a study tour of the alfalfa seed producing area in five western states. During that tour, I met, got to know, and visited with, some of the leading alfalfa experts in the U.S. Their experience and enthusiasm during that tour resulted in me returning to Kentucky with a renewed enthusiasm for alfalfa and its role in Kentucky. At that time, Kentucky had approximately 150,000 acres of alfalfa. A University of Kentucky study conducted earlier indicated a million acre potential.

In the fall of 1980, and shortly after my trip out west, we scheduled a KFGC Board meeting in Louisville. I had made arrangements for some farm visits in Shelby County on the afternoon before the board meeting. Dr. Monroe Rasnake traveled with me from Princeton to Louisville. During check-in at the hotel, Charlie Schnitzler and Wallace Campbell came into the lobby after driving in from Lincoln County. I invited Charlie and Wallace to accompany us on the farm visits. They agreed and we were off to Shelby County on a beautiful fall day to visit alfalfa fields. Roy Catlett had several visits lined-up. I remember visiting several fields with Jack and Frederica Clore. We also visited other alfalfa fields on several farms in the county. It was a most enjoyable afternoon and I learned a lot from Charlie and Wallace as we traveled. During these visits, Roy and I discussed the possibility of having a winter meeting just on alfalfa since there was so much interest in the county. Charlie Schnitzler told me during our travels that he felt the opportunities for alfalfa in Kentucky were great, and he encouraged me to place greater emphasis on this high yielding, high-quality crop. As always, Charlie volunteered to help in any way.
Over the next few weeks I developed some plans for a statewide meeting and discussed them with Ken Evans, Warren Thompson, Monroe Rasnake, Charlie Schnitzler and several County Agents. Each of these people were most supportive and encouraged me to move ahead.

In January of 1981, we had our first Kentucky Alfalfa Conference in Shelbyville, and repeated it in Princeton. The attendance, participation, and feedback was excellent. In 1982, the 2nd Annual Kentucky Alfalfa Conference was held in Lexington and Princeton in conjunction with the National Alfalfa Symposium. In 1984, we met in Princeton, and with standing room only realized we had outgrown that facility. We continued to meet each year thereafter (Table 1) with attendance of 150 to over 400.

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*Held in conjunction with National Alfalfa Symposium

Program Content – A review of the programs over the past thirty-four years indicates we have spent a lot of time on the basics. Soils, fertility, weed control, insect and disease control, establishment, varieties, harvesting, handling, storing, grazing, quality, marketing, economics, and alfalfa in livestock feeding programs have been frequent topics on past programs. Producers have been featured on many of the programs over the years, and it was a producer, Mr. Charlie Schnitzler, that served as our keynote speaker on our first conference program. In addition to the basics, we have complemented the program with timely, cutting-edge issues dealing with advances in
seed coating, variety development, hybrid alfalfa, grazing tolerance, Roundup Ready, baleage, pest management, etc.

**Hay Show** – In 1989, we began the Hay Show in cooperation with the Kentucky Department of Agriculture and later joined by the Kentucky Pride Hay Growers Association. The contest was sponsored by Garst Seed Company. Approximately $3,000 in prizes and trophies were awarded. The program has changed over the past decade. At present, in cooperation with the Kentucky Forage and Grassland Council, University of Kentucky and Kentucky Department of Agriculture, we present awards for the “monthly” highest quality alfalfa and alfalfa-grass hay tested through the Department of Agriculture.

**Industry - A Valuable Assist** – With only two exceptions, we have had exhibits at each conference. We value the support and contributions of all our exhibitors. Several exhibitors here today have been present at every conference. I have never asked one of the exhibitors for anything to which they didn't readily agree. Their financial contributions have helped us keep all our bills paid. Our surveys indicate that participants enjoy getting to visit with all the exhibitors and that exhibitors enjoy having the opportunity to meet and visit with Kentucky's leaders in alfalfa production, research, and education.

**Awards** – During the 20th Kentucky Alfalfa Conference and in cooperation with the Kentucky Forage & Grassland Council, the Alfalfa Awards Program was initiated. Since 2000, we have recognized outstanding achievement in the Producer, Public and Industry segments (Table 2).

Kentucky farmers have been the focus of the conference from day one. It was a farmer who helped me start this event. I have featured farmers on most of the Conferences. Most of our AFGC National Forage Spokesman participants from Kentucky spoke at this conference including: Charlie Schnitzler, Larry Jeffries, Russell Hackley, John Nowak, Jason Sandefur, Jay Price, Bill Payne, Todd Clark, Barry Drury, Charles Powell, John McCoy, Clayton Geralds and Myron Ellis. It has been farmers who have been my greatest supporters and encouragers over the years. Farmers who came to me during two ice storms when attendance was low and said “Garry if you need money to help pay for the conference, let me know.” To this special group of “friends”, I say THANK YOU and wish you the very best.
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**Proceedings** – We have been faithful in producing a comprehensive conference proceedings each year to have available at the conference. Christi and I want to say a special thanks to all speakers for providing their paper several weeks in advance. Proceedings have been distributed and used after the conference by many who couldn’t attend and also by University classes and for numerous trainings and workshops. Since 2004 we have posted the proceedings on our website.

**Media** – We have received excellent support from many media outlets including T.V., radio, newspapers, magazines and newsletters. In addition to their valuable asset in promoting the conference, many have attended and written stories, made radio and television programs as well as follow-up conference reports and highlights at meetings.

**Summary** – It's hard to believe that when this Conference started, my oldest son was four years old. At the 24th Kentucky Alfalfa Conference he was a speaker. Now, he and my youngest son are both fathers and I am a Papa. Time indeed has passed fast. I have been involved in many different conferences, symposia, and meetings over the years, but this Conference has been special. It is special for two important reasons. Reason one is the plant – Alfalfa—Queen of the Forage Crops – has been a tried and
true performer. It has proven its abilities to produce high yields and high quality forage and to be a money maker. The second reason is people – I have never come to this Conference without thinking of all the people that work so hard to make it happen. From my inspirations initially Charlie Schnitzler and Warren Thompson, to this group of special friends that I have invited to speak here today, and all those in-between, I say THANK YOU. I am also appreciative of the exhibitors who have been so supportive, to all the County Agents who give unselfishly to ensure the Conference runs smoothly. I am thankful to all who have attended over the past 35 years from throughout Kentucky along with 41 other states and 18 countries. I also want to thank the Kentucky Forage & Grassland Council, the Kentucky Department of Agriculture, and the University of Kentucky Plant and Soil Science Department for their many contributions.

I extend a very special THANK YOU to Christi Forsythe, who has done the most to make this Conference such a success. Her attention to details in preparing programs, coordinating exhibits, editing proceedings, and keeping the records is much appreciated. I close by thanking my wife Cheryl and our son’s Brian and Brad for their understanding and support for all the times I have been away from home working on this and many other conferences and meetings.

And now, after 35 years, where do we go from here?
ALFALFA IS OUR FAMILY FARMING OPERATION

Myron Ellis
Mercer County Hay Producer

Ellis Family Farm is a 5th generation family farm located in Harrodsburg, KY. Currently we farm 1250 acres total of which 870 acres is owned and the remainder is leased. We buy and resale between 1500-1800 head of feeder cattle per year and have 100 head of brood cows. The cattle operation feed is completely supplied by the first cutting of our 580 acres of alfalfa and alfalfa grass mix hay. From the second cutting on, we produce small square bales of alfalfa for the horse market in four states. Our normal production of square bales ranges between 75,000 and 100,000 bales per year. We also buy hay from local producers to resale to meet our customers’ needs.

Being a family farm we depend on mostly family members for our labor source. We employ three full time family members and one part time family member that is currently a high school student. We also have two full time employees. With such a small labor force we depend heavily on mechanization to handle the square bales as well as feed and care for the cattle.
WHAT'S REQUIRED TO BREAK THE "BEEF PER ACRE" KENTUCKY RECORD

Ken Johnson
Monroe County Agriculture & Natural Resources Extension Agent
Tompkinsville, KY

As I approach the task that Garry assigned me, I ask the question, "Do I really want to attempt to produce 1400 or more pounds of beef per acre?" An easy answer is "yes," but more likely "no." Most farmers I know, full or part time have all they can do now and to reach record levels of anything requires much more time and management. I am going to attempt to discuss the steps I think that will be required to reach record breaking production. Higher gains are certainly possible. We know alfalfa can produce 8 to 10 tons of yield per acre, much more with irrigation. I will take a plant, animal, and management approach to address this issue.

When we set the "pounds of beef per acre" record in 1991, we had a very good growing season. So pick a good year. Pick a productive soil that is well suited for alfalfa. You must also have a very productive stand of alfalfa, the kind of stand that is needed for top hay yields. At least five plants per square foot. Fertility must be in the high range for all nutrients. pH should around be 6.5. Hopefully you will have a high yielding variety of alfalfa. It will take 6-8 pounds of forage or more to produce one pound of gain; the stand will need to produce 5 to 6 tons of forage per acre to have chance of breaking this record. We mowed some of the field for hay in the spring so we would have more land area to add to the system as you move into hotter, dryer weather. Try to have shade and a sacrifice area t use when it’s muddy.

Just as you need a good soil and stand to break records, you need the right cattle. Since smaller calves have a lower maintenance requirement, more of what they eat will go towards gain. Our heifers weighed 482 pounds when they started. You probably don't want to be much lower than 450. They need to be healthy, growthy, and in only moderate flesh. If the calves are fat you don't stand a chance. We started with a 4000 pound per acre stocking rate. You need a high enough stocking rate to keep the alfalfa in a vegetative state. You will be adding and removing calves throughout the summer based on weight and forage availability; you must have a scale. You must have a have a good health program, implant the calves, and use a growth promoter, we used rumensin. It is to your advantage replace some to the calves as they get bigger, maybe 600 pounds or so and replace with smaller calves. Our calves gained 1.3 pounds per day, remember calves must gain enough to cover their fixed cost; after that more calves per acre will increase the rate of gain per acre.
Most of you can do all of the things I talked about above. The real key to making this work is time and management. You must have a very intensive grazing management system. We moved our cattle every two to three days. The more often you move the cattle the more efficiently you can harvest the alfalfa, giving you a better chance to obtain top gains. Many dairymen move lactating cows every few hours to get top milk production, you might want to consider using temporary fence and cutting fields into smaller sizes and more as often as you can manage. You need to graze the alfalfa down close to the ground. I think by making the calves graze the whole plant, stems as well as leaves, helps with the potential bloat problem. You need to see these calves at least twice a day to catch any problems early and remove that calf or calves and replace with others. Remove any calf that appears to be gaining slower than the others. You need to watch the alfalfa so you can move at the right time. Don't let the calves get overly hungry; you can set yourself up for bloat.

To make this work, you need to be watching the weather, the livestock, and the forage; sometimes this can be a bit overwhelming. These are my thoughts on ways to improve your grazing operation, even if not using every technique. Almost every technique discussed will help you bottom line. We didn’t do everything I have mentioned, we just got lucky.
In the Southeast, including legumes like alfalfa and clover in pastures provides many advantages. It reduces the impact of fescue toxicosis, provides free nitrogen, and improves pasture quality leading to increased animal performance. Individual animal performance is greater on grass/legume pastures compared to performance on similar monoculture grass stands. Daily gains for steers grazing clover-fescue swards is improved compared to straight tall fescue pastures (Figure 1). Improved performance is partially due to greater forage intakes. This practice is sound management even though legume bloat is a risk to livestock. If one considers the number of cattle grazing pastures containing legumes worldwide, the “fear of bloat” results in far greater economic losses from low beef cattle gain than the potential losses from bloat itself. In other words, if you don’t incorporate legumes into your pastures, you are leaving money on the table.

Figure 1 taken from ID-186 “Managing Legume-Induced Bloat in Cattle”
http://www.ca.uky.edu/agc/pubs/id/id186/id186.pdf
There are many millions of acres of pastures across the U.S. where legumes are not planted in pastures because cattleman are concerned about the risk of bloat. The authors don’t mean to belittle the “fear of bloat” though. Some of the best cattleman in the country have lost one or more head to bloat and most can tell you about at least one sleepless night when they stayed up worrying about the potential for dead animals the next morning from bloat. The objective of this presentation is simply to provide a realistic picture of the risks of bloat occurring on your farm and to provide an example of the economic losses you may suffer by not planting legumes. We will also provide information from the UK Pub ID-186 on how to reduce the risk of bloat on your operation.

As a background, the spring of 2010 saw some of the largest bloat losses in recent memory in Kentucky. The UK Veterinary Diagnostic Lab received reported bloat cases that were 5 to 10 times higher than normal. Most of these losses were attributed to an abundance of white clover in pastures and climatic conditions that encouraged bloat events. Following this spring, UK Beef and Forage Specialists, led by Dr. Jeff Lehmkuhler, conducted a survey of county agents to better understand the severity of the problem. Figure 2 shows that the central Bluegrass area of the state had the greatest losses. This was not a comprehensive survey since only 42 counties reported, but we believe that it’s safe to assume that the counties with the greatest losses were the ones that completed the survey.

Table 1 shows the results of the bloat survey. The important thing is that 2010 provides a good example of a worst case scenario for bloat in Kentucky. Interestingly, even with this worst case scenario type of year and the fact that many counties in Kentucky did not report, the incidence of bloat was only 1%.
Table 1. Summary of 2010 Kentucky Clover Induced Bloat Questionnaire: Number of operations and cattle numbers represented by questionnaire responses.

<table>
<thead>
<tr>
<th>Item</th>
<th>No. of responses</th>
<th>No. of counties represented</th>
<th>Total No. of cattle represented</th>
<th>No. of responses that indicating cattle lost to bloat</th>
<th>% of responses with cattle losses to bloat</th>
<th>Est. number of cattle lost to bloat</th>
<th>Cattle lost as a % of the total represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of responses</td>
<td>295</td>
<td></td>
<td>65,822</td>
<td>107</td>
<td>36.3%</td>
<td>670</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Dr. Kenny Burdine has developed several economic projections about the benefit of adding legumes to a pasture and the potential losses to your operation if you suffer death losses due to bloat. Table 2 shows the added value of including legumes in a pasture. On the conservative end legumes should provide an additional 0.25 lbs/hd/day gain and often add an additional 0.50 lbs/hd/day gain. When grazing mixed alfalfa/orchardgrass pastures that contain a 50% or more alfalfa, it would not be uncommon for the additional daily gain to be higher than this. In short, this table shows that adding legumes can give the potential for more gain per day and that this added daily gain translates into a making more money per head (even with the price slide).

Table 2. Increased weight gain valuation – the price impact – when grazing pastures that contain legumes. The “No change” column in this table represents the value of the animal that was grazing a pure grass pasture. The next two columns represent the animal that gained 0.25 and 0.50 lbs/day grazing a mixed grass/legume pasture and the additional revenue you would receive from this added gain.

<table>
<thead>
<tr>
<th>Sale Price</th>
<th>No. Change 750 lbs</th>
<th>0.25 lbs per day 795 lbs</th>
<th>0.5 lbs per day 840 lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200 per cwt</td>
<td>$1,500</td>
<td>$1,561</td>
<td>$1,620</td>
</tr>
<tr>
<td></td>
<td>$61</td>
<td>$120</td>
<td></td>
</tr>
<tr>
<td>$210 per cwt</td>
<td>$1,575</td>
<td>$1,641</td>
<td>$1,704</td>
</tr>
<tr>
<td></td>
<td>$66</td>
<td>$129</td>
<td></td>
</tr>
<tr>
<td>$220 per cwt</td>
<td>$1,650</td>
<td>$1,720</td>
<td>$1,788</td>
</tr>
<tr>
<td></td>
<td>$70</td>
<td>$138</td>
<td></td>
</tr>
</tbody>
</table>

Assumptions: 750# steer, $8 slide, 180 day period
Table 3 shows the economic losses that can occur when cattle die because of bloat. The simplest example is that if 1% of your herd is lost to bloat and the placement cost is $1000, then you lose $10 per head. In other words, if a cattleman with 100 head losses one animal, then he/she losses $10 per head because of this one mortality. Based on the 2010 Kentucky survey where losses were at historic highs, the bloat losses were approximately 1% in the area that was the hardest hit. We have also included a 2.5% and a 5% mortality rate because bloat does not affect all producers the same. For example, many producers may be using the strategies listed below to reduce the chance of bloat and have no losses, but if one producer in five has a 5% death rate, then the overall average mortality rate is 1%.

Table 3. Mortality reduction impacts based on placement cost and different mortality rates.

<table>
<thead>
<tr>
<th>Placement Cost</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1%</td>
</tr>
<tr>
<td>$1,000</td>
<td>$0</td>
</tr>
<tr>
<td>$1,200</td>
<td>$0</td>
</tr>
<tr>
<td>$1,400</td>
<td>$0</td>
</tr>
</tbody>
</table>

**Recommendations to reduce the risk of bloat**

When cattle graze lush plants capable of causing legume bloat, no management practice will insure bloat doesn’t occur. The following management strategies can, however, reduce its incidence:

- Grow grass-legume mixtures instead of pure legumes.
- Avoid grazing very immature white clover or alfalfa. Research shows alfalfa grazed less than 10 inches tall had two times more bloat than when it is grazed at 19 inches.
- Put animals on lush legume pastures only when plants are free of surface moisture (dew or rain).
- Provide a full feeding of hay before turning animals into lush legume stands for the first time.
- Although bloat is associated with certain plants, some animals have a genetic predisposition to bloat, so you should cull chronic bloaters.
• Do not remove animals from pasture during first signs of bloat. Continuous grazing results in less incidence of bloat than removal and return.
• Provide access to water and minerals.
• Observe animals closely following any abrupt change in the weather.
• Feed bloat-reducing compounds. *Note: Ionophores like monensin reduce the risk of bloat. Poloxalene is a compound that when fed at the recommended rate prevents bloat. It is often sold in “bloat blocks” or mineral blocks containing poloxalene. The limitation to bloat blocks is that all animals don’t consume the same amount. One way to insure the correct dosage is to mix poloxalene with feed and then give a daily ration of the mixture)*.
• Mowing and wilting legumes prior to grazing has shown some potential to reduce the incidence of bloat in alfalfa, based on research in the upper Midwest. Currently, the potential of this practice to reduce bloat when grazing white clover is uncertain.

In conclusion, bloat can be a concern when grazing mixed grass/legume stands during certain years. Although the incidence of bloat is rare, when it does occur it can be significant to an individual producer. One option is to not include legumes in your pastures in Kentucky, but leaving legumes out results in significant economic losses from gain you don’t realize (for more details see ID-186 “Managing Legume-Induced Bloat in Cattle” http://www.ca.uky.edu/agc/pubs/id/id186/id186.pdf).
“For 50 years an increasingly specious, pseudoscientific dogma has been growing in the Western world. This hypothesis originally proposed that coronary heart disease, the main cause of death here, is caused by the kind and amount of fat in our diets. That hypothesis was based upon fragile and selected data. The hypothesis has now been tested in dozens of clinical trial costing hundreds of millions of dollars... The evidence consistently says, 'No, this is not a sound hypothesis.'” (Mann, 1993 cited by Ottoboni, 2012)

The general public is becoming increasingly aware of the failure of the official nutritional policy of United States and other countries. Books like Good Calories, Bad Calories: Fats, Carbs, and the Controversial Science of Diet and Health (Taubes, 2008), Why We Get Fat and What To Do About It (Taubes, 2011) and The Big Fat Surprise: Why Butter, Meat and Cheese Belong in a Healthy Diet (Teicholz, 2014) have exposed the disconnect between nutrition science and nutrition policy, and have told the story of how we’ve come to this point in history.

Environmental concerns, often assembled under the often ill-defined term “sustainability,” are now being used to legitimize plant-based dietary policy and advice that can no longer be justified from nutrition science. The rhetoric and behavior being employed to justify this non-scientific position is remarkable similar to that used during the “heart-healthy” controversy of a generation ago. For this reason, both topics will be discussed in this paper.
“Beef: The REAL Health Food”

One definition of health food is “any natural food popularly believed to promote or sustain good health, as by containing vital nutrients, being grown without the use of pesticides, or having a low sodium or fat content” (dictionary.com, 2014). This source states the date of origin of this phrase as “1880–1885,” the beginning of the publishing career of Dr. John Harvey Kellogg, a faith-based advocate for a vegetarian diet and “biological living” (Urantia, 2014). Dr. Kellogg, along with his brother Will Keith “changed breakfast forever” when they developed and started marketing the first breakfast cereals at the turn of the 20th century (Kellogg’s, 2011). The popularity of some of Dr. Kellogg’s “treatments” have fortunately declined (e.g. yogurt enemas), but many of his disproven beliefs still persist today – promoted by the health food and other related industries, and enshrined in public policy.

The 2010 Dietary Guidelines for Americans recommends restricting our intake of saturated fat to less than 7 percent of calories, and our cholesterol intake to less than 300 mg per day (less than two eggs). They promote the use of low-fat milk and lean meat, and the use of “meat substitutes” in school lunches. These recommendations are consistent with the official dietary policy that began in 1977 with the release of the first Dietary Goals for the United States by the United States Senate Select Committee on Nutrition and Human Needs. These guidelines were not justified by the then-available science. They were adopted despite the concerns of researchers and physicians. Subsequent research has disproven the hypothesis upon which they were based. They have failed to produce the promised benefits. Since animal products are a significant source of saturated fat and cholesterol, the official advice has been to limit the consumption of animal products in general and red meat in particular. At best animal products have been wrongly accused and unfairly impacted by public policy; at worst vast physical and fiscal harm has been done to the American public.

It will be argued in this presentation that a diet based upon animal products (meat, poultry and eggs, fish and shellfish, and dairy) has repeated been shown to not only “promote or sustain good health,” but produce greater improvements in biomarkers of chronic disease risk than plant-based, high carbohydrate diets, and frequently greater than that produced by medication. In addition, it will be argued that it is in fact the refined carbohydrates (starches and sugars) and not animal protein or animal fat that are the most like dietary causes of numerous chronic illnesses. Further, it will be argued that, unlike plant-based diets, diets based upon animal products supply all of the known “vital nutrients” without the need for fortification or supplements. Most significantly it will be argued that the idea that a health food must have “a low … fat content” is scientifically unjustified, as are the frequent assertions that Americans should limit their consumption of red meat for the sake of their health (concerns regarding environmental and sustainability issues will be addressed in the companion paper “Red Meat is Green”). Since beef is America’s favorite red meat, the official and popular dietary messaging has been to limit beef consumption. The actual evidence, however, fully justifies describing beef as the real health food.
**Introduction:** A thorough discussion of diet, health and human nutrition is beyond the scope of this paper. The comprehensive review provided by Taubes in “Good Calories, Bad Calories” (Taubes, 2008) is highly recommended. Rather, the remainder of this paper will be a brief examination of the scientific controversy regarding dietary cholesterol and saturated fat recommendations.

In 1977 the United States Senate Select Committee on Nutrition and Human Needs chose one side of an on-going scientific debate. They endorsed the unproven diet-heart hypothesis, which proposed that the excessive consumption of fat in our diets – particularly saturated fats – raises serum cholesterol levels and so causes atherosclerosis, heart disease, and untimely death (Taubes, 2008). That decision was antithetical to the then-mainstream paradigm of the fattening carbohydrate, since low fat diets are higher in carbohydrates by definition. Ultimately, the goal of all dietary policy became reducing heart disease, and what was good for the heart must be good for every other diet-related matter. Thus an unproven hypothesis became the unquestioningly accepted basis for dietary recommendations for over a generation. The 2010 Guidelines, the “federal government’s evidence-based nutritional guidance to promote health, reduce the risk of chronic diseases, and reduce the prevalence of overweight and obesity,” (USDA, 2011) continues to maintain this position. The USDA’s admission that despite their dietary advice, “more than one-third of children and more than two-thirds of adults in the United States are overweight or obese.” (USDA, 2011) suggests the need for a thorough re-evaluation of the diet-heart hypothesis. A brief examination of the effect of dietary cholesterol upon serum cholesterol levels and the relationship between saturated fat and coronary heart disease will demonstrate that this hypothesis was not true and that advice to limit the consumption of animal products is groundless.

**Discussion:** At the time of the Committee’s decision there was a vigorous scientific debate about the diet-heart hypothesis. “Two strikingly polar attitudes persist on this subject, with much talk from each and little listening between.” (Blackburn, 1975). Three years later, the year after Dietary Goals was released, Thomas Dawber wrote: “It must still be admitted that the diet-heart relation is an unproved hypothesis that needs much more investigation.” (Dawber, 1978). Indeed, the Committee didn’t even know if their recommendations would work. The first entry on their list of “Important questions, which are currently being investigated” was “Does lowering the plasma cholesterol level through dietary modification prevent or delay heart disease in man?” (Senate Committee, 1977) Available research suggested it would not.

Two Columbia University biochemists had demonstrated in 1937 that dietary cholesterol has little or no influence on serum cholesterol (Rittenberg, Schoenheimer, 1937). This finding has never been refuted. For most individuals, the effect of following the recommendation would be “clinically meaningless.” (Howel et al., 1997). Nevertheless, we are still advised to eat less cholesterol because “telling people they should worry about cholesterol in their blood but not in their diet has been deemed too confusing” (Taubes, 2008). Lowering serum cholesterol by replacing saturated fat with polyunsaturated fats had produce mixed results. Such cholesterol lowering interventions
occasionally reduced heart disease mortality, but they increased cancer mortality (Dayton et al., 1969), so there was no decrease in total mortality. More deaths were recorded in the intervention group of one study, but the results went unreported for 16 years (Franz et al., 1989), because “we didn’t like the way it turned out.” (Taubes, 2008). This relationship between low cholesterol and increased cancer mortality has been repeatedly observed (Feinleib, 1983).

Ironically Ancel Keys, the father of the diet-heart hypothesis, reported seven years after the Guidelines were released that neither high cholesterol nor saturated fat consumption predicts total mortality (Keys et al, 1984). Keys later recanted the idea that dietary cholesterol raises blood levels: “Cholesterol in food has no effect on cholesterol in blood and we’ve known that all along.” “I’ve come think that cholesterol is not as important as we used to think it was,” he said, “Let’s reduce cholesterol by reasonable means, but let’s not get too excited about it.” (Boffey, 1987).

Just when the Committee was forming the guidelines that would shape the eating habits of every American, the first reports on Low Density Lipoprotein (LDL) cholesterol and High Density Lipoprotein (HDL) cholesterol were emerging from the Framingham, San Francisco, Puerto Rico, Albany and Honolulu cohort studies. They demonstrated that: Total cholesterol does not predict future heart disease; LDL cholesterol is a “marginal risk factor;” HDL cholesterol is a 4-fold better predictor of risk than LDL cholesterol and the only reliable predictor of risk for men or women over 50. It was demonstrated that saturated fat raises HDL cholesterol while carbohydrates lower it (Castelli et al, 1977, Gordon et al, 1977). It was reported in 1981 that saturated fat and total fat were positively associated with longevity (Gordon et al, 1981, Feinleib, 1981). This information would not deter policy makers from labeling saturated fat “artery-clogging” and that carbohydrates were “heart-healthy diet food.” The 2010 Guidelines, still state that “Healthy diets are high in carbohydrates.” (USDA, 2010)

The basis for recommending low-fat and low-saturated fat diets has been further disproven by recent research. Meta-Analyses on “Reduced or modified dietary fat for preventing cardiovascular disease” found no effect on longevity, and no “significant effect on cardiovascular events.” (Hooper et al, 2001). An analysis of “Multiple risk factor interventions for primary prevention for coronary heart disease” demonstrated that “The pooled effects suggest multiple risk factor intervention has no effect on mortality.” (Ebrahim et al. 2006) The Women’s Health Initiative failed to prove several frequently-stated dietary myths, although policy hasn’t been affected. “The intervention did not reduce risk of CHD or stroke.” (Howard et al. 2006) “A low-fat dietary pattern did not result in a statistically significant reduction in the risk of invasive breast cancer...” (Prentice et al. 2006). “There is no evidence that a low-fat dietary pattern intervention reduces colorectal cancer risk...” (Beresford et al. 2006). “A low-fat dietary pattern among generally healthy postmenopausal women showed no evidence of reducing diabetes risk...” (Tinker et al. 2008). Prior to the release of the 2010 Guidelines, the FAO stated that “The available evidence from cohort and randomized controlled trials is unsatisfactory and unreliable to make judgment about and substantiate the effects of dietary fat on risk of CHD.” (FAO, 2010, Skeaff, Miller, 2009). And in 2010 “A meta-
analysis of prospective epidemiologic studies showed that there is no significant
evidence for concluding that dietary saturated fat is associated with an increased risk of
CHD or CVD." (Siri-Tarino et al 2010) Yet the recommendations to restrict total fat and
saturated fat consumption continue.

Substantial evidence has accumulated that these recommendations are in fact
harmful. "The low-fat, high-carbohydrate diet, promulgated vigorously ... by the USDA
food pyramid, may well have played an unintended role in the current epidemics of
obesity, lipid abnormalities, type II diabetes, and metabolic syndromes." (Weinberg,
2004). The rate of obesity in adults has doubled in the last 20 years. It has almost
tripled in kids ages 2-11. It has more than tripled in children ages 12-19 (CDC, 2011).
Without major changes, 1 in 3 babies born today will develop diabetes in their lifetime
(ADA, 2011). Average healthcare costs for someone who has one or more chronic
conditions is 5 times greater than for someone without any chronic conditions
(Partnership for Solutions, 2004). Diets based upon animal products and high in fat
have been shown to produce greater weight loss, better blood glucose control, and
reduced CVD risks compared to low fat diets (Gardner, 2007).

Given that the numerous symptoms of metabolic syndrome are most effectively
treated by adopting a low carbohydrate, high fat way of eating (Taubes, 2008), and that
such diets will be based upon animal products, including red meat. And since beef is
America’s preferred red meat, calling beef a health food is justified. When the research,
clinical and anecdotal results of such diets are compared with those for diets based
upon the products of the low-fat industry, calling beef the real health food is also
justified.

"Red Meat IS Green!"

Gary Taubes, in “Why We Get Fat and What to Do About It,” provides the
introduction to this presentation (Taubes, 2011):

"Carbohydrate-restricted diets typically (if not, perhaps, ideally)
replace the carbohydrates in the diet with large or at least larger portions
of animal products—beginning with eggs for breakfast and moving to
meat, fish, or fowl for lunch and dinner. The implications of that are
proper to debate. Isn’t our dependence on animal products already bad
for the environment, and won’t it just get worse? Isn’t livestock production
a major contributor to global warming, water shortages, and pollution?
When thinking about a healthy diet, shouldn’t we think about what’s good
for the planet as well as what’s good for us? Do we have a right to kill
animals for our food or put them to work for us in producing it? Isn’t the
only morally and ethically defensible lifestyle a vegetarian one or even a
vegan one?"
Taubes correctly avoids these issues: “These are all important questions that need to be addressed, as individuals and as a society. But they have no place in the scientific and medical discussion of why we get fat.”

Is the statement that “livestock production a major contributor to global warming, water shortages, and pollution” correct? Do animal products from ruminants have a similar “footprint” to those from fish, poultry and swine? Is the production of a plant-based diet more sustainable? Is the belief that what’s best for humanity intrinsically bad for the planet correct?

Like “healthy diet,” the term “sustainability” encompasses a number of largely unexamined assumptions. When examined, they frequently do not support the popular understanding. Sustainability is a multifaceted topic that should consider of societal, economic, and environmental aspects. Frequently, however, concerns about the environment are the sole consideration. Hence “environmental,” “green,” and “sustainable” have become synonymous. These frequently conflated terms must be examined individually.

In the late 1980s “sustainable agriculture” began to receive attention and funding. At that time, it was synonymous with “organic” and the vegetarian belief system. Prominent members of the early organic and sustainable agriculture movements, in fact, went so far as to state that “animals have no place in sustainable agriculture” (Ballerstedt, 1992). The same belief system that heavily influenced the formation of the Dietary Guidelines, has informed the conventional wisdom regarding environmental issues. And those issues will now apparently will be used justify continuing to advocate plant-based diets.

“The USDA committee’s mandate is to ‘review the scientific and medical knowledge current at the time.’ But despite nine full days of meetings this year, it has yet to meaningfully reckon with any of these studies—which arguably constitute the most promising body of scientific literature on diet and disease in 50 years. Instead, the committee is focusing on new reasons to condemn red meat, such as how its production damages the environment. However, this is a separate scientific question that is outside the USDA’s mandate on health.”[emphasis added] (Teicholz, 2014)

Is the belief that the production of red meat has a greater impact on the environment than the production of the components of a plant-based diet justified? In other words Lierre Keith offers a substantial refutation in her book “The Vegetarian Myth” (Keith, 2009).

Aspects of Sustainability:

Societal: What is the social impact of the various alternatives? Are the health claims made for plant-based diets, for example, justified? Can the long-term health and well-being of large numbers of humans be maintained on plant-based diets? Projections
for a need to double the world’s food supply by 2050 should focus our debates and research. The quote "Any society is only three square meals away from revolution," while undetermined in origin, is nonetheless true.

The archeological record and anthropological research demonstrates that the human diet was based upon animal products. Research confirms that the modern diet ought to be, too. The mistaken belief that the healthy diet is a plant-based one, based upon carbohydrates, has produced an epidemic of chronic disease in the United States (Taubes 2011). The costs of this epidemic are unsustainable (these costs will be discussed in the Economic section, below). Diets based upon animal products produce improvements in a wide variety of chronic diseases. (Taubes, 2008) These diets are more sustainable – people stay on them – as compared with low-fat and semi-starvation diets (Taubes, 2008).

Ecological: A discussion of the ecological impact of any agricultural systems must begin with an acknowledgment that: Frequently stated “facts” against ruminant agriculture regarding greenhouse gas emissions and water use have been repeatedly shown to be wildly inaccurate; Our perception of “wilderness” and “nature” has been as distorted as our understanding of what constitutes a “healthy diet.” The following quote by D. F. Lott is extremely helpful:

“When Lewis and Clark headed west … they were exploring not a wilderness but a vast pasture managed by and for Native Americans" (Lott, 2002).

When Europeans first arrived in North America, they did not find a primeval landscape. Rather, they encountered a land significantly altered by humans through the use of fire, sophisticated agricultural techniques, mining, and road and mound building (Mann, 2006).

“At the time of Columbus the Western Hemisphere had been thoroughly painted with the human brush. Agriculture occurred in as much as two-thirds of what is now the continental United States, with large swathes of the Southwest terraced and irrigated. Among the maize fields in the Midwest and Southeast, mounds by the thousand stippled the land. The forests of the eastern seaboard had been peeled back from the coasts, which were now lined with farms. Salmon nets stretched across almost every ocean-bound stream in the Northwest. And almost everywhere there was Indian fire.”

“The virgin forest was not encountered in the sixteenth and seventeenth centuries,” wrote historian Stephen Pyne, “it was invented in the late eighteenth and early nineteenth centuries.” Far from destroying pristine wilderness, that is, Europeans bloodily created it. (Mann, 2006)

Forage plants are those plants eaten by animals directly as pasture, crop residue, or immature cereal crops, those cut for fodder, and conserved for later use as hay or silage. These diverse crops vary widely in their adaptation and feed quality. They are typically low in fat, high in fiber, and not utilizable by humans. While forage crops
can be grown on ground incapable of producing feedstuffs that are utilizable by humans, greater yields can be achieved on better arable ground. These crops have limited economic value until converted into meat, milk, and fiber. Three quarters of the feed consumed by the United States' beef cattle is forage (Heath, 1985).

Grasslands, including sown pasture and rangeland, are among the largest ecosystems in the world. The proportion of the earth's land area covered by grasslands in 2000 was estimated at 3.5 billion hectares (8.6 billion acres), representing 26% of the world land area and 70% of the world agricultural area. There are 255 million hectares (630 million acres) of pasture, pastured woodland, pastured cropland and public grazing lands in the US. Less than 9 percent of the cropland is pasture (Heath, 1985).

Perennial forage crops increase soil organic matter, fixing more carbon than woodland. Pasture crops reduce soil erosion, improving the infiltration of water into the soil profile and surface water quality. Without managed grazing or periodic burning, many grasslands will not remain grasslands. Ecological succession results in encroachment by woody, less productive species.

The symbiotic relationship between the ruminant animal and the microbial population in the rumen permits these mammals to thrive on a low-fat, high-fiber diet. This production of high-quality protein and animal fat offers an achievable form of sustainable form of agriculture. Pasture-based agriculture produces increased wealth while requiring fewer non-renewable inputs than annual crops. Biological nitrogen fixation by forage legumes and efficient nutrient cycling via the grazing animals' dung and urine reduces fertilizer requirements. Managed grazing of adapted pasture mixes reduces pesticide use. These perennial crops require less tillage, cultivation, and harvest than annual crops, meaning less equipment is needed, and less petroleum used. The key to farm sustainability is lowering the cost of production, rather than achieving maximum production. Well-managed pasture-based production systems are the means of achieving the lowest cost of production of animal products.

**Economic:** Forage-based livestock production systems are fundamental to the global economy, and are more economically sustainable than annual cropping systems. Grasslands contribute to the livelihoods of more than 800 million people, worldwide. They are a source of food and forage, energy and wildlife habitat. The single greatest source of new wealth (the conversion of natural resource into a salable commodity) in the US is the conversion of grass into beef.

The fiscal crisis currently facing the United States is, to a significant degree, driven by the dramatic increase in health care spending. US health care expenditures surpassed $2.3 trillion in 2008, more than three times that spent in 1990, and over eight times that spent in 1980 (CDC, 2010). The share of the U.S. economy that Americans spend on health care has increased from 7.2% of the Gross Domestic Product (GDP) in 1970 to 17.6% of GDP in 2009 (CDC, 2010). Chronic conditions such as diabetes, heart disease, stroke, obesity, cancer, gastroesophageal reflux disease (GERD) and Alzheimer's disease – in other words, metabolic diseases – are taking a heavy toll on
health while taking an increasing portion of the health care spending. Chronic diseases account for $3 of every $4 spent on healthcare. That’s nearly $7,900 for every American with a chronic disease (CDC, 2010).

Seventy percent of deaths in the US are due to chronic diseases (CDC, 2010). Chronic diseases such as diabetes, cancer, and heart disease are the leading causes of disability and death in the US. About 25% of people with chronic diseases have some type of activity limitation, including restrictions in employment and education (Partnership for Solutions, 2004).

Conventional wisdom states that obesity increases the risk of developing conditions such as diabetes and heart disease. An opinion informed by recent research understands that obesity is a metabolic disorder and is associated with other metabolic disorders, such as diabetes and heart disease. Obesity is not a cause of metabolic syndrome, it is one of metabolic syndrome’s conditions. This fundamental misunderstanding contributes to the epidemic of chronic diseases, including obesity, we’re now experiencing.

The rate of obesity in adults has doubled in the last 20 years. It has almost tripled in kids ages 2-11. It has more than tripled in children ages 12-19 (CDC, 2011). Without big changes, 1 in 3 babies born today will develop diabetes in their lifetime (ADA, 2011). Average healthcare costs for someone who has one or more chronic conditions is 5 times greater than for someone without any chronic conditions (Partnership for Solutions, 2004).

Here are the yearly costs due to a handful of conditions associated with metabolic syndrome:

Heart Disease and Stroke $ 432 Billion (Mensah and Brown, 2007)
Diabetes $ 174 Billion (ADA, 2011)
Obesity $ 147 Billion (Finkelstein, et al., 2009)
GERD (2005) $ 2 Billion / week, $ 104 Billion in lost productivity (IFFGD, 2008)
All cancers, except lung and lymphoma $ 100 Billion
Alzheimer’s $ 148 Billion (AA, 2007)

More than 1 trillion US dollars are represented by this partial list of conditions now thought to be associated with metabolic syndrome. Metabolic syndrome is most effectively treated by adopting a low carbohydrate, high fat way of eating. It’s likely caused by eating diets high in carbohydrate (Taubes, 2008). Until that is officially accepted by the massive disease treatment industries and agencies, health care costs will continue to be unsustainable and will threaten the long-term sovereignty of this country. To say nothing of the pain and suffering of millions of people.
Conclusions:

Ruminant animals occupy a unique ecological niche. The products of ruminant agriculture, red meat and full-fat dairy products, are a significant source of the world’s food supply and must be in future. The planet’s grasslands, both native and improved, are not widely appreciated nor are they close to achieving their potential. Agricultural systems based upon these natural and improved resources are sources of significant economic activity. Diets based upon anima products, including those from ruminants, have been shown to not only maintain human health, but restore it by correcting symptoms of metabolic syndrome, a significant factor in the current healthcare crisis. Red meat, therefore should be considered “green.”

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ALFALFA AND THE ENVIRONMENT

Don Ball
Professor Emeritus
Auburn University, AL

We live in a society in which many people don’t understand or appreciate agriculture as much as they really should. After all, only about 2% of the population of the United States is involved in agriculture, so most people don’t know much about it. Furthermore, most don’t spend much time thinking about it. Forage crops, including alfalfa, are especially under-appreciated because forage is not consumed directly by humans (alfalfa sprouts being a minor exception).

However, alfalfa contributes to our society in countless ways that most people don’t realize. It is an important source of nutrition for many animals that produce meat or dairy products, it is widely fed to horses, zoo animals, and other forage-consuming creatures, it is a major source of pollen and nectar for honey production, and it contributes to the production of other products such as leather and wool.

It is unfortunate, but understandable, that for many years there has been a great deal of apathy regarding agricultural production. However, these days those of us who are interested in agriculture sometimes have more to contend with from the general public than apathy. Criticism of various aspects of agricultural production is increasingly common. In the case of alfalfa, most criticism has been related to environmental issues (real or perceived).

This gives us an incentive to think about alfalfa’s relationship to the environment. We need to be aware of, and sensitive to, the concerns of the public regarding environmental issues. We also need to make certain that there is appropriate consideration of the numerous beneficial impacts of growing the crop, which will be the primary focus of this paper.

Adaptation, Versatility, And Widespread Use

One reason why alfalfa is important to the environment is simply because it occupies a significant amount of farmland. The alfalfa acreage in the United States is around 20 million, and there are an estimated 74 million acres grown worldwide. It is the most widely grown forage legume in the world. It can be grown on many different soil types and under a wide range of climatic conditions.
Alfalfa has long been recognized as a superb forage crop, which is why it is widely grown for dairy cattle, horses, sheep, and many other types of domesticated forage-consuming animals. Other reasons for its popularity and widespread use include that it has good yield potential, perennial growth habit, a long growing season, and nitrogen-fixing ability.

**Benefits To The Soil**

Any astute agriculturist understands the value of protecting the soil from water and wind erosion. In recent decades, much progress has been made in reducing soil erosion, but it is still a major problem in many situations. Alfalfa provides a good cover for land, and when a stand is established on a soil and site where it is well adapted and is properly managed, it will normally last for years, thus greatly reducing soil erosion as compared to that which often occurs with annual crops.

Alfalfa actually does much more for the soil than protect it from erosion; it actually improves it. Alfalfa has an extensive and deep root system that creates channels and facilitates micro-organism activity that in turn favors improved soil tilth. The result is better water infiltration (thus less rainfall runoff) and more aggregation of soil particles. To use a term that seems to be increasingly in favor in recent years, alfalfa improves soil health.

**Nitrogen Fixation**

A unique attribute of legumes is that most have the ability to fix nitrogen when their roots are in association with *Rhizobium* bacteria. Of course this is economically beneficial to producers because this biologically-produced nitrogen reduces or eliminates the expense and inconvenience of needing to periodically apply nitrogen fertilizer to stimulate crop growth. When nitrogen is biologically fixed instead of being applied in the form of commercial fertilizer, the risk of N-containing runoff is virtually eliminated and the likelihood of leaching of nitrogen is reduced.

The amount of nitrogen fixed by alfalfa varies based on a number of factors including stand density, harvest management, and climatic conditions, but is usually in the range of 150 to over 200 pounds/acre/year. On a dry matter basis, the crude protein content of alfalfa hay is typically 16 to 24%, which is difficult or impossible to attain with most forage grasses even with application of high levels of nitrogen fertilizer. It is expensive for livestock producers to provide supplementary protein in livestock rations, but in the case of alfalfa there is no nitrogen expense involved in providing high levels of protein.
Value In Crop Rotations

The two topics just addressed help explain why alfalfa is extremely valuable in crop rotations. Improved soil tilth that results in a healthier soil and increased water infiltration, combined with root channels that allow deeper rooting, favor growth of a crop that follows alfalfa, with the result typically being significantly enhanced yields and profit. Alfalfa often provides 50 to over 150 pounds of nitrogen per acre to a crop that immediately follows it, and may provide 50 pounds or more per acre to a crop the second year after alfalfa was grown. In addition to the economic benefit, these are significant contributions toward a goal for which producers should strive and of which the general public should approve; namely, sustainable agricultural production.

Wildlife Enhancement

Most environmentalists enthusiastically endorse the concept of wildlife enhancement. Evidence of alfalfa’s potential in this regard is that wild animals have always recognized it as a great crop; they feel free to visit alfalfa fields, consume alfalfa forage, or otherwise use it any time it is planted within the geographical area in which they live. In fact, some animals even alter their range in order to access it more easily or more frequently! There is hardly any alfalfa producer who has not had the experience of seeing deer, birds, and other wild animals in their alfalfa field(s).

Yet, the extent to which alfalfa is used by wildlife is almost certainly underestimated by most producers. After all, wild animals are shy and secretive, and generally prefer to avoid being in close proximity to humans. Many are primarily or exclusively nocturnal, and thus are active only at times when humans are not usually present. In addition, there may be a considerable amount of unobserved underground biological activity in an alfalfa field including by mice, voles, ground squirrels, etc.

In the Sacramento Valley in California, wildlife biologists did extensive studies of alfalfa fields to determine the extent of wildlife activity. They found that of 643 resident and migratory amphibians, birds, mammals, and reptiles known to occur in that area, 162 species (about 25%) were regularly using alfalfa fields to some extent, and about 10% percent were using alfalfa fields extensively.

Alfalfa is also an excellent insectory. In a study done near Ithaca, New York, entomologists identified 591 insect species in a single field. For many species of birds, including game birds such as quail and wild turkey, availability of a good supply of insects is quite important, especially when the birds are young. Alfalfa provides birds with high quality green leaf material as well as insects.
In some areas alfalfa is planted specifically for wildlife, mainly by deer hunters. Not only is alfalfa forage highly digestible with a high protein content, it also contains high levels of calcium and phosphorus, which are important in antler development. In addition, having alfalfa available during summer helps ensure adequate milk production by does (increasing the likelihood of rebreeding), and helps increase deer body weights prior the onset of winter.

Bridging nutritional gaps is of critical importance in wildlife management, and it is difficult to find a crop that rivals alfalfa with regard to the ability to provide high quality forage over a long period of time. This includes during drought periods when other forage crops are unproductive. Alfalfa can also be used as a tool to help keep wild animals in an area where they are desired.

Finally, although many other plants provide cover for wildlife as well or better than alfalfa, this is another benefit to wildlife that can be mentioned. Alfalfa can be especially attractive to small animals such as rabbits, and for young game birds including quail or wild turkeys that simultaneously need cover as well as a high level of nutrition.

The point is that an alfalfa field is much more biologically diverse than it may appear, and actually offers food and cover for many wildlife species, including game animals and game birds and even more species of non-game wildlife. Thus, anyone who grows alfalfa is, at least to some extent, enhancing wildlife, a fact of which environmentalists need to be aware.

Aesthetic Value

We normally don’t give much consideration to the aesthetic value of agricultural production, but perhaps we should. There is no doubt that many people who live in congested, highly-populated areas enjoy getting “out in the country” to breathe the fresh air and enjoy the scenery. Forage crops in general provide a pleasant vista, but an argument can be made that a field of alfalfa is especially attractive.

POSSIBLE ENVIRONMENTAL IMPACTS OF EXPECTED FUTURE DEVELOPMENTS

Low Lignin Alfalfa

For alfalfa producers, an extremely promising development on the horizon is low-lignin alfalfa. It is expected that seed of low-lignin varieties will be available within two years. Although feeding trials with low-lignin alfalfa have not yet been conducted, it is expected that such varieties will have substantially higher overall forage digestibility, thus improving animal performance.
In addition, it is expected that reduced lignin content will expand the harvest window for alfalfa. The reason is that it seems probable that instead of harvesting at (for example) 28 days, a producer could harvest a week or more later and still get forage that has nutritive value as good as conventional varieties harvested at 28 days.

We can only speculate as to the impacts low-lignin alfalfa may have on the environment. However, a longer interval between harvests will be a favorable development for many organisms that spend time in or near alfalfa fields. In some cases low-lignin alfalfa may allow a producer to make one less harvest during the growing season, which would be especially valuable to fauna of many types. In addition, yields could be increased with less expenditure of energy required for harvest.

**Increased Rumen Bypass Protein**

It is also expected that in the future there will be alfalfa varieties commercially available that will have a higher level of rumen bypass protein. This will result in less need for dairy producers and others who feed animals that have high protein needs to provide expensive supplemental protein. This would have an important environmental impact because protein broken down in the rumen results in more nitrogen being present in urine. Increased by-pass protein will reduce rumen protein breakdown.

**Final Thoughts**

Agriculture, including alfalfa in some cases, has been criticized in recent years by some environmentalists who believe that virtually everything associated with food production has negative environmental consequences. In reality that is not the case. In many settings, including in areas in which cities are encroaching on agricultural land, alfalfa makes an important contribution to wildlife, to the environment, and to landscape aesthetics. If those of us who work with alfalfa are mindful of the environmental implications of technological advances and management practices implemented, we should be able to make alfalfa even more environmentally friendly in the future.

**Selected References**


Hay Quality: What is it?

Garry Lacefield and Don Ball
Extension Forage Specialists
University of Kentucky and Professor Emeritus Auburn University, respectively

Profitable livestock production almost always requires a forage program that will supply large quantities of adequate quality, homegrown feed. A major percentage of the feed units for beef (83%) and dairy cattle (61%) come from forages. In addition, forages supply an estimated 91%, 72%, 15% and 99% of the nutrients consumed by sheep and goats, horses, swine, and wildlife, respectively.

Although both alfalfa quantity and quality are important, it is easier for livestock producers to recognize problems associated with alfalfa quantity than with alfalfa quality because quantity can be readily assessed visually; whereas, a laboratory analysis of a sample is required to determine quality. Fiber, which is less digestible than other components of alfalfa, increases with age, so it is not possible to simultaneously maximize alfalfa quantity and quality from a given alfalfa stand.

What is Alfalfa Quality?

Alfalfa quality has been defined in many ways, including protein, fiber, lignin content, relative feed value, relative forage quality, color, smell, leafiness, fineness of stems, total digestible nutrients, and other physical and/or chemical components. Each of these has merit, but all fall short of clearly defining alfalfa quality. Factors such as average daily gains, conception rates, milk production, wool production, etc. are reliable indicators of alfalfa quality.

Perhaps the best concise definition of alfalfa quality is: the extent to which alfalfa (pasture, hay, or silage) has the potential to produce a desired animal response. This definition acknowledges the necessity of considering the animal. As an example, a high producing dairy cow needs higher quality feed than a dry, pregnant beef cow. Animal performance is influenced by a number of factors, including:

Palatability - Will the animals eat it? Animal selection of one forage species over another depends on smell, touch, and taste. Therefore, palatability may be affected by texture, leafiness, fertilization, dung or urine patches, moisture content, pest infestation, or compounds that cause a forage to be sweet, sour, or salty. In general, high quality alfalfa is highly palatable and vice versa.

Intake - How much will they eat? Alfalfa must be consumed in adequate quantities to enable animals to perform well. In general, the higher the palatability and
forage quality, the more that will be consumed. The poorer forage quality is, the longer it remains in a ruminant animal’s digestive system, resulting in lower animal performance.

**Digestibility** - Of the alfalfa consumed, how much will be digested? Digestibility (the portion of the forage consumed as it passes through an animal’s body) varies greatly. Immature, leafy alfalfa may be 80 to 90 percent digested, while mature, stemmy material often has a digestibility below 50 percent.

**Nutrient content** - Once digested, does the alfalfa provide an adequate level of nutrients? Leafy, growing forage plants usually contain 70 to 90 percent water. Because of this range in water content, for most purposes, it is best to express forage yield and nutrient content on a dry matter basis. Forage dry matter can be divided into two main categories: (1) cell contents (the non-structural part of the plant tissue such as protein, sugar, and starch); and (2) structural components of the cell wall (cellulose, hemicellulose, and lignin).

**Anti-quality factors** - Depending on the plant species, time of year, environmental conditions, and animal sensitivity, various compounds may be present in forage that can result in reduced animal performance, sickness, or even death. Such compounds include tannins, nitrates, alkaloids, cyanoglycosides, estrogens, and mycotoxins. High quality forages must not contain harmful levels of anti-quality components.

The ultimate test of alfalfa quality is animal performance. Alfalfa quality encompasses its “nutritive quality” (its potential for supplying nutrients), the intake that results when it is made available to animals, and any anti-quality factors present. We cannot separate alfalfa quality from animals because their performance can be influenced by any of a number of factors associated with plants and forage-consuming animals (Figure 1). A failure to give proper consideration to any of these factors may result in a level of performance less than is desired.
WHAT CAN WE DO ABOUT ALFALFA QUALITY?

Alfalfa has high quality potential. Our ability to manage all the factors impacting quality will determine how much of this “potential” we can capture and have available for use by our animals or for sale.

Alfalfa quality is influenced by soils and fertility, varieties, other species, pests, growing conditions, season of the year, time of day, stage of maturity, harvesting, handling and storage, and of course weather. All of these factors can have an impact on alfalfa quality regardless of whether we are using it as pasture, hay, or silage.

Although all of the above are important, in general, the most important and the one that will have the greatest impact on alfalfa quality is the “stage of maturity” when harvested. As alfalfa plants advance form the vegetative to reproductive (seed) stage, they become higher in fiber and lignin content, lower in protein, digestibility and acceptability to livestock (Figure 2 and Tables 1 & 2). Delaying harvest from late bud to full bloom (early seed stage) can result in over 45 percent loss in protein. Digestibility can drop by up to 0.5 percent per day and RFV by 5 points per day.
Table 1. Effects of Alfalfa Hay Quality on Animal Performance

<table>
<thead>
<tr>
<th>Alfalfa Hay</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Protein</td>
<td>18.7</td>
<td>15.9</td>
<td>13.7</td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>29.4</td>
<td>35.4</td>
<td>46.7</td>
</tr>
<tr>
<td>Animal Performance*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay consumed/day</td>
<td>17.1</td>
<td>16.5</td>
<td>13.8</td>
</tr>
<tr>
<td>ADG</td>
<td>1.85</td>
<td>1.49</td>
<td>0.06</td>
</tr>
</tbody>
</table>

*550 lb. beef steers - Tennessee
Table 2. Estimated Grade, Average Concentration of Crude Protein (CP), Acid Detergent Fiber (ADF), Neutral Detergent Fiber (NDF) and Milk Yield in Wisconsin Forage Council Green Gold Project.

<table>
<thead>
<tr>
<th>Estimated Grade</th>
<th>Number of Cuts</th>
<th>CP%</th>
<th>ADF%</th>
<th>NDF%</th>
<th>Milk lbs/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime to 1</td>
<td>5</td>
<td>22</td>
<td>31</td>
<td>43</td>
<td>10,688</td>
</tr>
<tr>
<td>No. 1</td>
<td>4</td>
<td>21</td>
<td>32</td>
<td>44</td>
<td>9,120</td>
</tr>
<tr>
<td>No. 1 to 2</td>
<td>3</td>
<td>19</td>
<td>35</td>
<td>46</td>
<td>7,022</td>
</tr>
<tr>
<td>No. 2</td>
<td>2</td>
<td>17</td>
<td>36</td>
<td>48</td>
<td>4,259</td>
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</tbody>
</table>

SOURCE: Adapted from D.A. Rohweder, et al., University of Wisconsin.

WILL IT PAY TO PRODUCE HIGHER QUALITY?

This is an excellent question and one that I would like to say a resounding YES to; however, it’s not always that easy and true. To say “it depends” may seem like a very weak answer, but in this case I think it is true. For example, if you are selling by the ton or bale and quality is not a factor, then it will likely not pay you to go the extra mile to achieve the highest quality if overall yield is reduced in the process or stand persistence is compromised. There are some markets where this is the case, but things are changing.

In general, most people are able to market their highest quality alfalfa even during surplus production years. The biggest challenge during these years is how to market the medium and low quality.

With advances in testing and marketing, and with greater awareness of the relationship between quality and animal performance, and with a greater database showing the relationship between quality and price (Table 3), it appears the answer to the question “Will it pay?” is appearing more positive all the time.
Table 3. Forage Quality Values as Alfalfa Advances in Maturity.

<table>
<thead>
<tr>
<th>Stage of maturity</th>
<th>Crude protein</th>
<th>Acid detergent fiber</th>
<th>Neutral detergent fiber</th>
<th>Digestible dry matter</th>
<th>Relative feed value</th>
<th>Market value¹ average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetative</td>
<td>&gt;22</td>
<td>&lt;25</td>
<td>&lt;34</td>
<td>&gt;69</td>
<td>&gt;189</td>
<td>144</td>
</tr>
<tr>
<td>Bud</td>
<td>22-20</td>
<td>25-31</td>
<td>34-41</td>
<td>69-65</td>
<td>189-147</td>
<td>126</td>
</tr>
<tr>
<td>Early Bloom</td>
<td>19-18</td>
<td>32-36</td>
<td>42-46</td>
<td>64-61</td>
<td>146-123</td>
<td>96</td>
</tr>
<tr>
<td>Late Bloom</td>
<td>17-16</td>
<td>37-40</td>
<td>47-50</td>
<td>60-58</td>
<td>122-107</td>
<td>78</td>
</tr>
<tr>
<td>Seed pod</td>
<td>&lt;16</td>
<td>&gt;41</td>
<td>&gt;50</td>
<td>&lt;58</td>
<td>&lt;107</td>
<td>72</td>
</tr>
</tbody>
</table>

¹Market value based $Y = .88X - 22.3$ where, $Y = \$/T$ and $X = RFV$ index.

SOURCE: Dr. Neal Martin, Director, Dairy Forage Research Center, Madison, WI, personal communications.

SUMMARY

Alfalfa is a premier forage legume with potential for high yield, quality and stand persistence. Our challenge is: to establish to get good stands, produce for high yields, harvest for highest quality and market for profit.
Farmer Panel – What Hay Quality Means to Me

Clayton Geralds – Hart County Hay Producer
Clayton Geralds runs a commercial hay farm in Hart County near Munfordville, Kentucky. His total farm size is 630 acres, 350 of which are leased. The focus of his operation is producing small square bales for the horse market. Clayton currently grows a range of forage species including 500 acres of alfalfa and alfalfa/orchard grass and 130 acres of timothy and orchard grass. On average he puts up 100,000 small square bales a year.

Ben Cox – Taylor County Hay Producer
Ben Thomas Cox, A 1978 graduate of Western Kentucky University and 1982 grad of Auburn University School of Veterinary Medicine. He owns and operates Crossroads Animal Clinic in Campbellsville Kentucky. A three man mixed animal practice. In his spare time he manages a 300 acre Registered Angus and Gelbvieh operation. He currently has 80 mother cows and raises 30 acres of alfalfa and 75 acres of soybeans annually. He is married to Regina and has three children.

John McCoy – Warren County Hay Producer
John McCoy and his wife, Sherry, own 214 acres in south Warren County near Bowling Green, Kentucky. They maintain 100-125 registered Simmental cattle. They produce 120 acres of forage, including 100 acres of alfalfa and alfalfa/orchard grass and 20 acres of orchard grass. John is a Purple Heart veteran of the Vietnam War.

Dennis Wright – Logan County Hay Producer
Dennis Wright farms approximately 350 acres with his sons, Wesley and John, in the south east corner of Logan county. Our operation includes 5 acres dark fired tobacco, 15 acres burley, 230 acres of row crop and 80 acres alfalfa hay. We also bale about 20,000 bales of wheat straw and market about 40,000 bales of pine straw annually. In addition to this, we recently opened a farmers market in a nearby community. We grow and sell flowers, produce and our own farm raised beef.

I have been putting strings around plant fiber since I graduated from WKU in 1988. I wanted to farm, but it was difficult to get started after the farm crisis of the 80’s, so I bought a $1500 baler and started baling straw and selling to small markets in Nashville Tn. My philosophy was then, and still is today, that to break into an industry, you do what no one else wants to, or is willing to do. In 1999, I grew my first 10 acres of alfalfa. Since then I have grown to 80 acres. I haul the majority of our hay to buyers in Georgia and Florida. I bring back pine straw and sell to landscapers. The main thing that I tell people about growing alfalfa is that it is not for the faint of heart. The learning
curve is steep. I just completed my 15th crop and would just barely declare myself a competent producer.

**Minos or Glenn Cox – Caldwell County Hay Producers**

Our operation consists of 130 acres of pure stand alfalfa. I have 90 acres of new stand of Roundup Ready sowed in April of 2014 which should be excellent this year. Alfalfa is cut anywhere from four to six times per year depending on the weather for that year. Alfalfa is baled in small squares weighing sixty pounds per bale with most being tested by Kentucky Department of Agriculture and is sold mostly to horse people locally along with sales in most of the southern states. We have been producing Alfalfa for 25 to 30 years and strive to have a quality product. Stands usually last 5 to 6 years. The remaining acreage is leased out for crop production. Back in time we were rather large in pork production but have not had any swine in about 7 years.
MEMORIES
The First Annual

ALFALFA CONFERENCE

January 16, 1981

Fair Grounds (Floral Hall)
Shelbyville, Kentucky

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

PROGRAM

8:30 a.m. Registration and Refreshment

Establishment and Production

8:50 a.m. Welcome and Conference Overview
9:00 a.m. Alfalfa Seed Industry . . . Dr. Garry Lacefield
9:15 a.m. Soil and Fertility Requirements . . . . Dr. Monroe Rasnake
9:35 a.m. Alfalfa Variety Test Results . . . . . . . Dr. Roy Sigafus
9:55 a.m. Establishing the Stand . Dr. Garry Lacefield
10:10 a.m. Managing Alfalfa Diseases . . . . . . . Dr. Bill Nesmith
10:30 a.m. Break
11:00 a.m. Alfalfa Weed Problems and Their Control . . Dr. Jim Martin
11:20 a.m. Alfalfa Insect Pest Management . . . . . . Dr. Chris Christensen
11:40 a.m. Discussion
12:00 Noon Lunch

Harvesting and Utilization

1:00 p.m. Harvest Management . . . Mr. Harold Vaught
1:20 p.m. Alfalfa in Livestock Rations . . . . . . . Dr. Gary Lane
1:40 p.m. Alfalfa - A Producer's Story . . . . . . . Mr. Charles Schnitzler
Dairy Farmer -
Lincoln County