Mid-Atlantic Regional Agronomist Quarterly Newsletter

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To subscribe or unsubscribe, please send your request to the editor at rtaylor@udel.edu Comments, suggestions, and articles will be much appreciated and should be submitted at your earliest convenience or at least two weeks before the following dates: February 28, May 30, August 30, and November 30. The editor would like to acknowledge the kindness of Mr. Todd White who has granted us permission to use his scenic photographs seen on the front cover page. Please go to www.scenicbuckscounty.com to view more photographs.

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Development of an On-Farm Soybean Management Network

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In 2009, we initiated a project to develop an On-Farm Soybean Management Network in Pennsylvania to help producers, their advisors and ag industry representatives make more informed and research based decisions regarding soybean management. For the first year of the project, we established four objectives for the project:

1. Develop an on farm product testing network for soybean production in Pennsylvania.

2. Evaluate the influence of soybean at planting population on yield and final plant populations.

3. Conduct a survey of the bean leaf beetle infestations and bean pod mottle virus to help establish appropriate thresholds for treatment.

4. Develop a fly over survey of representative soybean fields in conjunction with the Iowa Soybean Association's On-Farm Network.

Development of the On-Farm Network

We selected seven soybean producers as cooperators for the On-Farm Network. Each was selected because of their experience with soybean production and willingness to participate in the project.

1. Chris and Andrew Kimmel – Armstrong County: Extension Coordinator Kevin Fry
2. Glen Krall – Lebanon County: Extension Coordinator Del Voight
3. Melvin Lesher– Franklin County Extension Coordinator Jon Rotz
4. Troy Alderfer -Berks County Extension Coordinator Mena Hautau

5. Adam, Tom, and Tim Rabenold and Adam Snyder - Dauphin County Extension Coordinator Paul Craig
6. Bill Behm -Chester County Extension Coordinator Jeff Graybill
7. Ralph McNeal- Bradford County Extension Coordinator Mark Madden

We feel we have developed an excellent network in our first year. Each of the cooperators was able to establish a replicated strip trial and at six of the seven sites we were able to collect good yield data. Yields averaged over 67 bushels per acre across all sites, which indicated that we have an excellent group for assessing treatments under high yield production conditions.

Soybean Yield Response to Reduced Seeding Rates

This study was initiated to assess the potential impact of reducing soybean seeding rates from 170,000 to 140,000. Similar research in Iowa with the On Farm Network has shown limited benefits to seeding rates above 140,000 seeds per acre. Depending on conditions, Iowa State University recommends between 125,000 and 140,000 seeds per acre http://extension.agron.iastate.edu/soybean/decisiontree.html . These recommendations are considerably lower than Penn State recommendations and those seeding rates used by many soybean producers in Pennsylvania. With increasing soybean seed costs, there is more potential interest in reducing soybean seeding rates.

Objectives

In 2009, we established a multi-location study to assess the potential for reducing seeding rate of soybean while maintaining maximum yield and to estimate the average final stands as a percentage of planted populations.

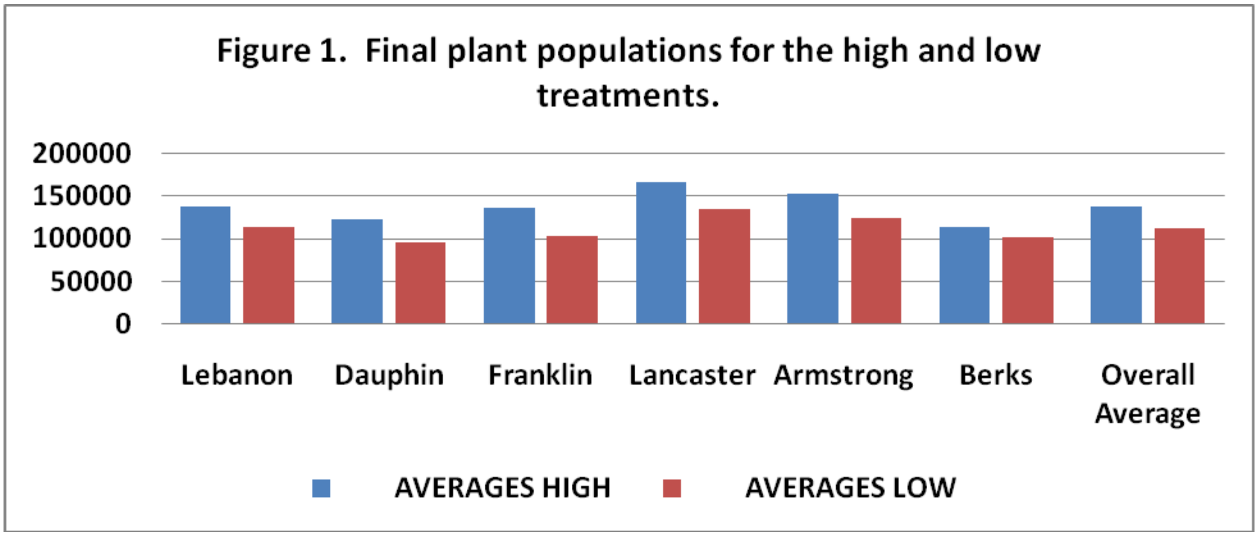
Population Protocol

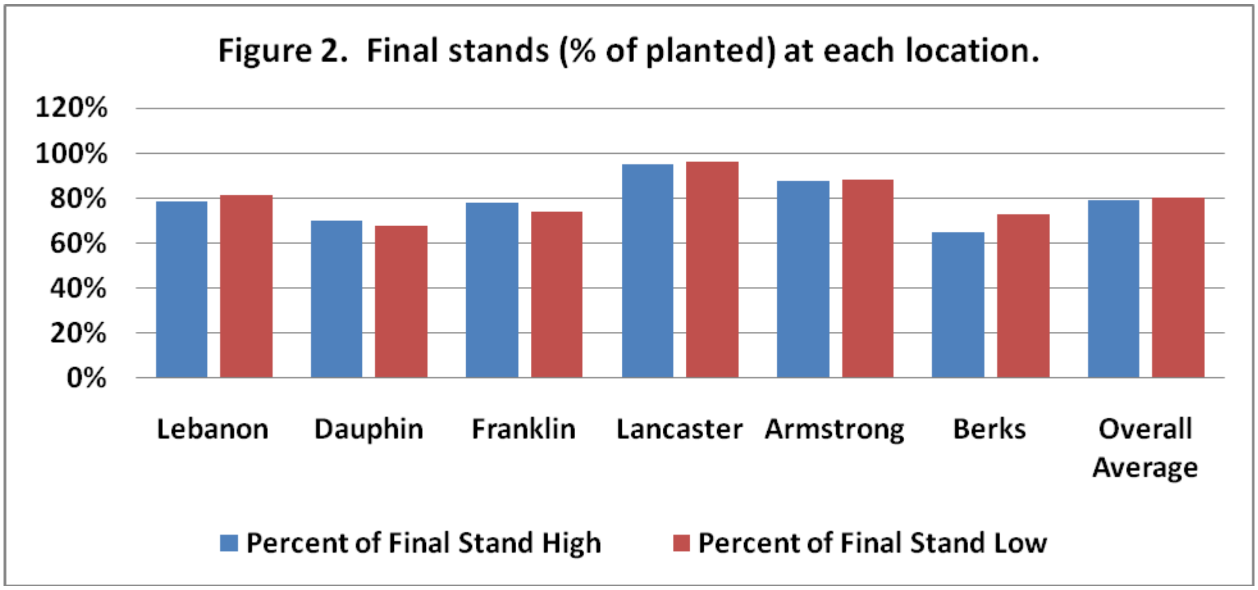
Six different On Farm Cooperators in Lebanon, Dauphin, Franklin, Lancaster, Armstrong and Berks Counties established soybeans at two different planting rates that were calibrated by the local On Farm Coordinator. Field length plots were established with two seeding rates of soybean, 140 K and 170 K, at each farm. Plots were replicated within each site similar to the diagram on the right. The width of plots was wide enough so that the platform head on the combine could be used for harvest, ensuring a full pass during harvest. All combines were equipped with a yield monitor to assess yield variation.

170,000 seeds/ac
140,000 seeds/ac
140,000 seeds/ac
170,000 seeds/ac
140,000 seeds/ac
170,000 seeds/ac
140,000 seeds/ac
170,000 seeds/ac

Results and Discussion

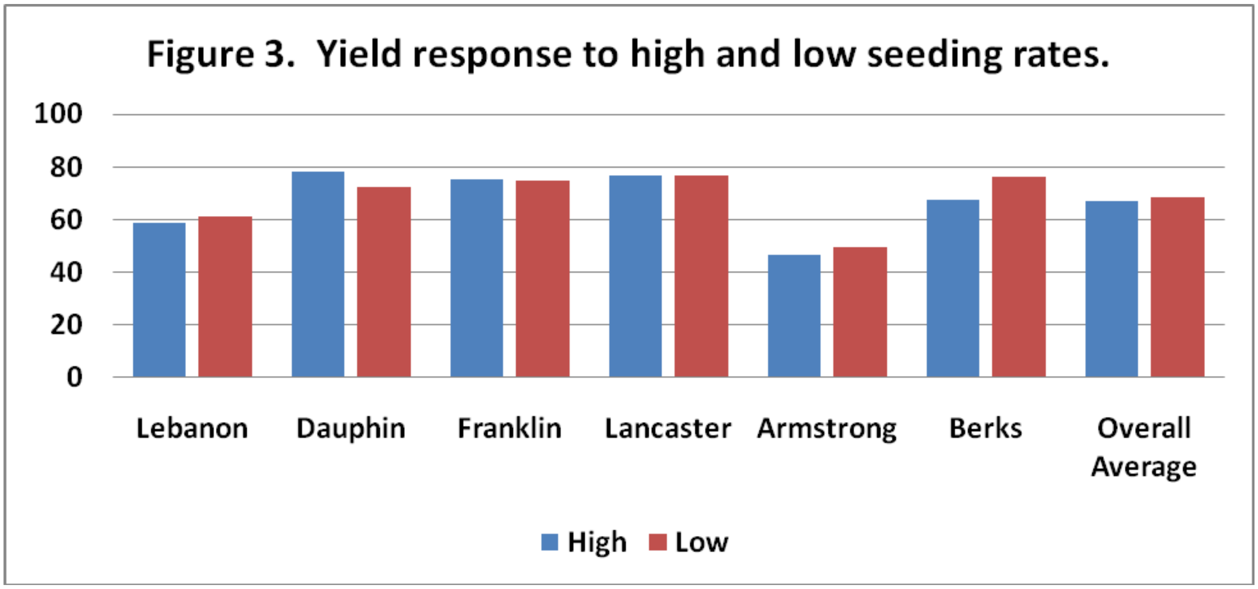
In our 2009 soybean network evaluation, cooperators planted populations of 170,000 and 140,000. Averaged across the six growers who completed the study, they achieved final populations of 138,000 and 113,000 plants per acre as final stands (Figure 1). In every case except one, final stands were at or above 100,000 plants per acre.   The trial also indicated that in this season, on average, Soybean Network Cooperators achieved stands that were approximately 80% of planted populations (Figure 2). Final stands ranged from 60% to 95% of the planted populations. If soybean producers can consistently achieve this level of emergence and survival, they should be able to adopt the lower seeding rates with minimal impact on yield.





Yields were nearly identical for the high and low populations, averaging 67.5 bu/acre for the high population and 67.3 bu/acre for the lower plant population (Figure 3). These results are consistent with the Iowa State recommendations that plant populations of 100,000 are adequate for high soybean yields. Yields were equivalent or higher with the lower seeding rates at all locations except the Dauphin location.

At an approximate seed cost of $65 for 140,000 count bag, reducing seeing rates would result in a $16.25 savings per acre. We also learned that all of the producers in the network achieved very high yields and likely are a good resource for testing products under high yield conditions in the future.



Previous research has indicated that soybeans can tolerate a wide range of plant populations with minimal impact on final yield. Penn State research as well as Iowa State and industry research confirm that final stands of about 100,000 plants per acre are adequate for high yields in high production environments. This study suggests that in many cases with modern equipment, good quality seed, and careful seeding practices, these plant populations could be achieved with seeding rates lower than 170,000 seeds per acre and probably 140,000 seeds per acre. In less than ideal conditions or seasons, reduced plant populations may lead to less than ideal stands and an increased need for replanting.

The decision to use lower seeding rates is best probably a field to field discussion, based on planting date, field conditions, and seed quality, but this study suggests that often a 140,000 seed drop will be adequate. There could also be some conditions where the lower seeding rate could have some advantage especially where lodging or foliar diseases are common problems.

Bean Leaf Beetle Assessment

Bean leaf beetle (BLB) population levels have grown over the last few years to economic levels in the state and region, yet little has been documented on the spread and population levels within Pennsylvania. In addition, the distribution of bean pod mottle virus (BPMV), which was first identified and confirmed, using lab analysis in four fields by Del Voight in Lebanon County, is not well understood in Pennsylvania. By surveying fields in Pennsylvania for BLB spread and by determining the link to the virus, a more proactive approach to management can be developed. This will assist growers in determining the best management practice to manage BLB. The threshold for treatment of the BLB is a function of the presence of BPMV. This virus causes discolored soybeans and green stems at harvest. Iowa State recommendations suggest that if the virus is present, growers should consider treatment. If BPMV is not present, they should scout and treat only when BLB reach established thresholds (Bradshaw, J. M. Rice, and

J.H. Hill. 2003. Management decisions for bean leaf beetles and bean pod mottle virus. Integrated Crop Management Newsletter. April 28, 2003. http://www.ipm.iastate.edu/ipm/icm/2003/4-28-2003/blbmanagement.html). Consequently, understanding if the virus is present or not is important for cost effective soybean management.

Objective

The objective of this study was to identify fields with bean leaf beetle feeding and then assess samples for the presence of the bean pod mottle virus through testing at a private laboratory.

Bean Leaf Beetle Protocol

Extension educators evaluated numerous fields throughout the region for the presence of BLB. In fields where significant feeding was detected, soybean leaf samples were collected and sent to the Ag Dia Laboratory in Elkhart, Indiana. Results were then tabulated by project personnel.

Results and Discussion

Bean leaf beetle populations crashed in the region in 2009, presumably because of the cold winter in 2008-2009. It was difficult to find BLB populations that were causing enough injury to potentially transmit the BPMV. A limited number of fields were sample and the results are shown in Table 1. A total of 16 samples were collected, but none of the samples tested positive for the BPMV. Apparently the low levels of BLB in 2009 may have reduced the transmission of this disease. Transmission of the disease is a function of beetle populations. If beetle populations rebound in the future, monitoring for the virus should be resumed.

Table 1. Number samples and results of testing for the BPMV in 2009 in Pennsylvania.

Site	Samples	Positive	Negative
Franklin	4	0	4
Lebanon	4	0	4
York	4	0	4
Armstrong	1	0	1
Lancaster	2	0	2
Berks	2	0	2

Aerial Imagery of Selected Soybean Fields

Aerial imagery can be an effective tool to diagnose field level production problems. The On Farm Network sponsored by the Iowa Soybean Association has used this technique to provide growers management information and to provide examples of common crop management problems. There is potential for this approach to be used in Pennsylvania.

Objective

Gain experience with the acquisition and interpretation of aerial imagery.

Results

The network was successful in utilizing scribble maps (http://scribblemaps.com/), a technology that allows for the identification of fields that then can be georeferenced and placed into shape files, and was able to get all the necessary information to the Iowa group. The shape files were put together and sent to the Iowa soybean board to gather the information over Pennsylvania fields. The network is awaiting the results of the fly over and once available will utilize them for diagnostics. At this time, we have identified qualified personnel at Penn State that are able to assist the group in achieving this goal for the 2010 planting season without reliance on an outside group. This connection, by itself, is a success allowing for timely results in Pennsylvania.

How Well Does Slug Bait Work?

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No-till farmers in the Shenandoah Valley of Virginia often struggle with slug damage in corn and soybean fields. Surface residue (which is a benefit of no-till farming) offers a favorable habitat for slugs. Slugs feed on seedling corn and soybean, often resulting in significant stand loss and /or slowing crop development. One management option available to farmers is the use of 'Deadline' slug bait (a mini-pellet impregnated with 4% metaldehyde). The bait must be spread in the field and consumed by the slugs to be effective. During 2008 and 2009 slug bait was applied in thirteen different corn and soybean fields in the Shenandoah Valley to evaluate its effectiveness.

All of the fields (except one) showed signs of significant slug feeding prior to bait application. The areas selected for the plots also had uniform stands and uniform soils. After infested fields were identified, slug bait was applied as soon as weather permitted. The plots were arranged in a replicated strip plot design with each treatment (bait versus no bait) replicated four times in each field. All of the plots were at least 150 feet long. Slug bait was applied using a push-type spreader or using a spreader mounted to a four wheeler. The goal was to apply 10 pounds of bait per acre. The actual rate was about 20 pounds per acre when using the push-type spreader and 10 pounds per acre with the four wheeler. For the 2008 and 2009 crop season, the 'Deadline' slug bait (when applied at 10 pounds per acre) cost $22 per acre. Stand counts to evaluate population were taken when the corn was at least knee high. Yield data was collected on all of the plots (except the Dirting plot) by harvesting the entire plot length using the farmer's combine and a weigh wagon. Yield on the Dirting corn plots was collected by hand-harvesting two 20-foot long rows.

Most of the plots were revisited several times within the two weeks after slug bait application to observe the treatments. In almost every corn plot, there was obviously less (or no) slug feeding where the bait was applied versus were no bait was applied within a week of slug bait application. In most situations where slug bait was applied, evidence of slug feeding on plants began again about three weeks after bait application. We presumed that rainfall dissolved the bait and additional slugs hatched. Although no direct measurements were taken, it appeared that a rainfall event of 0.1 to 0.2 inches had a minimal effect dissolving the bait. However, a rain of 0.5 inches or more appeared to dissolve 80 percent of the bait or more. It was difficult to notice feeding patterns in the soybean plots.

Plant population and yield response data are shown in Tables 1and 2. Statistical analysis of the individual plots indicated that both population and yield was significantly different at only three out of ten sites. This means we can only be 90% certain (LSD = 0.1) that the application of slug bait resulted in a yield response in three out of ten plots. However, in nine out of ten plots there was a slight numerical population and yield response. Some would argue that *"surely a numerical yield and population response in 9 out of 10 plots warrants attention.*" Further study and a greater number of experiments will be necessary to draw final conclusions.

Based on these data, we conclude the following:

Additional work to further evaluate the benefit of slug bait is warranted to understand when an application will provide an economical response. This is more of a vote in favor of slug bait than against slug bait. In many cases after installing 13 test plots to evaluate a product, the conclusion reached is *"the product does not work go find an alternative.*" In this case, the product appears to work (i.e. provide some control of slugs) but we are not sure it works well enough to be economical. The median yield response in the six corn grain plots and the three soybean plots was 3.2 and 2.6 bushels per acre, respectively. Even if we assume that farmers can get this type of response consistently, the cost of the bait exceeds the value of 3.2 or 2.6 bushels per acre of corn and soybeans respectively.

It is not clear that slug bait will consistently prevent slug damage in soybean. This is primarily due to the fact that the growing point of soybean is above ground when the plants emerge from the ground. In many cases the first visible symptoms of slug feeding in soybean shows plants that will not recover. There is not adequate time to see visible slug pressure in soybean and subsequently apply slug bait to emerging soybean before the slugs kill some plants. If there is a way to predict fields with significant slug pressure prior to soybean emergence then slug bait might work well on soybean.

Table 1: Plant population and yield response to 'Deadline' slug bait in corn.*

	Population	LSD = 0.10	Yield	LSD = 0.10
B-Mont corn 2009	2,275	NS	2.4 bu/A	NS
Dirting corn 2009	1,100	NS	1.2 T/A (Earlage)	NS
Fleming corn 2009 **	1,584	Sig	Not measured	--
Shillingburg corn 2009	1,250	NS	Not measured	--
B-Mont corn 2008	6,188	Sig	19 bu/A	NS
Vann corn 2008	2,688	Sig	4 bu/A	NS
Grandview corn 2008	1,250	NS	Not measured	--
Reeves 1 corn 2009	Not measured	--	51 bu/A	Sig
Reeves 2 corn 2009	Not measured	--	-18 bu/A	NS
Myers corn 2009	Not measured	--	1.7 bu/A	NS

* Example: A population response of 2,275 plants per acre was an average plant population of 30,000 plants/acre where bait was applied versus 27,725 where no bait was applied (30,000 – 27,725 = 2,275). NS, not significant. Sig, LSD=0.10

** The Fleming field had historical slug pressure and bait was applied within a few days of corn emergence. There were minimal visible signs of slug pressure prior to bait application. The soils were too un-uniform to collect yield data.

Table 2: Plant population and yield response to 'Deadline' slug bait in soybean.*

	Population	LSD = 0.10	Yield	LSD = 0.10
B-Mont soybean 2009	3,000	NS	2.7 bu/A	Sig
B-Mont soybean 2009	-1,607	NS	2.6 bu/A	Sig
Wisman soybean 2009	26,384	NS	1.6 bu/A	NS

*Example: A population response of 3,000 plants per acre was an average plant population of 100,000 plants/acre where bait was applied versus 97,000 where no bait was applied.

Acknowledgement: The authors would like to thank AMVAC, Rockingham Farmers Cooperative, Guy Gochenour, Jonathan Day, Mike Dirting, the Shillingburg Brothers, Jim Vann, C.W. and Chris Getz, Ernie Reeves, Ames Herbert, and Rod Youngman for their assistance with these plots.

Comparing Methods to Establish Clover in Permanent Pasture

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Establishing more clover in pasture can help increase forage and livestock productivity while reducing costs from buying nitrogen (N) fertilizer. Clovers can be difficult to establish in permanent pasture though. In Virginia, the simplest way to build clover into existing pasture is through frost seeding. This method usually involves broadcast seeding in mid-winter so freeze-thaw cycles help incorporate seed into soil. Unfortunately, this seeding method is notoriously unreliable for establishing good clover stands. Under similar conditions, no-till drilling clover seed into pasture might be a better strategy. To explore this issue, a replicated field experiment was recently initiated at Kentland Farm near Blacksburg, Va. The study compared broadcast frost seeding and no-till drilling methods to establish clover into permanent pasture.

In winter 2009, four 2.5 acre, pastures were chosen for the seeding experiment. The pastures were typical for the region consisting of mostly tall fescue, Kentucky bluegrass, some orchardgrass, and almost no clover. Before seeding, pastures were mob grazed by cattle to remove residual vegetation and fertilized with phosphorus (P) and potassium (K) as recommended by soil test. In early February, one half of each pasture was sown with a mixture of red (4 lbs/ac), ladino (2 lbs/ac.), and white clover (2 lbs/ac.) using a broadcast seeder. One month later, the remaining half of each pasture was planted with the same mixture but using a no-till drill.

Pastures were grazed by beef cows from late-April to October 2009. At first, we intensively strip grazed each pasture moving cattle to new grass every 1 to 2 days. This intensive grazing was done to help suppress grass growth and allow clovers to establish. We reduced stocking rate in mid-summer as grass growth slowed. To measure initial establishment success, we counted clover seedings in April. Forage samples were collected in June and August 2009 to measure clover contribution to forage yield.

In spring, we found more clover seedlings in the frost-seeded pastures (11 seedlings/ft^2) than in those planted with a no-till drill (6 seedlings/ft^2). By June, the white clover in the frost seeded pastures accounted for about 12% of the forage yield (by weight). This was higher than the no-till drilled pastures where white clover accounted for only about 6% of yield. Red clover established more slowly than white clovers and was less than 4% of total yield in June. By August, red and white clover yield was virtually identical between the seeding methods.

Together the clovers accounted for about 15% of the total forage yield, which was about 2.5 tons DM/acre.

To sum it up, we were very successful in establishing new clover into these permanent pastures. If we compare clover abundance in April to that in August, our planting increased the clover component in pastures more than 20 fold. That is like saying your savings account increased from $1000 to $20,000 in little over three months. Although we predicted drilling would work better to establish clover, frost seeding proved equally effective. The success of over-seeding was likely related to a combination of factors: 1) mob grazing in winter that reduced standing dead vegetation, 2) early planting during the first week of February, 3) aggressive grazing in spring to reduce grass competition, 4) good soil fertility (adequate P, K and pH) to stimulate clover growth, and 5) rainfall, which was abundant during the 2009 growing season. The exact factors that determine successful frost seeding still remain elusive as there are probably a combination of events involved. The good news is that producers can control most of these (e.g., stocking rate) and by doing so, should increase their chances of successful clover establishment.

Pugged Pastures: Challenges and Opportunities

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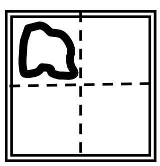
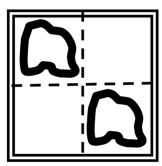
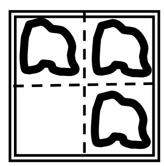
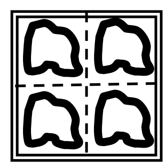
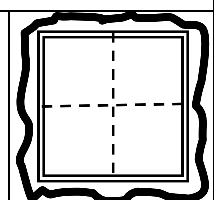
A wetter than normal winter has resulted in significant pugging damage in pastures in many areas of the country. Pugging occurs when the hooves of grazing livestock penetrate the soil surface during wet conditions causing damage to pasture plants as well as soil structure. Pasture plants can be torn and buried. Soils can be compacted resulting in lower water infiltration rates and increased runoff from pastures. The net result is decreased pasture productivity. Depending on the severity of the damage, decreases in pasture productivity can range from 20 to 80% for the first 8 to 12 months following the initial damage. Damaged sods are much more vulnerable to invasion from less productive weedy species. Even after pastures have appeared to recover, pasture productivity can be decreased by as much as 20%. Due to the lower productivity of severely pugged pastures, timely rehabilitation is necessary. The remainder of this article will discuss some options for rejuvenating damaged pastures.

Assess Pugging Damage. The first step in developing a recovery strategy is to get an accurate assessment of the severity of pugging damage. In many cases, pugging may not be as bad as it appears at first glance. Frank Mickan from Victoria's Dairy Extension Centre said it is important to avoid a quick emotionally based assessment. He developed a chart to help quantify pugging damage in pastures. This chart takes into account the percent of a given area that is damaged and the depth of the pugging damage. He suggests assessing several relatively small areas (1 x 1 ft) that are representative of the pugging damage that is present. This is best done by making a 1 ft^2 quadrat out of PVC pipe and laying it on the damaged area that is being assessed. Then, you should estimate how much of the total area of the paddock has been impacted (See Table 1, below). Pastures that have very light to light damage may recover fully without any inputs other than extra rest in the spring. Pastures with moderate damage may be thickened up by harrowing to level and smooth damaged areas, broadcasting seed, and cultipacking. Areas with severe and very severe damage will in most cases require full renovation.

Table 1. Assessing pasture damage using an area x depth matrix.

Depth of pugging	Percentage of quadrat damaged				
					
	0 – 25%	25 – 50%	50 – 75%	75 - <100	100%
0 – 1 in	Very light	Very light	Very light	Light	Light
1 – 2 in	Very light	Light	Moderate	Severe	Very severe
3 – 4 in	Light	Moderate	Very severe	Very severe	Very severe
> 4 in	Moderate	Severe	Very severe	Very severe	Very severe

Adapted from Rob La Grange. 2009. Getting pastures back into shape. In the Tassie Dairy News, Issue 10, November 2009, TIAR Dairy Centre, Tasmania.

Soil Test and Adjusting Fertility. Damaged areas should be soil tested and lime and fertilizer applied as needed. Soil fertility is a major factor impacting pasture productivity in the mid-Atlantic region. Poor fertility limits pasture growth and decreases legume presence. In addition, it results in weak sods that are more vulnerable to weed invasion. The best defense against weeds in pastures is maintaining a healthy and vigorous sod.

Rest and Relaxation. In cases where the pugging damage was very light or light, simply giving pastures a little tender loving care this spring may be enough. Allow damaged paddocks to get a little more mature before initiating grazing in the spring and give them a little longer rest periods after grazing. Make sure to avoid overgrazing these pastures this summer when they are stressed by high temperatures and drought.

Subsoiling and Surface Tillage. Subsoiling may in some cases have a beneficial impact on soil structure, but it has not been shown to consistently increase dry matter production of damaged pastures. Likewise surface tillage (harrowing, disking, etc.) alone has been shown to have limited impact on overall dry matter production. Both practices have no impact or, in some cases, may further damage recovering plants. In either case, pasture sods still have a decreased stand density making them vulnerable to invasion by undesirable weedy species.

Overseeding Damaged Sods. Pugging may provide an excellent opportunity to incorporate legumes and improved grass species into tall fescue sods. Damaged sods may be over-seeded with a legumes or a combination of grasses and legumes. This is best accomplished in late winter or early spring. Areas should be leveled with a drag harrow or other tillage implement. Seed can then be broadcast on the soil surface and cultipacked. A legume mixture that works well in the mid-Atlantic is 4-6 lb/A of red clover plus 1-2 lb/A of ladino clover. A perennial grass can also be added to this mixture as needed. Tall fescue can be broadcast at a rate of 10-15 lb/A and orchardgrass at 4-6 lb/A. If summer forage is needed, the damaged area may be prepared as described above and over-seed in mid- to late-April with a mixture of crabgrass (3-6 lb/A) and annual lespedeza (10-15 lb/A).

Reseeding Damaged Sods. In cases of severely and very severely pugged sods, complete renovation may be needed. Although sods can be reseeded in the spring, it may be advisable to wait until the following fall. In this case, severely damaged areas can be leveled and smoothed by harrowing in late spring and seeded with a summer annual crop such as pearl millet or sorghum-sudangrass. These crops can be utilized for summer grazing or conserved as hay or silage. This provides the opportunity to adjust soil fertility as needed and control any undesirable plant species with a nonslective herbicide application in late spring and again in late summer before reseeding the desired perennial forage mixture. This is an ideal opportunity to eliminate toxic tall fescue from a paddock and reseed a novel endophyte tall fescue variety.

The best solution to pugging damage is to work hard at avoiding it. This may not always be possible, but there are some strategies that you can implement when the Good Lord blesses us with a little more water than we can use at any given time. The first strategy is to keep the cattle moving. This will help keep them from damaging any one paddock severely. The second is to just select a paddock that needs renovation and let them camp out there with some hay until things dry up. This second option has some issues. Animals may likely be in the middle of a mucky mess and that is never good for animal health. In addition, you will have to feed hay.

For more information on renovating pastures and no-till seeding techniques visit Virginia Cooperative Extension website at http://www.pubs.ext.vt.edu/ or contact your local Cooperative Extension office.

Winter Grazing Strategies and Observations

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The December 2009 blizzard reinforced my belief that winter grazing is the best way to make money in the cattle business. We received approximately 20 inches of snow in northern Fauquier County, Virginia. I made it through the storm without feeding hay! Keep in mind that my operation is blessed with stockpiled fescue and southern slopes in the northern Piedmont. This does help a producer graze their cattle more days than in other parts of Virginia.

This storm was, however, a challenge that allowed me to learn a "few more tricks of the trade" as far as winter grazing goes. Below are a few observations.

Be prepared and watch the weather! Make sure fence and water systems are in order. We knew, by listening to the weather, that the storm could be bad; and it was. We moved most cattle to our better grazing fields the day before the storm hit. On one farm, due to time constraints, we weren't so lucky and moved cattle ¼ of a mile to another grazing farm the morning of the big storm with 6 inches of snow already accumulated. This was a little bit of a chore but it was still accomplished.

Cattle handled the bad weather better than people. Cattle are smart enough to "hold up" during cold, snow, and wind. People are not. People tend to raid the grocery shelves of bread, milk, and toilet paper; the three essentials necessary to survive a blizzard. Cattle are patient. People are not. Cattle will tend to change their grazing patterns based upon the weather. I noticed cattle tending to congregate and remain inactive during the early morning hours when there was heavy snow cover and cold temperatures. Cattle grazed more during the late morning and early afternoon hours when the temperature increased and snow pack melted from solar radiation.

Cattle will aggressively graze through 20 inches of snow if the snow if fluffy. This particular snow was good quality and allowed cattle to push the snow aside. Hillsides have less snow, due to winds, and cattle will tend to graze the higher ground because it takes less energy for the cattle to reach the underlying forage.

Cattle activity and tracking allows for continued winter grazing a few days after the blizzard. Cattle tracks pack the snow and, within a few days, solar radiation will melt the snow in the tracks and expose more tall fescue. Even with cold temperatures the snow pack "loosens up" or melts during mid-day and this is the time cattle will become very aggressive grazers.

Allowing cattle to make tracks is better at exposing tall fescue than plowing through a field to move the snow to the side. It is also easier and takes less fuel. I will still keep the snow plow method in my bag of tricks. However, I will always let the cattle do the work first.

It is not a sin to temporarily open up all gates to allow cattle to graze all fields with accumulated forage. Heavy snow pack obviously limits total available pasture. There are, however, different areas in different fields that will allow cattle to easily graze. Opening up all gates on a temporary basis will actually increase total forage supply to the herd. The cattle herd will find these "easy grazing" areas if given a chance. We will get back to our winter rotational system soon enough once the weather clears and things get back in order.

Cattle will spread out if allowed to graze versus congregating if being fed. Cattle grazing will keep the field in better condition and the cattle will stay cleaner.

In summary, here is how we handled the December 2009 blizzard. We moved cattle to higher ground a day before the blizzard hit, with one exception of moving cattle the day of the storm, December 20th. I waited for the storm to pass. Once the storm passed, I observed the cattle and they appeared to be dong fine. I then booked a room at "The Homestead" and spent two days of fun with my family. Please note that "The Homestead" had a Christmas Special for $99.00 per night. (Anyone who knows me knew they had to be running a special!) I came back on Dec 24th and observed cattle. They were still doing okay. We celebrated Christmas day without hay feeding and spent more time with family and friends. If available pasture declines later in the season, then we will feed hay. As of this writing on December 26 "all is good".

Robert Shoemaker is a nutrient management specialist for the Virginia Department of Conservation and Recreation and runs 250 brood cows near Delaplane, VA.

Greg Judy Challenges Grazing Paradigms at Winter Forage Conferences

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This winter's forage conferences attracted more than 450 participants from around Virginia and neighboring states. The conferences were held in Brandy Station, Harrisonburg, Blackstone, and Wytheville, VA. The planning committee was headed up by Dr. Gordon Groover from Virginia Tech and included various VFGC board members from all segments of Virginia's forage and livestock industry.

The keynote speaker at this year's conference was Greg Judy. Greg and his wife Jane run a grazing operation on 1400 acres of owned and leased near Clark, MO. They went from near bankruptcy in 1999 to paying off a 200 acre farm in just 3 years with custom grazing on leased land and are now completely debt free. Today, they own three farms and lease an additional seven. More recently they have implemented Holistic High Density Planned Grazing on there farms. This is a form of rotational stocking that combines a high stock density for very short periods of time with long recovery periods, sometimes more than 120 days. Since switching from a more traditional rotational stocking system, the Judy's have seen plant diversity and productivity increase dramatically. They attribute these changes to the longer rest periods and leaving increased amounts of plant litter on the soil surface. The litter is thought to provide a food source for micro flora and fauna in the soil, conserve soil moisture, and improve nutrient cycling.

In his high density grazing system, Greg allows the forage to mature before grazing, resulting in forage with a lower nutritive value. However, he manages around the lower forage quality by allowing animals to select the highest quality components from the sward and not forcing them to eat the lower quality components. The utilization rate is normally less than 50%. This approach to grazing management is almost opposite of traditional rotational stocking systems that focus on maintaining plants in a vegetative growth stage by grazing them every two to four weeks during the active growth periods. Greg's talk stimulated healthy discussion and some controversy; but more importantly, it caused conference participants to think about how they are currently managing grazing on their own farms.

The second talk of the day focused on reducing feed costs in cow-calf systems by extending grazing. Chris Teutsch from Virginia Tech's Southern Piedmont AREC, talked with participants about what needed to be in place before they could implement an extended grazing program on their farms. He then talked about selecting the correct forage species for extended grazing systems. He emphasized that profitable cow-calf systems will be based on well adapted perennial sods, which are supplemented with annuals as needed. Teutsch finished up his presentation by showing an example of a potential grazing system for each region of Commonwealth.

After lunch, Dr. Gordon Groover of the Agricultural and Applied Economics Department at Virginia Tech and David Fiske, Superintendent of Virginia Tech's Shenandoah Valley AREC talked about setting profitable stocking densities for cow-calf operations in Virginia. They led participants through a series of example farms that utilized rotational and continuous stocking, hay and stockpiling, and several stocking rates. In the end, they concluded that under current conditions, grazing systems that maximized grazing days were the most profitable.

Jim Parkhurst, Extension Wildlife Specialist from Virginia Tech, talked about alternative profit centers for livestock farms in Virginia. These profit centers focused on wildlife and the environment. He stressed the importance of developing these secondary enterprises in a manner that would compliment the primary enterprises on the farm. Some of the alternative profit centers that he covered included fee fishing, birding, alternative forest products such as mushrooms, traditional forest products such as timber, horse riding trails, retreats and more. Parkhurst emphasized the importance of seeking and heeding sound advice from professionals working with a given practice.

Greg Judy finished the day by talking about how to maintain good tenant-landowner relationships. His operation is heavily dependent on leased land and he stressed the importance of working with landowners toward a common goal. Judy felt that clear and frequent communication with landowners was an essential part of making them feel that they were an important part of the working farm. This communication could be as simple as sending e-mail updates on a regular basis that included pictures of ongoing projects. In some cases, helping to manage the wildlife by enhancing habitat was an important component of lease. In the end, Greg said that the best advice he could give is to manage your leased farms like you own them.

If you missed this winter's forage conference don't despair. We recoded the conference and the DVD is available for purchase. Please page 39 for details on purchasing a copy of the DVD.

Sweet Sorghum Grain and Biomass for Ethanol Variety Screening Trial on Delmarva – 2nd Year

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Maryland Delegates Addie Eckardt, Jim Mathias, and Rudy Cane explore sweet sorghum field trials with Dr. Samuel Geleta of Salisbury Univerisity's Biological Sciences Department and Dr. Karen Olmstead, Dean of the Richard A. Henson School of Science and Technology.

Collaborators

Jeffrey Benner, *Solar Fruits Biofuels, LLC*
Bob Kratochvil, *University of Maryland,*
Ron Mulford / David Armentrout , *LESREC University of Maryland,*
Henry Oakley, *Venture Manor Farms/Oakley's Farm Market*,
Richard Taylor, *University of Delaware*,

Introduction

Sweet sorghum has the potential to produce both first and second generation biofuels from different parts of the same plant. Ethanol, an advanced biofuel, can be produced directly from the sugar juice extracted from the stalk and from starch in the grain panicles. Additionally, the "bagasse" or residual stalks that remain after extracting the sap can be pelletized and enriched to be sold as animal feed or as fuel. The grain from the seed heads can also be used for bird or animal feed. Screening and introducing a high yielding variety or varieties of sweet sorghum is essential for sweet sorghum ethanol technology to be successful in the Eastern Shore and other areas of Maryland.

Objectives

To continue field trials, screening sweet sorghum varieties for biomass, juice yield and sugar content for ethanol production on Delmarva.

2009 Field Trials

In 2009 (first year) eight sweet sorghum varieties were planted under irrigated and dryland conditions on Solar Fruits Biofuels Farm at Salisbury MD. Planting and all cultural practices were done in collaboration with Henry Oakley. This project was funded by MGPUB.

Additional support came from LESREC, the Poplar Hill Research Center UMD, and Salisbury University.

Experimental Design

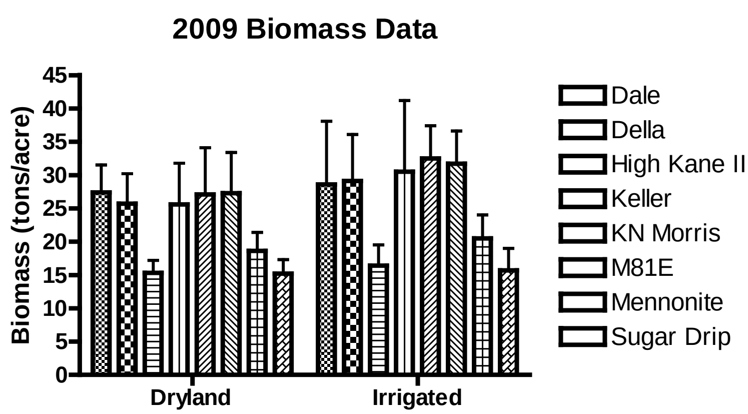
The sweet sorghum varieties were planted in a randomized, complete block design with four replications. The experiment was conducted under both dryland and drip irrigation conditions. Due to the unusually wet growing season, irrigation was applied only once. On each test plot, sweet sorghum seeds were drill planted on four 30 ft rows with 30 inch spacing between rows on May 16, 2009. Post-planting weed control was done mainly through cultivation and hand hoeing, with limited spraying.

Data was collected from the central 10 ft of the two center rows. Above ground biomass, juice volume, and Brix sugar at wax stage (soft-dough) were collected. Additional data were: seed weight, plant height and lodging index at maturity.

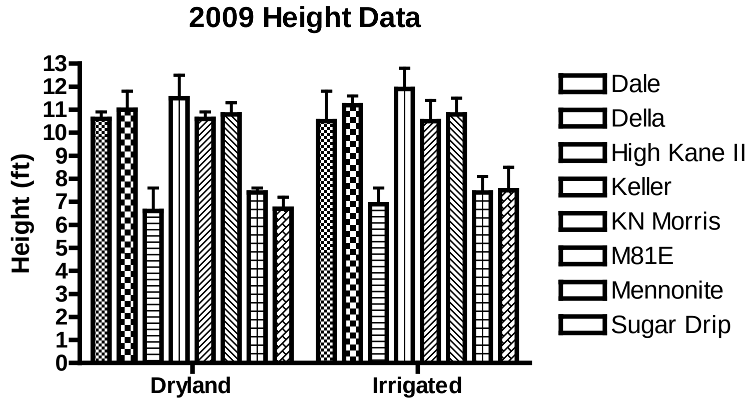
Table 1. Dates and days to first harvesting at soft dough stage are given below.

Varieties	First harvesting date @ soft dough	Number of days to soft dough stage
Hi Kane II	8/28	104
Mennonite	8/29	105
Sugar Drip	8/29	105
Della	9/15	122
KN-Morris	9/19	126
Keller	9/25	132
Dale	9/26	133
M81E	10/2	139

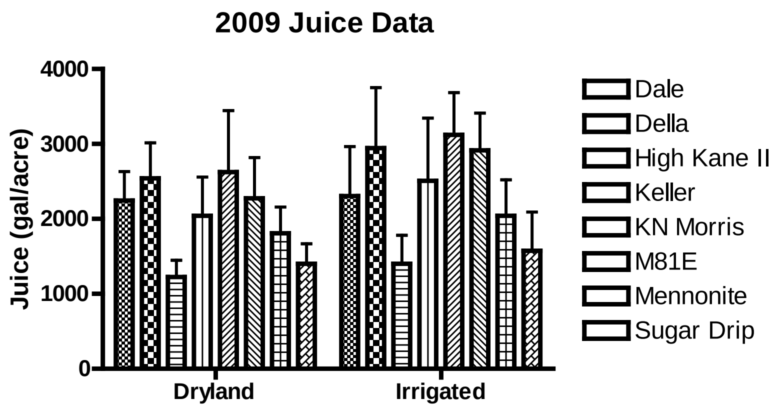
Results



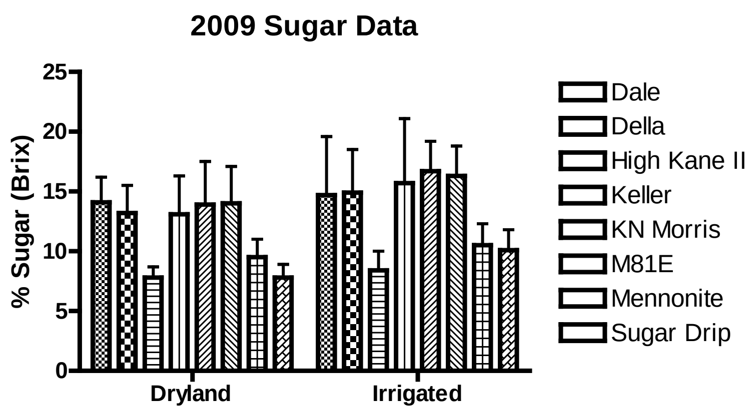
Total biomass varied among the varieties studied, but was not influenced by irrigation. The varieties with the highest biomass were Dale, Della, Keller, KN Morris and M81E.



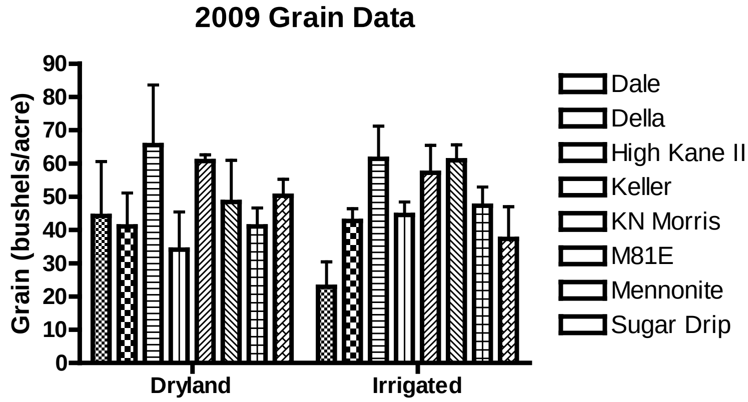
Plant height varied among the varieties studied, but was not influenced by irrigation. The tallest varieties were Dale, Della, Keller, KN Morris and M81E.



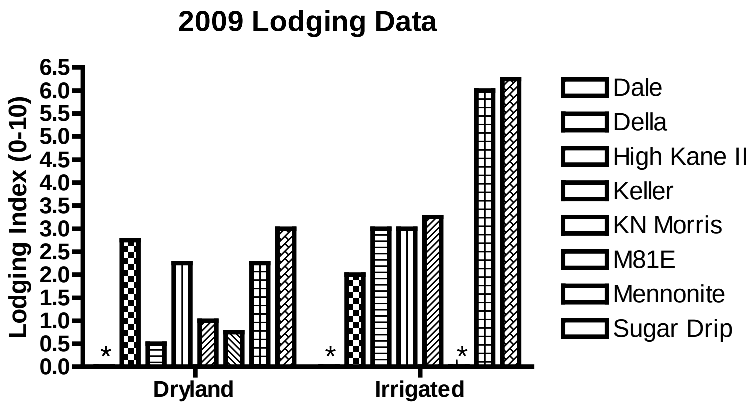
Juice yield varied among the varieties studied. The varieties with the highest juice yields were Dale, Della, Keller, KN Morris and M81E. Overall, higher juice yields were obtained from the irrigated plots (juice [gal/acre]: 2351 irrigated vs. 2020 dryland).



Percent sugar varied among the varieties studied. The varieties with the highest percent sugar were Dale, Della, Keller, KN Morris and M81E. Percent sugar was highest on the non-irrigated plots (Brix: 14.5 dryland vs. 13.8 irrigated).



Grain yield varied among the varieties studied but was not influenced by irrigation. The highest yielding varieties were High Kane II, KN Morris and M81E.



* Indicated zero lodging

Lodging showed considerable variation among varieties and between dryland and irrigated plots. The varieties least prone to lodging on non-irrigated plots were Dale, High Kane II, KN Morris and M81E. On irrigated plots, Dale and M81E were least prone to lodging.

Conclusion

Based on the 2009 field trials, the best performing varieties for ethanol production from juice were Dale, Della, Keller, KN Morris and M81E. Dale, Della and Keller, however, showed rather low grain production. Due to their overall poor performance, Mennonite and Sugar drip will be replaced in the 2010 field trials with Theis and Topper 76-6. Three years of field trials are necessary to make sound varietal recommendations for the region.

Considerations for Selecting Summer Annual Grasses

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In the past, recommendations for choosing a summer annual variety were to find a reasonably priced, locally available variety, and focus on management. While good management is absolutely critical for optimizing productivity and animal performance, recent data indicates that yield potential and digestibility should also be considered.

A trial conducted at Virginia Tech's Southern Piedmont Agricultural Research and Extension Center evaluated the yield and digestibility of 22 varieties of summer annual grasses including conventional and BMR forage sorghums, sudangrasses, and sorghum-sudangrass hybrids, and pearl millet. The study was planted on June 1, 2009 and all plots received 75 lb nitrogen (N) per acre at seeding and 60 lb N per acre after the first harvest. Plots were harvested on July 27, September 10, and October 21, 2009.

At the first harvest, yields for species-variety combinations differed by 1.5 ton per acre, ranging from 1.9 to 3.4 ton per acre. *In vitro* true digestibility also varied at the first harvest, ranging from 54 to 75%. The first harvest represented approximately 70% of the total yield. The total yield for the growing season differed by 1.7 ton per acre, ranging from 2.4 to 4.1 ton per acre. A weighted average for digestibility ranged from 59 to 75% for the 2009 growing season. What was most interesting is that the highest yielding variety in the trial was also one of the most digestible. This indicates that high yield and digestibility may not be mutually exclusive traits. In fact, when digestibility was graphed against yield for the species-variety combinations used in this trial, no relationship was found (Figure 1).

To better understand how to use yield and digestibility data when selecting or recommending a summer annual grass species-variety combination for livestock operations, the difference from average for the yield and digestibility was graphed and the graph was divided into four quadrants (Figure 2). The upper right hand quadrant includes varieties that have above average yield and digestibility. These species-variety combinations would be the most desirable to include in a forage production system. Varieties in the upper left hand quadrant have above average digestibility, but below average yields. While digestibility is good and animals may perform well on these varieties, dry matter production is lower. In the bottom left hand quadrant, species-variety combinations with below average yield and digestibility are found. These varieties would likely be the last choice for including in forage production programs. The final quadrant located in the bottom right hand side of the graph, includes varieties that have above average yield and below average digestibility. These varieties might be suitable for operations focused primarily on yield with less emphasis on animal performance.

Suggestions for Selecting and Utilizing Summer Annuals

Consider Yield. Variety-species combinations should perform well in replicated, independent trials. At least two years of data from your particular geographic region should be used to select a variety, but three or more years of data is preferable.

Consider Digestibility. In the past, digestibility data for summer annual varieties has been limited, but current breeding and marketing efforts have placed a renewed emphasis on this trait (Figure 3). To select or recommend the best possible summer annual species-variety combination, it is important to ask your local seed supplier for both yield and digestibility data.

Consider Price. Cost is always an important consideration when selecting any input for forage-livestock systems. However, seed cost needs to be considered on a relative basis. For example, an inexpensive variety that has low yield and digestibility may actually cost you more in the long run. One way to put seed cost on a relative basis is to consider seed cost as a function of variety performance. For example if the seed cost was $35 per acre for both varieties A and B but digestible yield was 2.7 and 1.7 ton per acre, respectively, then the relative seed cost of variety B would be about be about 1.6 times higher than for variety A.

Manage for Optimum Performance. In comparison to perennial forage species, annuals cost more to grow, especially if they are poorly managed. Therefore, it is critical to manage summer annual grasses properly. This includes not only selecting a high performing variety, but also planting at the proper seeding date and rate, using good establishment techniques, properly fertilizing, and managing grazing/haying.

The data presented in this article represents only one growing season and was used primarily to illustrate the importance of considering yield and digestibility when selecting improved summer annual species-variety combinations. Remember that variety selection should be based on two, but preferably three or more years of data from your geographic region. For more information on selecting and managing summer annuals grasses, contact your local Cooperative Extension office or visit with your local seed supplier.

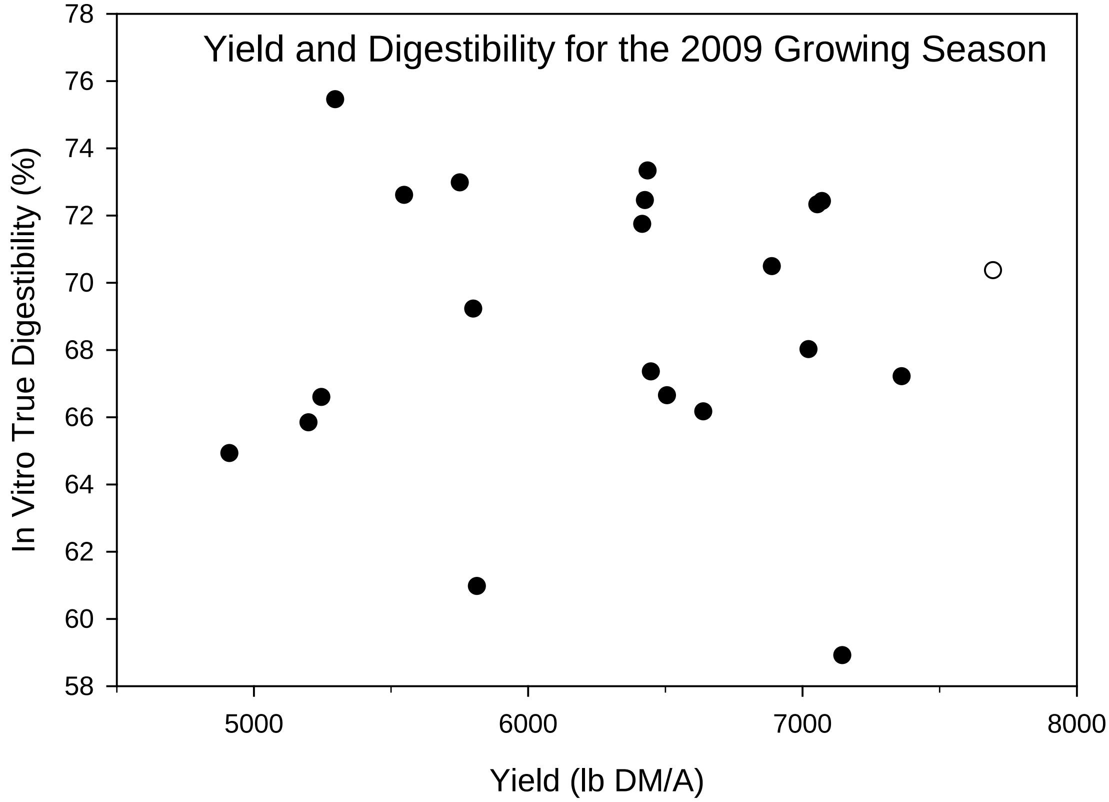

Figure 1. No relationship between total yield and *in vitro* true digestibility was found for the 22 species-variety combinations in the 2009 summer annual variety trial held at Virginia Tech's Southern Piedmont Agriculture Research and Extension Center located near Blackstone, Va.

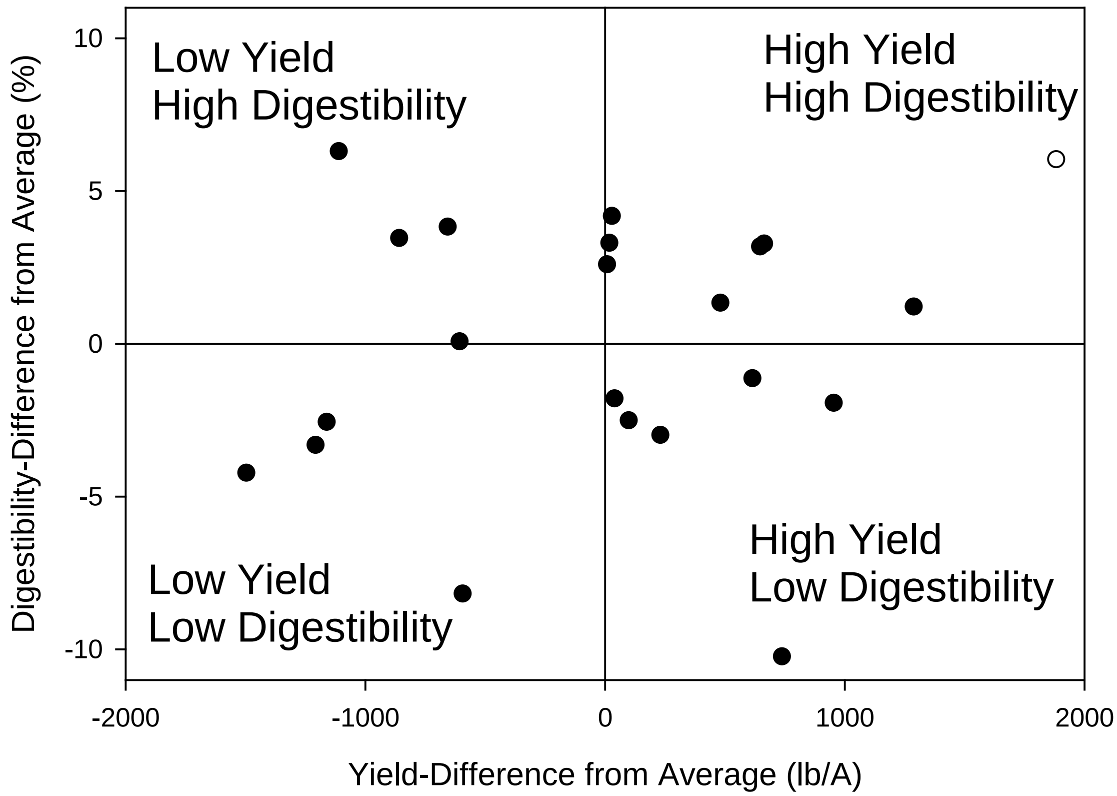

Figure 2. In this graph yield and in vitro digestibility are expressed as a difference from the average value. The value of zero represents the average value for the trial. Negative values represent a value that is below average, while a positive value represents a value that is above average. Producers should try to select varieties that are above average for both yield and digestibility.

Figure 3. Recently breeding programs for summer annuals grasses have put an increased emphasis on digestibility. The photo above shows a sorghum-sudangrass that possesses the brown midrib or BMR trait that is commonly, but not always associated with lower lignin concentrations and increased digestibility.

Weed Management in Summer Annual Grass Crops

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The use of summer annual grasses for supplemental forage is gaining popularity. The advantage of the summer annual grasses is that they produce abundant forage during July and August when cool-season grasses decline in productivity called the “summer slump”. When planted in late May or June, these grasses establish quickly, grow rapidly, have moderate to high drought tolerance, and can typically be grazed within 5 to 8 weeks of planting.

There are both common and species dependent disadvantages to the summer annual grasses. Common to all species is the fact that they usually are killed by the fall frost and will not survive the first fall freeze. The average date of the first fall frost is mid- to late-October for much of the region. By this time, cool-season grass production has increased again with the onset on cooler temperatures and fall precipitation levels. So although the death of the warm-season summer annuals can be considered a disadvantage, it is not a serious problem since pasture productivity usually has recovered by the time these summer grasses die.

Another common disadvantage is the extra production costs entailed with using annual species. The seed must be purchased each year, equipment must be rented or kept on hand to plant the annuals, and some form of annual tillage and/or vegetation control must occur. Seed costs, however, are relative and in general a review of many warm-season grass species as of the date of this article shows that seed costs range from $0.50 to $1.25 per pound and suggested seeding rates generally between 20 and 50 lb/acre. At a 30 lb/acre seeding rate and $0.75 per pound seed costs, annual seed cost would be under $25/acre contrasted with a novel-endophyte tall fescue which would cost about $150/acre but would be a long-term investment. Another mitigating factor to the cost issue is that many growers own or have access to brillion seeders that are old enough not to be considered a large capital expense. Annual tillage or seedbed preparation and the opportunity cost associated with the land area used for the annual crop will be the biggest expenses for summer annuals versus perennial cool-season grasses.

With certain precautions outlined below, cattle can graze or be fed forage sorghum, sudangrass, sorghum-sudan hybrids, foxtail millet, hybrid pearl millet, or crabgrass. Horses can graze hybrid pearl millet or crabgrass, and teff can be used for hay then grazed before frost.

Sorghum, sudangrass, and sorghum-sudangrass hybrids contain dhurrin which can break down and release prussic acid (HCN, cyanogenic compounds). Levels can be high enough in young, drought-stressed, wilted, injured, or frosted plants to cause cyanide poisoning. Millets do not contain dhurrin or prussic acid. The concentration of dhurrin varies by species with the most in sorghums and the least in sudangrass. Grazers should not graze these species if they are not greater than 18 inches tall and should delay grazing until young or re-growing plants are 24 to 30 inches tall. Do not graze drought-stressed plants until they recover after sufficient rainfall (usually 4 - 5 days) or until the plants fully recover from other stresses. Frosted plants should not be grazed until the leaves are dead and completely dried down, usually about a week to ten days following a killing frost. Cyanide dissipates from properly cured hay and properly ensiled forage, making them safe to feed.

All summer annual grasses can accumulate high levels of nitrates when fertilization is followed by stress (usually drought). The potential for nitrate poisoning can be reduced by moderating nitrogen fertilizer rates, allowing stressed plants to fully recover, testing for nitrate levels before grazing, and providing supplemental low-nitrate forage when moderate to high nitrate levels are suspected. Nitrate levels are not reduced in cured hay or green chopped forage, and are only partially reduced in ensiled forage. Another management option if the nitrate levels are not excessively high is to graze the tops of the forage and leave all the lower stubble. Nitrates are highest in the stem material and are highest closest to the soil surface. If harvesting fertilized drought-stress warm-season grasses for hay, avoid harvesting the lower stems. Millet accumulates as much or more nitrate than the sorghums. Horses have been observed grazing entire hybrid pearl millet plants to within an inch or two of the soil surface, so top grazing may not work in this situation (high nitrate levels suspected or confirmed).

Weed management begins with a clean seedbed. For conventionally tilled seedbeds, tillage should occur as close to planting as possible. In no-tillage seedings, follow the label concerning how much time to allow between the use of a nonselective herbicide such as glyphosate and seeding. When possible, choose fields with few to no perennial weeds, and avoid fields with a high number of grassy weeds.

As with any cool-season forage crop, successful establishment begins with properly amended soils (pH and fertility), proper seeding rate and depth, and appropriate seeding equipment. A critical component for establishment is waiting until the soil temperature warms enough to ensure rapid seedling emergence from the seedbed. When moisture is adequate, summer annual forage grasses emerge quickly, grow fast, and compete well with weeds. There often is no need for additional weed control. However, chemical weed control can be warranted when establishment is slow, weed populations are high, potentially toxic weeds are present, or high quality (weed-free) hay or forage is desired.

Unfortunately, herbicide options for summer annual grasses are limited. Some plant growth regulator (PGR) herbicides are labeled for use with these annual forages. Another limitation is that PGR herbicides are not recommended during the hot summer months due to their potential to injure sensitive plants with physical or vapor drift. Non-PGR herbicide options are listed in the table below. Pay particular attention to rotational crop restrictions for the preemergence herbicides (refer to label for crops not listed). Atrazine is typically not recommended due to its long rotation to other forage crops, and should only be used if corn or sorghum will be planted in the following spring. Check herbicide labels for weeds controlled. The postemergence herbicides in this table typically control only small annual broadleaf weeds. The herbicide labels will list the maximum weed size or growth stage at which the herbicide will be effective. Often the best herbicide is that weed-free seedbed and a rapid vigorous seedling.

Table 1. Herbicide options for weed control in summer annual grasses.

		Application information					Rotation restrictions (months)		
Herbicide	Labeled annual grasses	Timing/ weed type	Use rate per acre	Crop stage	Season maximum rate	Grazing/ harvest interval	Rotation to grasses	Rotation to small grains	Rotation to alfalfa/ clover
Atrazine[a] 4L	Forage sorghum, sorghum × sudangrass hybrid	PPI, Pre, POST/ broadleaf	3.2 to 4.0 pt (see label for details)	Up to 12 inches	5 pt	PPI or Pre = 60 days POST = 45 days	Second year	Next year to second year[e]	Second year
Callisto[a]	Pearl millet	Pre/ broadleaf	Up to 6.0 fl oz	n/a	6.0 fl oz (1 applic.)	n/a	18	4	10/18
Dual II Magnum[b,c]	Forage sorghum	Pre/ grass	1.0 to 1.67 pt[d]	n/a	1 applic..	n/a	Next spring	4.5	4/9
Aim[a]	Teff, crabgrass	POST/ broadleaf	0.5 to 2.0 fl oz	Any	5.9 fl oz (3 applic.)	0	0	0	12/12
Aim[a]	Millets	POST/ broadleaf	0.5 to 2.0 fl oz	Up to jointing	2.0 fl oz	7 days	0	0	12/12
Aim[a]	Forage sorghum	POST/ broadleaf	0.5 to 1.0 fl oz	Up to 6 leaf	1 fl oz	After 6 leaf	0	0	12/12
Basagran[a]	Forage sorghum	POST/ broadleaf	1.0 to 2.0 pt	Before heading	2 pt	12 days	0	0	0
Buctril[b] 2EC (for 4EC formulation cut rates in half)	Forage sorghum, sudangrass, sorghum × sudangrass hybrid	POST/ broadleaf	1 pt	3 leaf but prior to pre-boot	2 pt	45 days	1	1	1
			1.5 pt	4 leaf but prior to pre-boot					

[a] Check label for adjuvant recommendations.
[b]No adjuvant is recommended.
[c]Requires the use of Concep-treated seed.
[d]Coarase soils 1.0 to 1.33 pt/acre, medium soils 1.33 to 1.5 pt/acre, and fined soils 1.33 to 1.67 pt/acre.
[e]Next year if applied before June 10 or the second year after application if applied after June 10.

Sustaining Reproductive Fertility in Dairy Cattle: The Role of Artificial Insemination

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Dairy farm income is determined by annual culling decisions, milk yields and calf and cow sales. Milk yields per cow increase by as much as 2.9-3.0 lbs per day for every 1,000 lb increase in 305 day, fat corrected milk equivalents (ME). Reproductive efficiency impacts daily milk production efficiency within a 305 fat corrected ME because of the shape of the lactation curve. Spread over a lifetime of 305 ME, the shape of lactation curves for each parity can very significantly impact lifetime milk production efficiency. A greater number of parities per cow's productive lifetime generate greater amounts of milk production efficiency in a lifetime. As a result, estimated losses (more appropriately called unrealized income) for increase in days open past 40 days will cost producers dearly over the productive lifetime of any cow.

One useful measure of reproductive efficiency is days open (DO) or calving to conception interval within herds. DO typically refer to days in milk at the time of conception. Days open are affected by a variety of management decisions impacting nutrition and ration programs, voluntary and involuntary culling rates, heat detection rates, conception rates, and overall pregnancy rates. Increase in DO affects profitability by decreasing milk yields and availability of heifer crop for herd replacements or sales. Estimated *lifetime* daily milk yields are maximized at 110DO and quickly fall off with increasing DO up to > 200 DIM In addition, the number of mature heifers produced per cow declined with increasing DO to the point that at 145-150 DO heifer production decreases to less than one per cow. This could lead to real problems with replacement availability. Estimated costs per additional DO past 160 DIM have been placed at $1.37 in the average herd with 34% cull rates, 2.12 services/conception in heifers and 2.33 services/conception in cows, 45% first service conception rates, 45% heat detection rates and feed costs of $1.50/day for dry cows, $0.17/kg milk, heifer rearing costs of $1.70/day, and $1,600 heifer replacement costs.

Since DO is impacted by conception rates (CR) and heat detection rates (HDR), producers stand to gain considerably by improving both indices. Pregnancy rate (PR) that is determined as CR x HDR should benefit from reductions in DO as well. Incorporation of timed artificial insemination programs (e.g. Ovsynch, Presynch, Cosynch) into reproductive management strategies can move HDR to 100% and improve pregnancy rates at any given conception rate in a herd. This assumes cows are capable of responding to the timed artificial insemination (TAI) program and the insemination program is optimum. The reality in modern dairy cattle is fertility is clearly on the decline due in large part to changes in management and environment that disrupt responsiveness of cattle to these programs. These changes impact infertility through erosive effects on conception rates and early embryonic death rates.

Since semen processing and handling directly impacts conception rates, recommended semen handling procedures as well as semen quality always deserve periodic reevaluation in any dairy. Producers need to consider every step of semen handling from placing semen in liquid nitrogen to insemination. Be aware that infertility problems related to semen handling may not be an obvious glaring mistake. Practically speaking, complacency with semen handling leads to many small mistakes in several steps of handling that collectively erode semen quality and associated fertility. Key areas of consideration should include several of the most problematic concerns. Optimized pregnancy rates must include evaluation of procedures for semen removal from tanks, thawing temperature, thawing time, incomplete drying of straws and improper cutting of straws prior to insertion in sheaths and insemination rods, timing of insemination, and *in utero* semen placement. These areas can be overlooked particularly when timed artificial insemination simultaneously deliver groups of cattle for insemination all at the same time.

It has been proposed by Saacke (2009) that fertilized ovum from singly ovulated cows were maximally fertilized under conditions promoting oocyte contact with many viable semen. Unfertilized ova simply were exposed to too few sperm and/or sperm of low quality. Although early embryonic death is often attributed to fertilization of poor quality ovum or poor quality uterine environments that cannot sustain embryo growth, early embryonic death has also been associated with low numbers of semen contacting ovum. Presumably, low numbers of sperm contact with the ova resulted in oocyte exposure to poor quality semen. Poor quality sperm could trigger conception but resulted in formation of a weak, poor quality embryo. These embryos cannot sustain adequate levels of *in utero* growth necessary for pregnancy recognition by the dam.

Experimentally, the greatest amounts of high quality embryo formation were associated with oocyte exposure to 10 sperm. Sperm contact at numbers less than this was associated with poorer quality embryos or conception failures. This suggested inadequate sperm competition at the site of fertilization leads to low conception or poor quality embryos. Presumably, competition between sperm for oocyte penetration favors fertilization by the more vigorous, high quality sperm. Thus, poor quality semen or inappropriate semen placement could erode embryo quality.

Practically speaking, maximizing the number of sperm per oocyte at the time of conception is impacted by quality of sperm production by the bull and timing of insemination. Good quality bull studs monitor sperm quality at the time of collection by regular inspection for abnormal semen. Bulls with higher percentage of abnormal sperm generate poor quality embryos and conception failures and are eliminated from the market. Producers have little impact on this facet of male fertility. However, producers can impact timing of insemination. Insemination too early relative to ovulation results in sperm waiting in the oviduct for the entry of an oocyte. The sperm become too aged to vigorously compete for fertilization. Poor quality sperm of lowered viability result in low numbers of sperm contact with the oocyte. Fertilization rates are low. In contrast, late insemination relative to ovulation leads to excessive oocyte aging when the oocyte awaits sperm delivery to the oviduct. Aged oocytes are notorious for producing poor quality embryos that suffer high frequencies of early embryonic death. In general, insemination 12 hours post estrus onset maximizes conception rates while minimizing early embryonic death rates.

Thus, any measure that increases the timely delivery of high numbers of quality sperm to the oocyte will improve reproductive efficiency over the productive lifetime of a cow. Producers should consider the following important points during semen handling, particularly when breeding groups of cattle on timed artificial insemination programs.

1. ***Never allow semen straws to rise above frost lines (4-5 inches from the top of the tank) when removing a straw.***

Frozen, cryopreserved semen warms to -70 or -80°C very quickly when removed from liquid nitrogen. Considering the -300°C storage temperature, movement to -70 or -80°C is an enormous change in temperature. Placing this -70 to -80°C semen back into the liquid nitrogen is tantamount to refreezing the semen and can severely erode semen viability. Undoubtedly, this error is the most common problem encountered on the dairy farm. To approach this problem, producers need an AI representative to occasionally review breeding procedures and observe semen removal procedures. Suspect cases of semen damage can be readily assessed by suppliers or veterinarians by evaluating semen viability and motility in straws that have remained in tanks over extended periods of time.

2. ***Insure proper time and temperature of straw thaw procedures during straw thaw.***

Post-thaw semen quality is impacted by extender constituents, glycerol content in extenders, freeze rate, and straw size. Although reports vary considerably, a safe rule to follow is performing a 45 second thaw in a 35°C water bath. Producers should use a water bath, thermometer and timer to ensure uniform thawing procedures across all semen samples. There is no question that slow thaws conducted at improper temperatures injure semen viability more so than post-thawing temperature problems. However, proprietary differences in extender constituents and freezing rates have allowed modified air thaw procedures to be adopted for some straws. Producers should follow each manufactures recommendations and not adopt a universal thawing procedure across different sources of semen. Generally speaking however, slower thaw rates achieved by air thaw procedures place semen quality at greater risk and may impact different semen samples differently. Be aware not all semen can withstand slower thawing temperatures as this property can vary across semen samples, bulls and studs.

3. ***Thaw only enough semen units that inseminators can successfully place in the uterus over a 10 minute period.***

TAI programs, enlarging herds, and increasing labor costs make it reasonable to improve upon efficiency of artificial insemination procedures by breeding groups of synchronized animals all at the same time. Thus, inseminators may thaw multiple straws of semen simultaneously to expedite breeding efficiency. Some earlier data suggests this may not always work well because conception rates of inseminations performed later in the group were not as high as those performed earlier in the groups. However, these results have been highly variable across trials. Always consider the amount of inseminator experience and training: unprofessional inseminators experience erosions in conception rates of later inseminations whereas conception rates among experienced inseminators may not drop in the later inseminations. Thus, always consider inseminator experience and skills in semen delivery when determining how many straws of semen could be thawed at one time without negatively impacting conception rates.

However, training and experience may not always be the primary determinant of conception rates with batch thaws of semen. Conception rates among highly experienced herdsmen inseminators can be as good as those of professionally inseminators. Studies with no loss of conception rates kept elapsed time between initial semen thaw and insemination between 4.0 to 6.0 minutes for early inseminations and 7.5 to 11 minutes for the later inseminations. Likely, the temperature changes in thawed semen prior to insemination contributed to fertility problems between the early and late inseminations.

Post-thaw temperature changes could have negative effects on semen motility. To prevent some of these problems Dalton et al. (2004) made several recommendations. They suggested producers should try to exercise (a) accurate detection of estrus in cows for insemination, (b) care in semen thaw procedures (c) avoid straw to straw contact that could enable straws freezing together during semen thaw, (d) use of proper hygiene (e) thermal protection of straws during syringe assembly and straw loading and (f) insemination no later than 15 minutes after semen thaw. A good rule to follow is to thaw no more than 4 straws at a time provided all 4 are utilized within 20 minutes of thaw (Kaproth et al., 2002). Producers who leave straws thawed longer or thaw more than 4 straws may notice a decrease in conception rates by breeding order if semen quality deteriorates in the straws employed in the last insemination. A decline in conception rates may be more apparent in very warm or very cold environmental conditions because these adverse conditions favor post-thaw temperature fluctuations that could erode sperm quality. Thermal protection of the straw, sheath and AI gun should be implemented to limit post-thaw temperature fluctuations under adverse environmental conditions.

4. ***Deposition of semen in the proper intrauterine site.***

An enormous amount of applied work has been directed at addressing where semen deposition should occur to maximize fertility. Generally speaking, semen samples with adequate, viable, progressively motile sperm can be deposited anywhere in the uterus to accomplish acceptable conception rates. The reason most likely stems from observations that progressively motile sperm are distributed throughout the uterus in a relatively brief period of 4-6 hours. Distribution may be partly a function of progressive motility in semen samples but more likely reflects uterine motility initiated by high estrogen levels during estrus itself. Conception rates were not affected even in times when low numbers of spermatids were deposited in horns on the same or opposite to the side of ovulation. Thus, the most important recommendation is semen should be inseminated into cows accurately identified in estrus. Strong heats (driven by high estrogen levels) likely create the most efficient semen distribution in the female reproductive tract. Semen should be placed in the uterine body or horn because intra-cervical deposition of semen will lower conception rates.

5. ***Avoid asynchronous mating (mating mismatches) by inseminating cows at the proper time of estrus.***

The goal of an estrus detection program should be to identify estrus positively and accurately and also identify animals in anestrus. The ultimate goal is to achieve synchronous mating wherein viable semen is placed in the uterus in the presence of viable ova. This implies producers should be able to predict the time of ovulation and thereby inseminate cows to maximize contact between viable semen and viable ova. In the past, when cows were more closely observed, timing of insemination followed the AM-PM rule. Cows observed in estrus in the AM were bred in the following PM. Cows observed in the PM were bred the following AM. Unfortunately, practical estrus observations are difficult to achieve in modern, large dairy herds.

Estrus detection is labor intensive and monotonous such that frequent, careful observation is unlikely to be a routine management practice. Second, heavy lactation demands coupled with lameness and flooring conditions in modern dairy cattle units hinder strong estrus behavior. In the absence of frequent, accurate behavioral observation, onset of estrus is inaccurately determined. Studies on conception rates in cattle where onset of estrus is unknown, suggest once daily insemination of cows in standing estrus results in conception rates no different from those following the AM-PM rule.

Onset of estrus is important to know because the interval from the first standing event in estrus to ovulation is 22-32 hours. Ova viability lasts 24 hours with the period of greatest fertility lasting only 6-10 hours. Semen transport to the site of fertilization requires 6 hours and semen remain viable in the reproductive tract for 24-30 hours. Thus cattle inseminated too early in estrus have little viable semen remaining in the uterus to fertilize the newly ovulated ova. Cattle inseminated too late in estrus may have nonviable ova or ova with marginal chances of fertilization by the time sufficient numbers of viable semen can be delivered to the site of fertilization.

Recent studies suggest the odds of pregnancy increase in cows bred between 4-12 hours after onset of standing estrus behavior. Insemination anytime < 4 hours after onset of standing estrus behavior or >16 hours after the onset of standing estrus behavior negatively impacted pregnancy rates. Conception rates in the 4-12 hour period were 50% whereas after 16 hours conception rates fell to 30%. Achieving this type of high conception rate means instituting programs of frequent daily estrus detection. In the absence of this management practice, onset of estrus is not able to be identified accurately. A practical solution under these conditions is to breed cows soon after standing heat up to 12 hours after estrus detection.

6. ***Incomplete drying or improper straw cuts.***

Water on the straw at the time of straw cutting will come in contact with the semen and have debilitating consequences for semen quality. Straws should be completely dried to avoid this problem. Improperly positioned cuts can lead to straws too short for the rod. As a result, semen wicks up the rod leading to contamination and detrimental effects on semen quality.

Conflicting data exists regarding the effect of sire source on pregnancy rates in TAI programs. Indices of sire fertility such as estimated relative conception rate (ERCR) are available for producers to assess sire fertility. For example, the ERCR is a measure of the relative 70 day pregnancy rate of individual sires. Producers should be aware, however, that the small amount of available data suggests sire fertility generally accounts for a very small proportion of conception failure across most commercial dairy units. This may be even more true with the advent of TAI programs. Sire fertility reflects the ability of any particular sire to produce high quality sperm that effectively compete in high numbers for oocyte fertilization.

Difference in sire fertility may become more apparent in breeding programs based on observational heat detection. Fertility differences appear in these programs because timing of insemination with ovulation can be problematic due to problems with the accuracy of estrus detection. The more inaccurate the estrus observation program, the higher the likelihood of asynchronous breeding.

Asynchronous breeding, particularly where insemination occurs too close to the time of ovulation would result in higher rates of conception failure because lower quality semen experiences poorer longevity in the uterus. Too many sperm die while waiting for an oocyte appearance after ovulation. Lower *in utero* longevity results in fewer numbers of sperm competing for oocyte fertilization. However, with the advent of timed artificial insemination, timing of ovulation with insemination is closely controlled. Provided good compliance is practiced, TAI programs lower the chances of asynchronous mating. Therefore, bulls of high and low fertility achieved similar conception rates in Presynch-Ovsynch programs even when there was a 24 hour difference between the time of GnRH administration and insemination (Cornwell et al., 2006).

Lastly, producers need to be aware how semen and insemination problems impact hallmark indices of reproductive function. Inevitably, the greatest impact will be to extend DO to conception. *Conception rates drop across all cows as service per conception increase for services per conception in all cows* ***and*** *services per conception for pregnant cows. A key finding is decreased conception rates and increased services per conception in heifers, all cows and pregnant cows.* Poor quality semen will not impact conception rates across different periods of days in milk other than to say conception rates will be low in all cows no matter how many days in milk exist at the time of insemination. Poor quality semen may slightly increase percent of cows with longer inter-estrus interval length due to elevated rates of early embryonic death.

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"Managing Risk in Cow-Calf Systems" Available on DVD

This winter's *Virginia Forage and Grassland Council's Winter Forage Conferences* were well attended with more than 450 people participating. Topics included holistic high density grazing, extending grazing, setting a profitable stocking rate, alternative profit centers based on wildlife and the environment, and maintaining good tenant-landowner relationships. If you missed this meeting don't despair, we were able to capture all of the presentations as Camtasia videos and they along with handouts and an electronic copy of the proceedings are available on DVD. All you need to do is to slip the DVD into the DVD drive on your computer and click on the talk you would like to hear or the handout you would like to view. For more information on purchasing a DVD set from this year's or past year's winter conferences, please contact Margaret Kenny at 434-292-5331 or makenny@vt.edu.

Notices and Upcoming Events

March 20-21, 2010
Carroll Horse Expo, Carroll County Ag Center. For more information contact Roxanne Bowman at 443-621-0274 or via email at carrollhorseexpo@gmail.com

March 23, 2010
Field and Forage Crop Production Seminar, Two locations: Warren Grange on Rt 643 (Asbury/Broadway Rd), Broadway, NJ from 1:00 to 3:00 pm and at the Burlington County Extension Office, 2 Academy Drive, Westampton, NJ from 7:00 to 9:00 pm. For more information contact Bill Bamka at 609-265-5757 or via email at bamka@njaes.rutgers.edu

April 7, 2010
Baltimore County Horse Talk, Hereford Fire Hall Banquet Room, Summit Manor, 510 Monkton Road, Hereford, MD. For reservations, contact Ciara McMurtrie at 410-666-1188, ext 112 or by email at ciara.mcmurtrie@md.nacdnet.net by March 31, 2010

April 10, 2010
Agronomy Scout School, State College, PA, Ag Sciences and Industries Bldg., PSU Campus. For more information, contact Dwight Lingenfelter at email dxl18@psu.edu or by phone at 814-865-2242 or to register visit our web site at http://cmeg.psu.edu/scout-school.cfm

April 22, 2010
2010 Horse Pasture Walk Series, Soil Testing and Amendments, Ellicott City, MD Central Maryland Research and Education Center at the University of Maryland Equine Rotational Grazing Demonstration Site. For more information visit our website www.ansc.umd.edu/ERG or to register (required) contact Edith Silvious, 2115 Animal Sciences Center, University of Maryland, College Park, MD 20742 or email at esilviou@umd.edu or by phone at 301-405-5781

June 2, 2010
Small Grain Field Day, Landisville, PA at the Southeast Research and Extension Center. For more information contact Del Voight at email dgv1@psu.edu or by phone at

June 17, 2010
2010 Horse Pasture Walk Series, Grass Cover and Pasture Improvements, Ellicott City, MD Central Maryland Research and Education Center at the University of Maryland Equine Rotational Grazing Demonstration Site. For more information visit our website www.ansc.umd.edu/ERG or to register (required) contact Edith Silvious, 2115 Animal Sciences Center, University of Maryland, College Park, MD 20742 or email at esilviou@umd.edu or by phone at 301-405-5781

July 22, 2010
2010 Maryland Commodity Classic, Wye Research and Education Center in Wye Mills, MD and Queen Anne's County 4-H Park. For more information, contact Lynne Hoot at 410-956-5771 or via email at LynneHoot@aol.com

August 12, 2010
2010 Horse Pasture Walk Series, Weed Identification and Control, Ellicott City, MD Central Maryland Research and Education Center at the University of Maryland Equine Rotational Grazing Demonstration Site. For more information visit our website www.ansc.umd.edu/ERG or to register (required) contact Edith Silvious, 2115 Animal Sciences Center, University of Maryland, College Park, MD 20742 or email at esilviou@umd.edu or by phone at 301-405-5781

September 11, 2010
2010 Horse Pasture Seminar, College Park, MD and Ellicott City, MD Central Maryland Research and Education Center at the University of Maryland Equine Rotational Grazing Demonstration Site. For more information visit our website www.ansc.umd.edu/ERG or to register (required) contact Edith Silvious, 2115 Animal Sciences Center, University of Maryland, College Park, MD 20742 or email at esilviou@umd.edu or by phone at 301-405-5781

Newsletter Web Address

The Regional Agronomist Newsletter is posted on several web sites. Among these are the following locations:

http://www.grains.cses.vt.edu/ Look for Mid-Atlantic Regional Agronomy Newsletter

or

www.mdcrops.umd.edu Click on Newsletter

Photographs for Newsletter Cover

To view more of Todd White's Bucks County photographs, please visit the following web site:

www.scenicbuckscounty.com