Project Contacts

Livestock
Shawn Deering, Gentry Co.
660.726.5610
Jim Humphrey, Andrew Co.
816.324.3147
Amie Schleicher, Atchison Co.
660.744.6231

Ag Business
Randa Doty, Nodaway Co.
660.582.8101

Agronomy
Wayne Flanary, Holt Co.
660.446.3724
Heather Benedict, Harrison Co.
660.425.6434

2011 Results
Improving Tall Fescue Production in Northwest Missouri with Legumes and Nitrogen Application Timing
Thanks to Bruce Burdick, Superintendent, Hundley-Whaley Ag Experiment Station, and staff for their assistance; Missouri Southern Seed and Hoffman and Reed, Trenton, for supplying seed; Dr. Robert Kallenbach, State Forage Specialist, for his expertise in demonstration design.

Future Implications

BarOptima Plus E 34 tall fescue needs to be evaluated over a multi-year period to see if it is suited to northwest Missouri. It also needs to be evaluated to determine persistence in a continuously grazed situation, as that is how the majority of our cow-calf producers manage their pastures. Establishment costs may be prohibitive for cow-calf producers, but may be economically feasible for stocker operators.
Using Legumes and Nitrogen Application Timing in Tall Fescue to Improve Forage Production

Wayne Flanary
Regional Agronomy Specialist
University of Missouri Extension
Holt County

Objective

To demonstrate the use of different legumes to reduce the need for nitrogen fertilizer and nitrogen application timing to improve forage production.

Procedures

Plots were established at the Hundley-Whaley Research Center in spring of 2008 in an area in which tall fescue had been used as a parking area during field days. Plots were established measuring 9 x 15 feet with 10 foot alleys with four replications in a randomized complete block design. In spring of 2011, Red clover was in over-seeded February at a rate of 4 lbs per acre.

Nitrogen application rate of 60 pounds per acre was applied as urea with the addition of the mid-rate of Agrotain. Plots were harvested with a bagging lawn mower and grab samples taken from each replication and combined for measuring moisture. Plots were cut at a 3.5 inch height.

2011 Results

Table 1 contains the treatment means of the individual harvests and total harvests. The first harvest was later than planned because of a wet spring. The first cutting had greater yields compared to both the August and November harvest. Red clover, Birdsfoot trefoil, and white clover all increased total yield. Lespedeza was lower-yielding but yielded more than the spring application of 60 pounds of nitrogen.

The use of August nitrogen application combined with over-seeding red clover provides two benefits. Over-seeded red clover without spring nitrogen allows the clover to successfully compete with the fescue to establish itself. Spring applications of nitrogen choke red clover as the fescue is stimulated by the nitrogen. The August nitrogen application does not reduce the legumes but stimulates fall growth of fescue for stockpiling.

The distribution of dry matter shown in Figure 1 shows the greatest yield occurred with the May harvest date. The September harvest yields was reduced by dry weather.
Table 1. Treatment dry matter yields for each of the different harvest dates.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Clover</td>
<td>5100</td>
<td>2236</td>
<td>7336</td>
</tr>
<tr>
<td>Birdsfoot Trefoil</td>
<td>7348</td>
<td>4393</td>
<td>11741</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>8251</td>
<td>4437</td>
<td>12688</td>
</tr>
<tr>
<td>White Clover (Kopa II)</td>
<td>5617</td>
<td>1793</td>
<td>7410</td>
</tr>
<tr>
<td>White Clover (Durana)</td>
<td>6684</td>
<td>2518</td>
<td>9202</td>
</tr>
<tr>
<td>Lespedeza</td>
<td>2501</td>
<td>1530</td>
<td>4031</td>
</tr>
<tr>
<td>White Clover (Kopa II) &amp; Alsike</td>
<td>5360</td>
<td>1808</td>
<td>7168</td>
</tr>
<tr>
<td>Fescue</td>
<td>2136</td>
<td>1411</td>
<td>3547</td>
</tr>
<tr>
<td>60 lb N March 15</td>
<td>4418</td>
<td>1553</td>
<td>5971</td>
</tr>
<tr>
<td>60 lb N Aug 15</td>
<td>3959</td>
<td>2795</td>
<td>6754</td>
</tr>
<tr>
<td>80 lb N March 15 &amp; Red Clover</td>
<td>5600</td>
<td>987</td>
<td>6587</td>
</tr>
<tr>
<td>60 lb N Aug 15 Red Clover</td>
<td>4676</td>
<td>2462</td>
<td>7138</td>
</tr>
<tr>
<td>80 lb N March 15 &amp; Aug 15</td>
<td>6585</td>
<td>2442</td>
<td>9027</td>
</tr>
<tr>
<td>80 lb N March 15 &amp; June 15 &amp; Aug 15</td>
<td>6256</td>
<td>3438</td>
<td>9694</td>
</tr>
</tbody>
</table>

LSD .05 = 2003
CV % = 26.6

Figure 1. Treatment dry matter yield means for each of the harvest dates.
The 2010 harvest yields were the greatest compared to 2008, which was the establishment year, 2009 and 2011. All treatments except the spring nitrogen application yielded greater in 2010 compared to other years.

Figure 2. Comparison of 2011, 2010, 2009 and 2008 dry matter means.
Spend some time on your grazing system—it's worth it!

Amie Schleicher
Regional Livestock Specialist
University of Missouri Extension
Atchison County

The concept of rotational grazing of pastures is definitely not new. Most beef cattle producers have implemented some level of rotational grazing in their pastures because of the benefits of rest and recovery on pastures after grazing. Nonetheless, we still see pastures that are overgrazed or unevenly grazed. Many producers are limited in how much they can invest in their grazing systems because of time, labor, and financial constraints, but there are costs associated with that loss in productivity.

In “Pastures For Profit: A Guide to Rotational Grazing”, the authors suggested that the advantages of management intensive grazing, compared to continuous or less intensive rotational systems, included:
- More stable production during poor growing conditions (especially drought),
- Greater yield potential,
- Higher quality forage available,
- Decreased weed and erosion problems, and
- More uniform soil fertility levels.

In that same bulletin, the authors also suggested these benefits from rotational grazing: economic benefits, time savings, environmental benefits, wildlife advantages, increased pasture productivity, aesthetics and human health benefits, and animal health and welfare.

The benefits of rotational grazing can help solve some of the main concerns we hear from producers in regards to forages. Common concerns are: weeds, too much grass in the spring but not enough in the summer, running out of grass, buying or leasing pasture is too expensive, additional pasture is not available, fertilizer costs are too high, drought (running out of pasture and hay), tall fescue toxicosis, and limited time to spend on grazing management. Most of these could be addressed, in part, by making changes to the grazing system.

Overgrazing is oftentimes an issue in pastures that are continuously or unevenly grazed. We may take for granted the significance of overgrazing on the plant because some of the damage occurs below the soil surface. This was described in the Pasture Management Guide for Northern Missouri (Figure 1). The leaves are producing food for the plant; when that food production is reduced, less is stored in the roots and the plant is less able to regrow.

Methods

A comparison demonstration was established on September 9th, 2009 at the MU Hundley-Whaley Research Center in Albany, MO to evaluate yield and quality differences between BarOptima Plus E34 and Kentucky 31 tall fescue varieties in Northwest Missouri. Plots were designed to measure 10’ x 15’ with 10’ alleys in between. Four plots of each variety were assigned in a 2 x 4 randomized block design which is highlighted in the diagram below.

<table>
<thead>
<tr>
<th>Plot Layout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rep 4</td>
</tr>
<tr>
<td>Alley</td>
</tr>
<tr>
<td>Rep 3</td>
</tr>
<tr>
<td>Alley</td>
</tr>
<tr>
<td>Rep 2</td>
</tr>
<tr>
<td>Alley</td>
</tr>
<tr>
<td>Rep 1</td>
</tr>
<tr>
<td>Alley</td>
</tr>
</tbody>
</table>

Plots were fertilized with 60 pounds of nitrogen on . They were harvested on May 31 and October 27, 2011. Samples were air dried and sent to a commercial laboratory for forage quality analysis. Dry matter yield and forage quality results are as follows:

Dry Matter Yield, October 27, 2011

<table>
<thead>
<tr>
<th>Dry Matter Yield, October 27, 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSD .05 = NS</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

2970
2870
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0

Kentucky 31
BarOptima Plus E34

LSD ;.05 = NS
Comparison of BarOptima Plus E34 and Kentucky 31 Tall Fescue

Shawn Deering
Regional Livestock Specialist
University of Missouri Extension
Gentry County

Background

Kentucky 31 is the base of our cool-season forage resource in northwest Missouri. While it has many advantages (persistence, drought tolerance, toughness, stockpiling ability), it also has the negative effects of the endophyte (fungus that lives inside the plant) or more specifically the toxins that the endophyte produces. These toxins have been proven to cause decreased animal reproductive rates, performance, and milk production. Most producers try to employ management strategies to dilute the effects of the endophyte, but some have tried to utilize endophyte-free or novel endophyte fescue varieties.

BarOptima Plus E34 is a novel endophyte variety of tall fescue that seems to be the fescue grass of choice for grazing dairy producers in Southwest Missouri. In fact, it seems that it is hard to determine whether perennial ryegrass or BarOptima Plus E34 tall fescue is the best suited for these dairy producers. Under their intensively managed grazing systems that incorporate a rest period following grazing, this fescue variety has persisted and allowed for satisfactory milk production. Barenbrug USA researchers examined alkaloid profiles of numerous fescues with endophytes that were collected from around the world. They isolated many endophytes from fescues which lacked alkaloids known to be toxic to livestock. These endophytes were inoculated into different soft-leaf tall fescue germplasm and were then evaluated for their alkaloid profiles and endophyte stability. From this research they were able to pick a beneficial endophyte that was coded “E34”. University research trials suggest that BarOptima E34 tall fescue is higher yielding and more palatable than Kentucky 31, resulting in higher intakes, improved performance, and increased rate of gain.

Grazing Preference*

<table>
<thead>
<tr>
<th></th>
<th>May 19, 2007</th>
<th>May 16, 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>BarOptima Plus E34</td>
<td>4.5</td>
<td>5.8</td>
</tr>
<tr>
<td>Kentucky 31</td>
<td>3.0</td>
<td>3.2</td>
</tr>
<tr>
<td>Select</td>
<td>2.3</td>
<td>2.8</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>0.9</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Scale=1-9, 9=all forage grazed

*University of Kentucky, Lexington, KY

Plants weakened by overgrazing can result in an opportunity for weed species to flourish. Gerrish went on to write in the Missouri Grazing Manual:

“Weeds are almost always a symptom of inappropriate fertility or grazing management. Weeds do not crowd out pasture plants. The pasture plants are thinned either through low fertility or improper grazing, and weeds take their place. A healthy, densely growing, vigorous pasture is the best weed control strategy available.”

Many producers deal with too much forage in the spring and too little in the summer. This is because the growth rate of the forages that are typically present in our pasture systems, primarily cool-season grasses, are extremely productive in spring but experience a “summer slump” and leave producers short on forage. Research from the Forage Systems Research Center (Figure 2) has shown that when a 3-paddock rotational grazing system was compared to a 24-paddock, while the 3-paddock had higher growth in the spring (when producers don’t need extra forage), the 24-paddock system had higher daily growth rates for the rest of the grazing system (when producers typically need the forage). This is because forage that “gets ahead of you” in the spring becomes reproductive and produces less tillers later in the spring.
Another issue producers are dealing with is high input costs, including fertilizer. Manure nutrients are valuable but are oftentimes unevenly distributed, being more concentrated around loafing areas. Another study at the Forage Systems Research Center took a closer look at manure distribution and how it varied by grazing intensity (Table 1). As pastures were rotated more frequently, it took less time for there to be one manure pile deposited per square yard. Rotational grazing helps with manure distribution, which is especially beneficial when fertilizer costs are high.

<table>
<thead>
<tr>
<th>Rotation frequency</th>
<th>Years to get 1 pile/sq. yard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>27</td>
</tr>
<tr>
<td>14-day</td>
<td>8</td>
</tr>
<tr>
<td>4-day</td>
<td>4-5</td>
</tr>
<tr>
<td>2-day</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 1. The effect of grazing intensity on manure distribution in pastures.

In northwest Missouri, we have seen a significant loss in cattle numbers and the conversion of pasture ground to row crop production. It is extremely difficult to find pasture and, if you can, it is expensive to rent or buy. In most cases, our only option is to do a better job managing the pasture we have. Improving our grazing systems is a way we can do just that. A relatively small investment in time can reap big benefits.

References:
Forage Production Measuring Device
Jim Humphrey
Regional Livestock Specialist
University of Missouri Extension
Andrew County

The Farmworks Feed Reader we are currently working with was developed in New Zealand and was designed to allow pasture assessment while doing normal day to day activities such as checking calves, water systems, mineral feeders and fences. The unit runs on a 12V system and is mounted on a four wheel all-terrain vehicle. Our unit is equipped with Global Positioning System (GPS) that allows for automatic identification of the location of every reading taken and automatically stores those readings.

The device uses a set formula to determine the volume of forage in a given area. This formula can be changed for different forages as well as different times of the year. The unit will produce forage production maps that can be useful for recording and monitoring production of individual pastures and paddocks for current and future supplemental feed needs.

The Feed Reader head uses an ultrasonic measuring device which calculates the height and density of forages in millimeters. The combination of the height and density readings from the ultrasonic head are combined into a formula that is stored in the console and converted to average kilograms of dry matter per hectare and stored in the console. These numbers are then downloaded by wireless connection to a computer compatible with our units software. To convert this number to pounds per acre we take the number and multiply it by .89.

Our unit has a console that displays current readings as well as previous readings in millimeters that can be viewed while taking forage measurements. The ultrasonic head takes about 10 readings every second and if the readings seem outside the parameters (such as driving over a cattle trail) the unit will discard only the outliers and use the other readings to determine the amount of forage present. If less than 70% of those readings recorded are within the parameters of the unit, the software will discard all of the readings during that second. While taking readings the display will give you the percentage of readings that are being accepted, so you can tell if something seems out of the ordinary.
Using Drought Damaged Corn for Forage

Wayne Flanary
Regional Agronomist
University of Missouri Extension

Before utilizing corn for forage, be sure to contact crop insurance as the first step. Secondly, estimate the corn grain yield. This is important to determine the possible income from harvesting grain compared to utilizing the corn as a source of forage. Next, check the labels of chemicals applied to determine if the corn stalks can be harvested for forage.

The best method to utilize drought damaged corn is by making silage. Harvest timing is critical as moisture should be around 65% for proper fermentation. Too wet, it will not ensile properly. Also, too dry, it will also not ensile properly. Therefore, it is important to know the moisture content of the corn plants. Guide 3151, which can be found on-line or obtained at your local Extension office, describes how to use a microwave oven to determine the moisture of silage.

If plants are too dry to ensile, water can be added at the silo but this takes a lot of water which may not be available. As a general rule of thumb, add four gallons of water per ton of silage for each 1 percent desired rise in moisture content. Be sure to add water as the silo is being filled.

Generally, silage will generally reduce the levels of nitrates in harvested corn forage but not always. Growers may raise the cutting height of equipment as often nitrates accumulate in the bottom of plants. Guide 4590 recommends raising the cutting height as high as 18 to 20 inches to reduce high nitrate concentrations. However, most literature recommends cutting height of 8 to 10 inches normally.

Nitrates test kits, which use color as an indicator, can be used to determine if nitrates are throughout the plant or at the lower part of the stalk. The Veterinarian diagnostic laboratory at the University of Missouri, Columbia recommends that if the qualitative nitrate test comes back uniformly high up the whole stalk, the a quantitative test should be taken to account for the dilution effects of the ears and leaves. The sample should be chopped before sending to the laboratory to aid in obtaining a representative sample of forage. Also, after ensiling, it is best to test silage for nitrates.

Plants with green leaves are generally too wet for good silage. The stalk and ear of plants contain a lot of moisture. Once plants die, they will dry out fast. Plants could be windrowed and allow to dry somewhat before chopping if moisture is too high.

Drought damaged corn should be chopped to 3/8 to ½ inch in length. This will aid in packing.
Green chop can be another method effective but can be dangerous. Be sure to test stalks for nitrates. If nitrates are present, nitrates will change into nitrites which are ten times as deadly if green chop begins to heat. Chop and immediately feed only the amount that animals will clean up in one feeding. Never turn hungry animals into your feed source but introduce animals to feed gradually.

Haying is the most difficult way to harvest drought damaged corn. If ears have started to form, the stalk and ears will be difficult to dry. Baling corn too high in moisture will result in rotting and even fire. Use a crimper when windrowing. Also, bales stored outside will absorb water as they are not as solid as grass bales.

Nitrate in stalks will not decrease when baled. Adjust the cutting height to 8 to 10 inches as nitrates tend to accumulate in the base of plants.

If you are having trouble baling and getting corn plants to dry. Some growers have shredded stalks then raked and baled. Try only a few acres to test how this method would work for you and if losses are acceptable.

Another option is to bag high moisture baled corn. This works best when corn is in the milk stage and stalks are not large. Stalks can puncture the plastic allowing air in. Visit with your equipment supplier regarding how to best use this equipment to handle corn.

Grazing can be used by strip grazing using electric fences. Make two to three moves per week with daily being best. Be sure to train cows to electric fences before turning in.

Windrow grazing may also be another alternative. This is same as if you were baling corn but has several advantages such as ease of fencing and the size of strips needed are easier to determine.

References:
Guide 4590. Corn Silage
Forage Plot Budget Summary

Randa Doty
Ag Business Specialist
University of Missouri Extension
Nodaway County

The 2011 forage plot budget summary for the Hundley-Whaley forage plots tells much of the same story that it has told in the three years prior. Adding legumes to the plots not only increased the amount of forages produced, but also increased the value of production. In comparison, applying nitrogen also increased forage production, but the cost of nitrogen tended to make the income over fertility cost lower than if legumes were added.

When choosing a type legume to interseed in your fescue pasture or fertilizer application regime to use to increase production, there are many factors to consider. The production budgets are a good place to start to help estimate the value of production. Looking at the production curves is another tool to explore to determine what is best for you. However, one of the most important factors you should determine is if your management style can fit into the system you are considering. Some legumes need to be managed in a specific way to maintain the stand. If the stand is not managed properly, life expectancy of the stand can be shortened which decreases the benefits of the legume. Some legumes have trouble standing up to hard grazing or need special management to maintain the stand. Livestock tend to select for those plants and they may not thrive in a grazing situation. A rotational grazing system is always encouraged to manage forages effectively when grazing.

When comparing the nitrogen application timings, it is hard not to notice the difference in the yields when comparing March vs. August application of nitrogen. Traditionally, forage producers fertilize their pastures and hayfields in the spring. In both cases in this trial, the August applications out produced and out earned the March applications. It is often hard for producers to change their management techniques when they have been working in the past.

The goal of this trial is to show producers ways that they can make small adjustments in their production techniques and make a big difference in their bottom line. We hope that seeing some of these differences helps make producers think about their production techniques and maybe run trials on their farm. We challenge you to think outside the box and be willing to try something new. Next year, set aside some acres and try something different and see if it works for you and if you can make small changes in your techniques to make a big difference in your bottom line.

Methods

As mentioned previously in this booklet, the tall fescue and legume plots were harvested on May 31 and September 15, 2011. Paired samples of each of the fourteen treatments were air dried and after yield data was collected they were then submitted to a custom laboratory facility utilizing NIR (near infrared) methods for forage quality analysis. Samples were statistically analyzed using ANOVA procedures to determine least significant difference (LSD) at the ninety-five percent confidence level (LSD .05). If the LSD .05 = a number greater than zero, there was a significant difference observed. For example, in the crude protein chart for the May 31 harvest, red clover had a % crude protein value of 13.0 and birdsfoot trefoil had a value of 18.1. The difference between those two treatments was 5.1, which is greater than 4.26. So, there was a statistically significant difference between % crude protein levels for red clover and birdsfoot trefoil harvested on that date. For ease of reading, results are presented by cutting date in the order of CP, NDF, TDN and RFQ.
Forage production is challenging at best. While we want high yields, we also want high quality. Unfortunately, the two do not always go hand-in-hand. Yield is pretty simple to measure and anyone with a set of scales can do it. Quality determination is more complicated in that samples must be analyzed in a lab. What are we looking for when we sample for quality? The main components we are interested in are crude protein, energy, and digestibility. While there are other things we can analyze for, if we have information for these three we can do a pretty good job balancing beef cattle diets. Therefore, these are the areas we are highlighting. Crude Protein (CP) is the sum of true protein and non-protein nitrogen. Most plant protein will be true protein, with the exception of some of the nitrate-accumulating grasses such as sudangrass. It is a measure of the forage’s ability to meet the protein needs of livestock. Different classes of beef cattle have different protein requirements. In general, younger, growing cattle and cows in early lactation have the highest protein needs. % Total Digestible Nutrients (TDN) is a measurement of energy that gives the percentage of digestible material (protein, fiber, nonstructural carbohydrates, and fat) in forage. % Neutral Detergent Fiber (NDF) represents the bulkiness or all of the structural or cell wall material in the forage (hemicellulose, cellulose, lignin, and silica). Because forage fiber is bulky, there is a limit to the amount that will fit in a cow’s rumen (first stomach). When that limit is reached, she will stop eating and thus the NDF of forage is inversely related to the amount that a cow or calf is able to consume. Forages with low NDF values result in higher intakes as compared to those with high NDF values. Relative Forage Quality (RFQ) is an index for ranking forages and is calculated from crude protein, acid detergent fiber, NDF, fat, ash, and NDF digestibility at 48 hours. An RFQ of 100 is considered the average score and is representative of full-bloom alfalfa. RFQ reflects the feeding value of forage and higher values mean higher quality.

Why are we interested in forage quality? Well, higher quality forages equate to greater animal performance. By sampling the tall fescue and legume plots for quality at different times during the production cycle, we will begin to establish a forage quality database for northwest Missouri. In addition to the nitrogen fixation that legumes provide to grasses in a grass-legume mixed pasture, legumes are typically higher in nutrients and have a positive effect on forage quality. This is especially true during the "summer slump" period when cool-season grasses are lower in quality. This forage quality information should prove to be useful for area farmers and ranchers as they manage pastures and hayfields for maximum animal gains as well as maximum forage yield.

<table>
<thead>
<tr>
<th>Establishment Cost and Stand Life Comparison for Legumes</th>
<th>Treatment</th>
<th>Establishment Cost</th>
<th>Expected life of legume stand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Common Red Clover</td>
<td>$28.50</td>
<td>2 years</td>
<td></td>
</tr>
<tr>
<td>2Birdsfoot Trefoil</td>
<td>$33.80</td>
<td>10 years</td>
<td></td>
</tr>
<tr>
<td>3Alfalfa</td>
<td>$43.50</td>
<td>7 years</td>
<td></td>
</tr>
<tr>
<td>4Kopa II White Clover</td>
<td>$11.90</td>
<td>4 years</td>
<td></td>
</tr>
<tr>
<td>5Durana White Clover</td>
<td>$13.25</td>
<td>4 years</td>
<td></td>
</tr>
<tr>
<td>6Common Lespedeza</td>
<td>$57.50</td>
<td>3 years</td>
<td></td>
</tr>
<tr>
<td>Kopa II White Clover &amp; Alsike</td>
<td>$12.45</td>
<td>4 years</td>
<td></td>
</tr>
</tbody>
</table>

1Stand was established in 2008, complete budget can be viewed in Improving Tall Fescue Production in Northwest Missouri with Legumes and Timing of Nitrogen Application: A producer’s guide.

2Stand life is estimated to reflect the life of an average stand when managed under ideal conditions.
## 2011 Hundley Whaley Forage Plot Budget Summary - Year 4

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Common Red Clover</th>
<th>Birdsfoot Trefoil</th>
<th>Alfalfa</th>
<th>Kopa II White Clover</th>
<th>Durana White Clover</th>
<th>Common Lespedeza</th>
<th>Kopa II White Clover + Alsike</th>
<th>0 Nitrogen</th>
<th>60 N March</th>
<th>60 N Aug</th>
<th>60 N Mar + Red Clover</th>
<th>60 N Aug + Red Clover</th>
<th>60 N Mar, Aug</th>
<th>60 N - Mar, June, Aug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Production/Acre¹</td>
<td>$70.59 per ton/DM</td>
<td>$258.92</td>
<td>$414.39</td>
<td>$447.81</td>
<td>$261.53</td>
<td>$324.78</td>
<td>$142.27</td>
<td>$252.99</td>
<td>$125.19</td>
<td>$210.74</td>
<td>$238.38</td>
<td>$232.48</td>
<td>$251.93</td>
<td>$318.60</td>
</tr>
</tbody>
</table>

### Fertilizer Cost

<table>
<thead>
<tr>
<th>Nitrogen Rate (lbs/acre)</th>
<th>lbs/acre</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>60</th>
<th>120</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total N Cost per acre</td>
<td>$0.23/lb of N (Urea)²</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>13.80</td>
</tr>
<tr>
<td>Agrotain Cost</td>
<td>$0.06 Agrotain/lb of N</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3.60</td>
</tr>
<tr>
<td>Application Charge per acre</td>
<td>$5.00/lb</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>10.00</td>
<td>15.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Fertility Cost/lb</th>
<th>$258.92</th>
<th>$414.39</th>
<th>$447.81</th>
<th>$261.53</th>
<th>$324.78</th>
<th>$142.27</th>
<th>$252.99</th>
<th>$125.19</th>
<th>$210.74</th>
<th>$238.38</th>
<th>$232.48</th>
<th>$251.93</th>
<th>$318.60</th>
<th>$342.14</th>
</tr>
</thead>
</table>

### Income over fertility cost per acre

| $258.92 | $414.39 | $447.81 | $261.53 | $324.78 | $142.27 | $252.99 | $125.19 | $188.34 | $210.08 | $229.53 | $273.80 | $274.94 |

¹ Value of production is compared to hay values. Hay price is on a 100% dry matter basis. Hay valued at $70.59 dry matter basis equals $60 per ton as-fed at 85% dry matter. Hay price taken from the 2011 Missouri Farm Financial Outlook, Projected Prices and Costs Used in 2011 Crop and Forage Budgets.

² Value of N(Urea) taken from the 2011 Missouri Farm Financial Outlook, Projected Prices and Costs Used in 2011 Crop and Forage Budgets.

Prepared by Randa Doty, MU Extension Agricultural Business Specialist